Oracle RHP (Rapid Home Provisioning) 使用手册

ohsdba

目录

RHP 是什么 1
RHP 的特点和功能 2
RHP 在 18c 中的更新 3
本地模式下“switch home” 3
零宕机数据库升级 3
模拟执行 3
认证插件 3
在 RHP Server 之间共享“Gold Image” 3
可定时执行和批量操作 4
开始支持 Oracle Exadata 一体机 4
RHP (Rapid Home Provisioning) 的架构 4
本地模式下的输出 5
服务器模式下的输出 5
RHP 架构图 5
目标端 (no RHP Client) 6
RHP 客户端 (RHP Client) 6
RHP Client 的多种创建方式 6
如何从 unmanaged 转变成 managed 7
RHP 典型应用场景 7
建立 RHP Server 的前提条件 7
RHP Server 软件要求 7
RHP Server 内存最低要求 8
RHP Server 存储最低要求 8
RHP Server 网络最低要求 8
RHP Server 网络 IP 最低要求 8
RHP 软件授权 8
如何配置 RHP Server 9
停止 RHP Server 10

移除 RHP Server 10
增加 RHP Server 10
启动 RHP Server 10
查看 RHP Server 配置 10
增加 HAVIP 11
RHP 在-MGMTDB 数据库中的信息 11
Gold Images 的相关操作 15
Image 状态和访问 15
Image Series 15
导入 Image 15
创建 Series 和添加 Image 16
查看 series 16
Workingcopy and Unmanaged HOME 17
邮件通知 17
角色管理 17
客户端管理 18
登录凭证 18
审计功能 19
命令行工具 rhpctl 19
rhpctl import image 21
rhpctl add workingcopy 21
rhpctl add database 21
rhpctl move 23
rhpctl upgrade 23
rhpctl zdtupgrade upgrade 24
rhpctl add imagetype 25
RHP 可提供标准化的部署 26
Cluster (集群) 26
Database (数据库) 26
通用软件 26
支持的集群和数据库版本列表 27

部署的软件的存储选项 28
打补丁方式的改变 28
传统方式下打补丁 28
1. Prepare home for out of place patching 28
2. Apply the Patch 28
3. Orchestrate switching the database to the new home 28
4. REPEAT THE LEFTHAND COLUMN FOR EVERY DATABASE IN THIS HOME 28
5. Apply SQL 28
6. Fix Dependent Scripts 29
通过 RHP 打补丁 29
对 Data Guard 的支持 29
GI 和 Database 补丁一起打 29
已部署的副本 30
要完成的迁移 30
要执行的命令 30
操作步骤解析 30
如何节省 Gold Image 存储空间 31
一般的方法制作 Image 31
节省空间的方法来制作 Image 31
支持用户自定义脚本 32
测试脚本内容 33
创建和查询 useraction 33
将 useraction 和 imagetype 关联 34
在 RHP 服务端查看脚本信息 34
如何删除 useraction 35
RHP 相关服务用到的端口 36
通过 rhpctl 部署和升级数据库 38
原始环境信息 38
部署架构图 38
从 ood 上导入 11204 的 Image 39

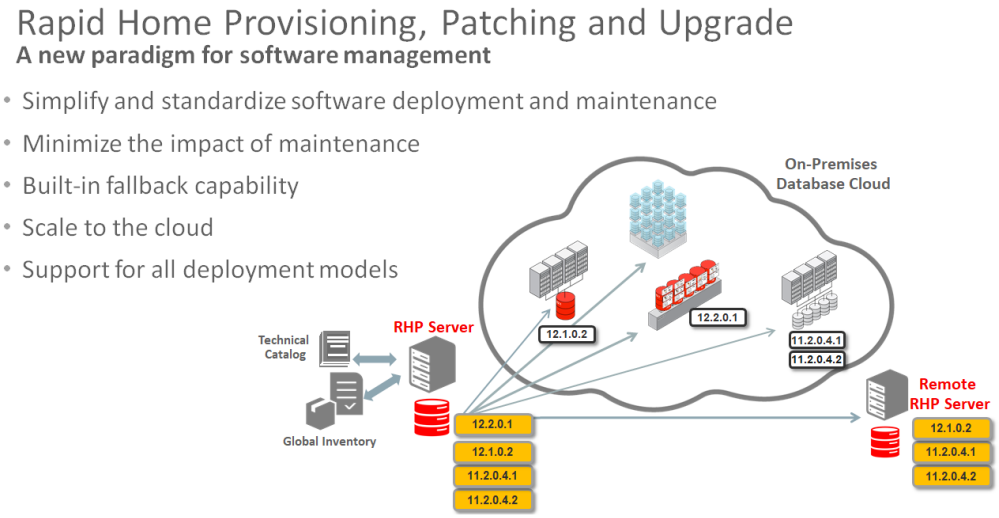
从 ohs1 上导入 183 的 Image 39
在 ohs 上部署 11204 的 ORACLE HOME 40
在 ohs 上创建 11204 的数据库 42
在 ohs 上部署 183 的 ORACLE HOME 44
在 ohs1 上查询部署的 workingcopy 的信息 47
模拟数据库 11204 到 183 的升级 49
升级数据库 (from 11204 to 183) 49
在 ohs 上查看升级的相关日志 53
注意事项 55
18c 在本地模式下通过 rhpctl move 切换 ORACLE HOME 55
查看情况环境 55
安装 18.3 ORACLE HOME 56
执行切换命令 56
检查、编译下失效对象 59
查看 bug 信息 61
本地模式下 rhpctl move 命令参考 63
通过 rhpctl 部署 12.2 集群 66
1.部署 12.2 GI Cluster 66
2.用 DBCA 创建数据库 68
3.部署基于 image DB122_PATCH1 的副本 68
4.移动数据库 orcl13db 从 Unmanaged 到 Managed 69
通过 rhpctl 部署 12.1 集群并做数据库的升级 70
1.部署 12.2GI Cluster 70
2.部署基于 image DB112 的副本，并创建数据库 71
3.部署基于 image DB12102_PSU 的副本 71
4.部署基于 image GRID12102_PSU 的副本 71
5.把数据库从 11.2 升级到 12.1.0.2 71
6.把 GI 从 12.1 移动到 12.1 PSU 72
零宕机升级数据库 72
OGG 命令行 74
Data Guard 命令行 75
Reference 76

12.1 Reference 76
12.2 Reference 76
18c Reference 76
Rapid Home Provisioning Use Cases 76
附录一: rhpctl add workingcopy 命令参考 78
数据库相关参数选项 78
集群相关参数选项 79
软件 Home 组权限熟悉 81
数据库软件 82
集群软件 83
附录二: 部署 12.2 GI Cluster 的响应文件样本 84
附录三: 部署 12.1.0.2 GI Cluster 的响应文件样本 84
附录四: 部署 11.2.0.4 GI Cluster 的响应文件样本 84

RHP 是什么

随着 IT 信息化的发展。现在数据中心的规模越来越大，对管理员的要求也越来越高。同时，用户希望快速访问始终在线的服务，因此对于企业来说，部署和维护必须高效且对业务运行无干扰。为了跟上步伐，必须减少运维复杂性和手动参与的步骤。Oracle RHP（Rapid Home Provisioning）的解决方案标准化、简化了软件分发和管理。自动化和高效率是她的特点，她最小化了对大规模部署的影响。

Rapid Home Provisioning（RHP）代表了一种标准的方法，以统一的方式，在软件基础设施的所有体系结构层（Oracle Database 和其他第三方定制软件）上进行部署、补丁、升级、迁移等工作。



Rapid Home Provisioning（RHP）是一种部署软件 HOME 的方法。我们可以从已安装的 HOME 中创建 Image，并存储和管理，Oracle 称之为“Gold Image”。DBA 可以在这个“Gold Image”上制作副本（workingcopy），然后把这些副本供应到数据中心的所有目标端。

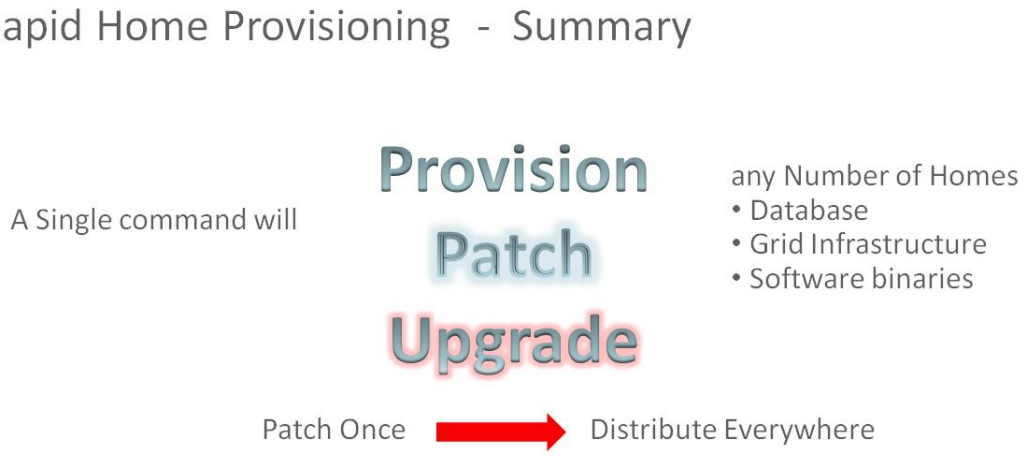
RHP 服务是 Grid Infrastructure 的一部分。Oracle Clusterware 会管理 RHP 的相关组件。这些组件包括 RHP Server 自身、GNS、一个用于支持 HA-NFS 的 VIP（不论是否使用 NFS 来存储 workingcopy，都是必须的）和用于存储 workingcopy 快照的 ASM 集群文件系统（ACFS）。

“Gold Image”代表一个 Home，无论是 Oracle 数据库软件 Home，还是第三方的或自定义软件 Home。“Gold Image”存储在 Oracle 自动软件管理集群文件系统（Oracle ACFS）中。

RHP 的相关元数据存储在 Grid Infrastructure Management Repository。Management Database MGMTDB 在安装 Grid infrastructure 时会被创建。

RHP 的特点和功能

RHP 提供集中的软件部署和维护。软件只需要安装一次，然后存储在 RHP 服务器上，并且从那里可以随时向数据中心的任何节点或集群供应。主要特征包括：管理现有部署，不需要任何更改、不需要重新配置、也不需要代理或守护程序。



主要优势有：

- 流程自动化，减少人工参与的步骤
- 简化了数据库相关的安装部署、修补和升级
- 最大限度地减少维护的影响和风险
- 支持大规模部署

RHP 的基本功能：

- Gold Images 集中存储，包括 GI、DB、应用、中间件等
- 支持安装和配置新的集群和数据库
- 最小化维护窗口
- 一条命令就能搞定安装、补丁或升级
- 内置了还原和从失败点继续的能力执行
- 邮件通知
- 支持自定义工作流
- 提供审计日志
- 支持所有部署模型——物理机器、虚拟化、容器、Oracle 多租户

RHP 在 18c 中的更新

本地模式下“switch home”

不需要 RHP 服务器或客户端，在本地模式下就可以通过 rhpctl 快捷的更新 Oracle Database 和 GI Homes。从 18c 开始，在 GI 和 DB HOME 下，我们都能找到 rhpctl 这个命令。在本地模式下，就可以通过 rhpctl move gihome|database 来做快速切换 ORACLE HOME。

零宕机数据库升级

零停机时间数据库升级自动执行数据库升级所需的所有步骤。它可以在升级过程中最小化甚至消除应用程序停机时间。它还可以最小化资源需求。还提供了一个回退路径，以便在必要时回滚升级。通过自动化升级过程中涉及的所有步骤，零停机数据库升级减少了数据库升级的工作量、风险和应用程序影响。

模拟执行

封装在 RHP 命令中的工作流由多个较小的步骤组成，其中一些步骤可能失败。新版本包含一个“Dry Run”命令模式，允许在命令执行之前查找并修复许多潜在的错误。

虽然 RHP 允许在纠正错误条件之后恢复失败的命令，但是在执行命令之前通常最好尽可能地解决许多潜在的问题。这最小化了在维护窗口期间可能出现的问题和纠正措施的干扰。新的“Dry Run”命令模式将测试给定命令的先决条件，而不做任何更改，并报告潜在的问题。然后，可以在实际执行命令之前纠正这些错误。

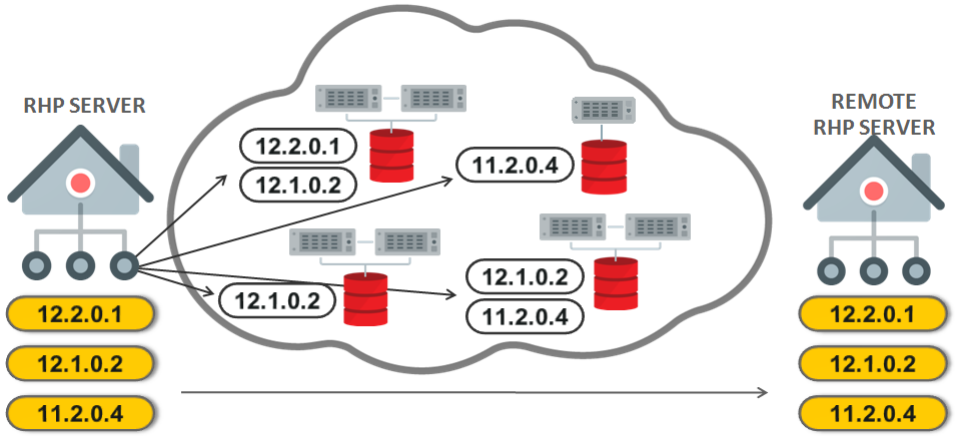
认证插件

为了验证 RHP 服务器和目标服务器之间的通信，您可以提供登录凭据。或者在与 RHP 客户端通信时，在内部自动处理大多数操作的身份验证。新的插件框架支持附加的用户定义的身份验证过程。客户环境中的主机到主机身份验证，尤其是在合规意识比较强的行业，比如金融和电子商务中，通常将利用 RHP 不支持的先进技术和产品。该特性 RHP 的认证与客户数据中心使用的机制集成成为可能。使用的参数是-auth <plugin_name> [<plugin_args>]。

例如-auth sshkey -arg1 user:ssh_user -arg2 identity_file:path_to_identity_file_on_RHPS -arg3 sudo_location:path_to_sudo_binary_on_target

在 RHP Server 之间共享“Gold Image”

在 RHP 架构中，一个中央的 RHP 服务器对给定数据中心（或数据中心的网络段）内的一组目标进行操作。大型企业通常托管多个数据中心，在每个数据中心内可能有单独的网络段。每个都需要一个专用的 RHP 服务器。对于这些客户，该特性提供了在 RHP 服务器之间共享 Gold Images 的简单和安全机制。对 Gold Image 的传输和管理更方便。可以通过命令 rhpctl register server 来实现。



可定时执行和批量操作

RHP 命令现在可以提前调度。任务也可以周期性地运行。命令队列也可以被查询和修改。此外，命令可以应用到 RHP 客户端列表。
调度和捆绑自动化任务对于维护大型数据库区域至关重要。RHP 现在支持调度关键任务，例如部署新 HOME、切换到新 HOME 和扩展集群等。此外，现在还可以将客户端列表添加到命令中，从而促进大规模操作。

开始支持 Oracle Exadata 一体机

这个版本引入了对 Oracle Exadata 基础设施补丁的支持。除了对 Oracle Database 和 GI Homes 的现有支持之外，用于数据库节点的软件、Storage Cell、InfiniBand 交换机软件的软件也可以使用 RHP 进行修补。通过 RHP 还可以管理和追踪这些维护。

RHP (Rapid Home Provisioning) 的架构

RHP 是从 12.1 开始引入的，也只有在 GI 下面才有，文件名是 rhpctl。在这个版本，如果要通过 rhpctl 部署软件 HOME，必须是配置了 RHP Client 才可以。到了 12.2，在没有 RHP Client 客户下，也可以部署。从 18c 开始，没有安装 GI 也可以使用（也可以说在单实例下面也可以使用），从数据库的 HOME 下我们能找到 rhpctl 这命令。

版本	GI_HOME(rhpctl)	DB_HOME(rhpctl)	RHP 是否默认安装	是否需要配置 RHP Client 才部署	DB 是否支持本地 move
12.1	有	无	否	是	否
12.2	有	无	否	否	否
18c	有	有	是	否	是

本地模式下的输出

从 18c 开始，在安装 GI 的时候，RHP Server 是默认被安装的，使用的是本地模式。也就是下面的输出，只有 move 命令。

```
[orgrid@ohs1 ~]$ rhpctl
Usage: rhpctl <command> <object> [<options>]
    commands: move
    objects: database|gihome

For detailed help on each command and object and its options use:
  rhpctl <command> <object> -help
[orgrid@ohs1 ~]$
```

服务器模式下的输出

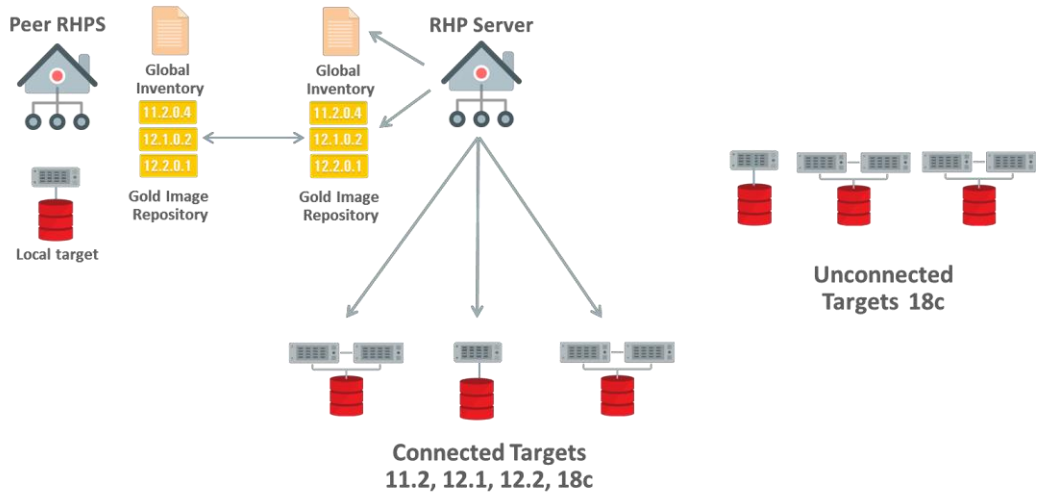
```
[orgrid@ohs1 ~]$ rhpctl
Usage: rhpctl <command> <object> [<options>]
    commands:
add|addnode|allow|delete|deleteimage|deletenode|disallow|discover|export|grant|import|insertimage|instantiate|modify|move|promote|
query|register|revoke|subscribe|uninstantiate|unregister|unsubscribe|upgrade|verify|enable|disable|collect|deploy
    objects:
audit|client|credentials|database|gihome|image|imagetype|job|node|osconfig|peerserver|role|series|server|user|useraction|workingco
py

For detailed help on each command and object and its options use:
  rhpctl <command> <object> -help
[orgrid@ohs1 ~]$
```

RHP 架构图

RHP (Rapid Home Provisioning) 服务依赖于 Grid Infrastructure。她存储和管理了很多 ORACLE_HOME 的模板，我们称之为“Gold Images”。 您可以向数据中心中的任何节点部署基于“Gold Images”的副本 (working copy 实际上就是基于 Gold Image 部署的 ORACLE HOME)。RHP 支持 Oracle Home、Oracle Database、Grid Infrastructure、和新集群 (前提是需要操作系统和网络已配置好) 的部署，以及 GI、DB 的升级和迁移等，还支持第三方的软件。

RHP 可以管理其集群自身,12.2.0.1 或更高版本的 Rapid Home Provisioning Clients,还可以管理通过 RHP Service 部署的 Oracle Grid Infrastructure 11gR2 (11.2.0.4) 和 12cR1 (12.1.0.2)，称为 Clientless Targets 安装。RHP 还可以管理在 Oracle Restart 上运行的单实例数据库以及没有集群软件的服务器。总之一句话，只要是 11.2.0.3 以上的无论是集群还是单实例都可以管理，前提是必须通过 RHP 部署部署。

下面的架构图描述的是通过 RHP Server 部署 11.2、12.1、12.2、18c target，这些称为 Managed target。还有一些未连接的 18c target，这些不是通过 RHP Server 部署的，称之为 Unmanaged target，不能通过 RHP 管理。由于这些不是通过 RHP Server 部署的，所以 RHP 也无法直接管理。下面会介绍目标端、RHP 客户端，注意这些都不是必须的。



目标端 (no RHP Client)

没有运行 Oracle Grid Infrastructure RHP Client 的目标称为 Clientless Targets。这些目标不能发起与 RHP Service 的通信，只能从 RHP Service 端进行管理。这些目标可以运行网格基础设施 11.2.0.4/12.1.0.2/12.2.0.1，或者没有安装 GI，只运行了单实例的 Oracle 实例数据库，或者是安装 Oracle Restart 等。SSH 协议用于 RHPS 和目标之间的通信。

RHP 客户端 (RHP Client)

RHP Client 进程是一个集群中的 HA 资源，运行在集群的一个节点中，并处理来自 RHP Service 的请求。能够与客户端交互，并在没有凭据的情况下执行预期的任务。此外，客户端可以在本地启动许多任务。在启动时，客户机-服务器进程之间建立一个经过身份验证的通信通道并保持连接，称为 JMX 通信通道。这需要在 RHP Service 和 RHP Client 上都打开端口来建立这个通道。

RHP Client 的多种创建方式

- 当 Pre-12.2 的集群 (unmanaged or managed) 升级到 12.2，会自动的配置和启用 RHP Client
- 在 Unmanaged 12.2 Cluster 上打补丁时， 会自动的配置和启用 RHP Client

- 对 Unmanaged 12.2 Cluster，可以通过“rhpctl add client”来配置和启用 RHP Client
- 当通过 RHP 部署新 12.2 集群时，RHP Client 会自动的被配置和启动

如何从 unmanaged 转变成 managed

只要是通过 rhpctl 部署的 HOME 都属于被托管（managed）的，不是通过 rhpctl 部署的 HOME 都统称为非托管（unmanaged）的。例如，在一个非托管的 HOME 下，在补丁或升级过程中，可以通过 rhpctl 部署新的 HOME，然后通过 rhpctl 做升级或迁移，非托管（unmanaged）的 HOME 可以很容易的切换到被托管（managed），纳入 RHP 的管理框架。
在正常运行时操作中，通过 RHP 部署的客户端或目标端不依赖于 RHP 服务。因此，即使 RHP 服务不可用，已经部署的 home 不会受到影响。

RHP 典型应用场景

- Populate RHP Service with gold images
- Organize gold images in to series
- Create and start a 12.2 RHP Client from the RHP Service
- Move an unmanaged 12.2 database (not created with RHP) to a managed copy
- Create a 12.1 GI deployment from the RHP Service
- Provision an 11.2 database on the target
- Upgrade the database to 12.1
- Patch the GI
- User actions and image types

建立 RHP Server 的前提条件

RHP 是 Grid Infrastructure 的一部分，推荐的最小硬件配置与 GI 部署配置相同。从 18c 开始默认安装为本地模式。

RHP Server 软件要求

你需要安装 Oracle GI 12.1.0.2 以上的版本，也可以是单节点（single-node Grid Infrastructure deployment，不是 Oracle restart）的如果对 HA 没有要求。
注意：Oracle Grid Infrastructure standalone (Oracle Restart) 是不支持 RHP Server 的。
2126710.1 RHP: Rapid Home Provisioning Server - Minimum Requirement
2097026.1 How to Setup a Rapid Home Provisioning (RHP) Server and Client
2124960.1 Rapid Home Provisioning (RHP) setup in 1-Click

RHP Server 内存最低要求

最低 4G 内存

- Swap 空间要求
  --> 等于内存大小，如果内存是在 4GB 和 16GB 之间
  --> 大于 16 GB 如果内存超过 16 GB

RHP Server 存储最低要求

- 至少 6.9 GB 磁盘空间
- 至少 1 GB /tmp
- 至少 100Gb ASM DiskGroup 用于存储 Gold Images

RHP Server 网络最低要求

- 以太网接口卡用于 Oracle Grid Infrastructure 公共网络
- 以太网接口卡用于 Oracle Grid Infrastructure 私有网络

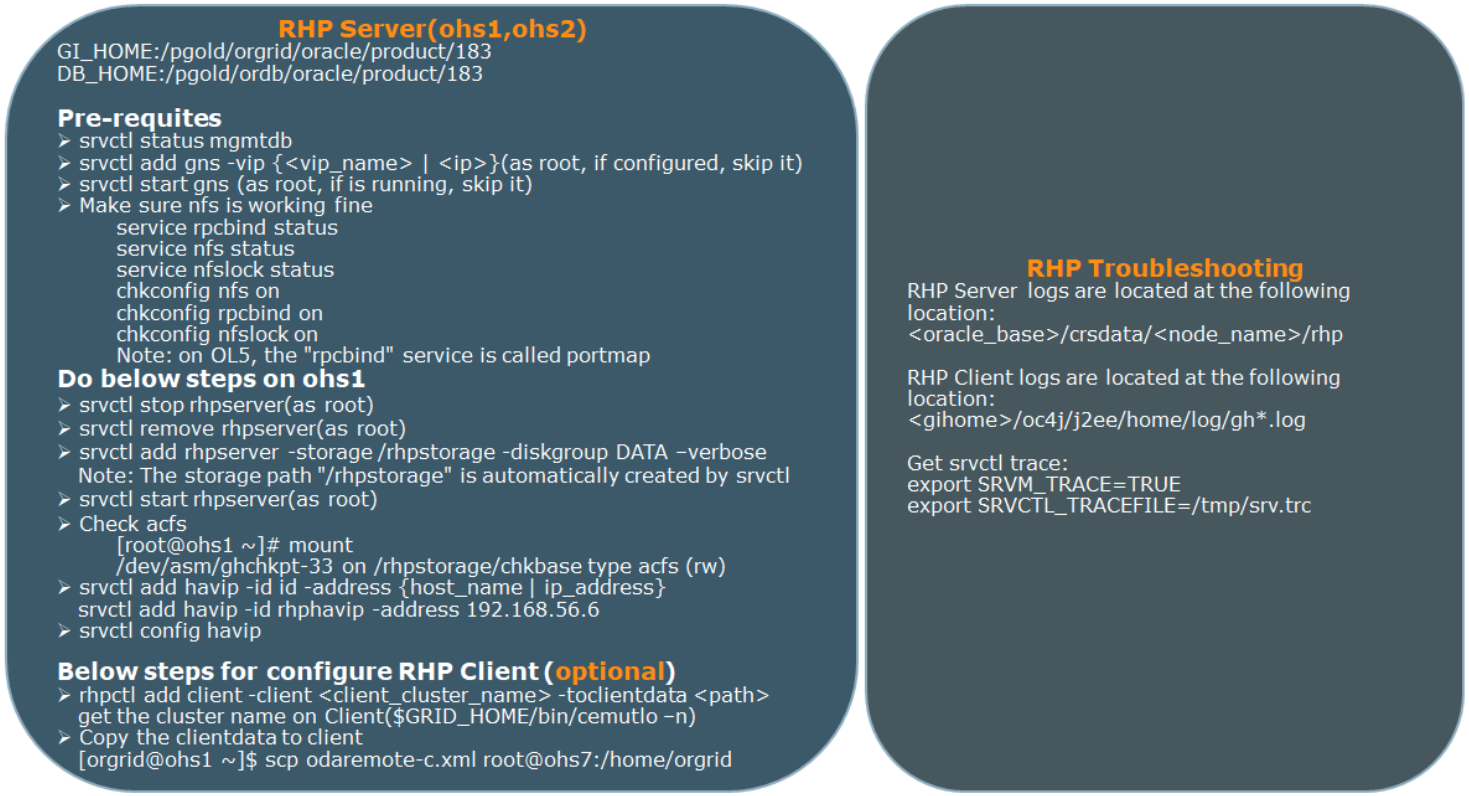
RHP Server 网络 IP 最低要求

- 1 Host IP
- 1 GNS VIP (without Zone Delegation) (*)
- 1 HA-VIP for RHP HANFS usage (*)
- 1 host VIP for Oracle Grid Infrastructure
- SCAN IPs:
  1 single name that resolves to 3 IP addresses on the same subnet as your default public network (if DNS is in use)
  1 single name that resolves to 1 IP addresses in "/etc/hosts" (if the DNS is not in use)

RHP 软件授权

RHP 是 GI 12.1 和之后的一个特性。如果在本地使用，不需要额外的授权。如果配置了 RHP client， 就需要购买 Database Lifecycle Management Pack。

如何配置 RHP Server




```
[orgrid@ohs1 ~]# rhpctl
Usage: rhpctl <command> <object> [<options>]
    commands: move
    objects: database|gihome

For detailed help on each command and object and its options use:
  rhpctl <command> <object> -help
[orgrid @ohs1 ~]#
```

注意：如果执行 rhpctl 后，看到上面的输出，说明当前的 rhpctl 是默认的本地模式，或是没有配置 RHP。下面是详细的配置步骤

停止 RHP Server

```
[orgrid@ohs1 ~]$ srvctl stop rhpserver
[orgrid@ohs1 ~]$ srvctl remove rhpserver
PRCN-2018 : Current user orgrid is not a privileged user
[orgrid@ohs1 ~]$ which srvctl
/pgold/orgrid/oracle/product/183/bin/srvctl
[orgrid@ohs1 ~]$ su -
Password:
```

移除 RHP Server

```
[root@ohs1 ~]# /pgold/orgrid/oracle/product/183/bin/srvctl remove rhpserver
[root@ohs1 ~]#
```

增加 RHP Server

```
[root@ohs1 ~]# /pgold/orgrid/oracle/product/183/bin/srvctl add rhpserver -storage /rhpstorage -diskgroup DATA -verbose
ohs1.ohsdba.cn: Creating a new volume...
ohs1.ohsdba.cn: Checking for the existence of file system...
ohs1.ohsdba.cn: Creating a new ACFS file system...
ohs1.ohsdba.cn: Starting the ACFS file system...
ohs1.ohsdba.cn: Creating authentication keys...
[root@ohs1 ~]# su  - orgrid
```

Note: /rhpstorage 会被自动创建

启动 RHP Server

```
[root@ohs1 ~]# /pgold/orgrid/oracle/product/183/bin/srvctl start rhpserver
[root@ohs1 ~]# /pgold/orgrid/oracle/product/183/bin/srvctl status rhpserver
Rapid Home Provisioning Server is enabled
Rapid Home Provisioning Server is running on node ohs1
```

查看 RHP Server 配置

```
[root@ohs1 ~]# /pgold/orgrid/oracle/product/183/bin/srvctl config rhpserver
Storage base path: /rhpstorage
Disk Groups: DATA
Port number: 23795
```

```
Transfer port range:
Rapid Home Provisioning Server is enabled
Rapid Home Provisioning Server is individually enabled on nodes:
Rapid Home Provisioning Server is individually disabled on nodes:
Email address:
Mail server address:
Mail server port:
Transport Level Security disabled
HTTP Secure is enabled
[orgrid@ohs1 ~]$ df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/mapper/vg_ohs-lv_root
                       50G  5.1G   42G  11% /
tmpfs                 2.4G  1.1G  1.3G  46% /dev/shm
/dev/sda1             477M   84M  368M  19% /boot
/dev/mapper/vg_ohs-lv_pgold
                      537G   23G  487G   5% /pgold
/dev/asm/ghchkpt-33   5.5G  784M  4.8G  14% /rhpstorage/chkbase
/dev/asm/ghvol464715-33
                       12G  5.7G  6.4G  47% /rhpstorage/images/iDB112957258
/dev/asm/ghvol895499-33
                       22G   12G   11G  51% /rhpstorage/images/iDB183271079
[orgrid@ohs1 ~]$
```

增加 HAVIP

```
[root@ohs1 ~]# /pgold/orgrid/oracle/product/183/bin/srvctl add havip -id havip -address 192.168.56.6
```

RHP 在-MGMTDB 数据库中的信息

```
[orgrid@ohs1 ~]$ export ORACLE_SID=-MGMTDB
[orgrid@ohs1 ~]$ sqlplus / as sysdba

SQL*Plus: Release 18.0.0.0.0 - Production on Tue Oct 9 21:07:24 2018
Version 18.3.0.0.0
```

```
Copyright (c) 1982, 2018, Oracle.  All rights reserved.
Connected to:
Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.3.0.0.0

SQL> show pdbs

    CON_ID CON_NAME                       OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  NO
         3 GIMR_DSCREP_10                 READ WRITE NO  --Note: DSCREP=Domain Service Cluster Repository

SQL> alter session set container=GIMR_DSCREP_10;
Session altered.
SQL> select username from dba_users order by created;
USERNAME
--------------------------------------------------------------------------------
SYS
AUDSYS
SYSTEM
SYSBACKUP
SYSRAC
SYSKM
SYSDG
OUTLN
GSMADMIN_INTERNAL
GSMUSER
DIP
XS$NULL
REMOTE_SCHEDULER_AGENT
DBSFWUSER
ORACLE_OCM
SYS$UMF
DBSNMP
```

```
APPQOSSYS
GSMCATUSER
GGSYS
XDB
ANONYMOUS
WMSYS
PDBADMIN
PCMRADMIN
EMUSER
QOS
PCMRPATCH
CALOG
CHM
CHA
GHSUSER18
32 rows selected.
SQL>
SQL> col owner for a10
col object_name for a30
col object_type for a30
select owner,object_name,object_type from dba_objects where owner='GHSUSER18' and object_type='TABLE';
SQL> SQL> SQL>

OWNER      OBJECT_NAME                    OBJECT_TYPE
---------- ------------------------------ ------------------------------
GHSUSER18  IMGTYPE                        TABLE
GHSUSER18  IMGSRS                         TABLE
GHSUSER18  JOBSCHEDULER                   TABLE
GHSUSER18  USERACTION                     TABLE
GHSUSER18  SWHOMES                        TABLE
GHSUSER18  IMAGEPOLICIES                  TABLE
GHSUSER18  GHAUDIT                        TABLE
GHSUSER18  IMGSRS_USERS                   TABLE
GHSUSER18  IMAGE_ROLES                    TABLE
```

```
GHSUSER18  USER_ROLES                      TABLE
GHSUSER18  JOBID                           TABLE
GHSUSER18  ROLEIMPL_M_PRIVLIST             TABLE
GHSUSER18  IMGS                            TABLE
GHSUSER18  HOLDER                          TABLE
GHSUSER18  MOVE                            TABLE
GHSUSER18  ROLES                           TABLE
GHSUSER18  IMGTYPE_USERACTION              TABLE
GHSUSER18  IMGSRS_IMAGES                   TABLE
GHSUSER18  WCOPY_ROLES                     TABLE
GHSUSER18  SITES                           TABLE
GHSUSER18  JOBSCHEDULER_ROLES              TABLE
GHSUSER18  PARENT_CHILD_ROLE               TABLE
GHSUSER18  USERS                           TABLE
GHSUSER18  SEQUENCE                        TABLE

24 rows selected.
```

```
col name for a10
col IMGSIZE for 999,999,999,999
col HOME for a80
col DBSOFTWARE_VERSION for a20
col IMGTYPE for a30
set lines 160
SELECT NAME,HOME,IMGSIZE,DBSOFTWARE_VERSION,IMGTYPE FROM GHSUSER18.IMGS;
```

```
SQL> col name for a10
SQL> col IMGSIZE for 999,999,999,999
SQL> col HOME for a80
SQL> col DBSOFTWARE_VERSION for a20
SQL> col IMGTYPE for a30
SQL> set lines 160
SQL> SELECT NAME,HOME,IMGSIZE,DBSOFTWARE_VERSION,IMGTYPE FROM GHSUSER18.IMGS;

NAME       HOME                                                                              IMGSIZE DBSOFTWARE_VERSION   IMGTYPE
---------- --------------------------------------------------------------------------------- --------------- -------------------- ------------------------------
DB112      /rhpstorage/images/iDB112957258/swhome                                          4,820,192 11.2.0.4.0|false|    ORACLEDBSOFTWARE
DB183      /rhpstorage/images/iDB183271079/.ACFS/snaps/iDB183/swhome                       9,861,968 18.0.0.0.0|true|18.3 ORACLEDBSOFTWARE
```

Gold Images 的相关操作

每个“Gold Image”都代表一个 HOME,可以是 Oracle 数据库 HOME、Grid Infrastructure HOME 或任何其他软件 HOME。应用程序不会直接在“Gold Image”上运行。可以从“Gold Image”上创建副本 (working copy),然后在这些 workingcopy 上运行。“Gold Image”可以从 RHP 服务上安装的 HOME、RHP Client 或数据中心中的任何节点导入。Gold Image 还可以在 RHP 服务之间共享。默认的状态是 PUBLISHED, 在创建 image 的时候可以指定参数-state 来设置状态, 之后还可以通过 “promote image” 命令来改变状态。

有多种方式来创建 “gold images”, 一个是 “import image”, 一个是 “add image”, 一个是 “register image”(这个在白皮书中暂时没找到说明)

- “add image” 用于从 workingcopy 中创建副本。并且这个 workingcopy 是在 RHP 服务端上, 并且存储选项是 RHP_MANAGED。通过这个还可以节省存储空间。这个在后面会有介绍。
- “import image” 用于从安装的 HOME 中创建 “Gold Image”。可以是在 RHP 服务端, 也可以是 RHP Client 端, 或者是一个没有客户端的目标端 (11.2, 12.1 or 12.2) , 这个是常用选项。

支持 import image 的 Database 和 GI 版本为 11.2.0.4, 12.1.0.2, and 12.2.0.1。请记住, 数据中心中的任何家 HOME 都可以作为 “gold images” 导入, 因此您可以选择哪些 image 作为标准化部署基础。

Image 状态和访问

RHP 允许您定义 Image 的状态 PUBLISHED、RESTRICTED、TESTABLE (发布的、可测试的或受限的三种), 来实现 Image 的生命周期管理。此外, 还可以在角色和特定用户级别控制对给定映像的访问。

Image Series

使用 image series 是将不同的 “gold image” 组合成逻辑组的一种方便方法。Series 可以表示一系列的补丁级别, 不同的 Series 可以针对特定的用例进行定制。

导入 Image

下面我们在 RHP 服务端上导入已安装的 HOME

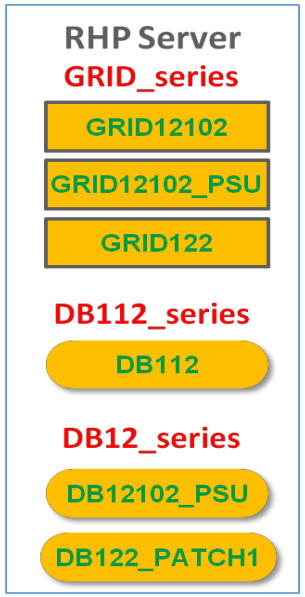
```
rhpctl import image -image DB12102_PSU -path <installed_home_path> -imagetype ORACLEDBSOFTWARE
rhpctl import image -image DB122 -path <installed_home_path> -imagetype ORACLEDBSOFTWARE
rhpctl import image -image DB122_PATCH1 -path <installed_home_path> -imagetype ORACLEDBSOFTWARE
rhpctl import image -image GRID12102 -path <installed_home_path> -imagetype ORACLEGISOFTWARE
rhpctl import image -image GRID12102_PSU -path <installed_home_path> -imagetype ORACLEGISOFTWARE
rhpctl import image -image GRID122 -path <installed_home_path> -imagetype ORACLEGISOFTWARE
```

创建 Series 和添加 Image

```
rhpctl add series  -series DB112_series
rhpctl insertimage series -series DB112_series -image DB112

rhpctl add series  -series DB12_series
rhpctl insertimage series -series DB12_series -image DB12102_PSU
rhpctl insertimage series -series DB12_series -image DB122_PATCH1

rhpctl add series  -series GRID_series
rhpctl insertimage series -series GRID_series -image GRID12102
rhpctl insertimage series -series GRID_series -image GRID12102_PSU
rhpctl insertimage series -series GRID_series -image GRID122
```

每个系列可能包含 0 个、1 个或多个“gold images”。一个“gold images”可能属于 0 个，1 个或多个系列。用户可以订阅这些系列，当“gold images”从系列中添加或移除时会收到邮件通知。

查看 series




```
[orgrid@ohs1 ~]$ rhpctl query series
Image series: DB12_series
Image series: GRID_series
Image series: DB112_series

[orgrid@ohs1 ~]$ rhpctl query series - series GRID_series
Image name: GRID12102
Image name: GRID12102_PSU
Image name: GRID122
[orgrid@ohs1 ~]$
```

Workingcopy and Unmanaged HOME

只要是通过 rhpctl 部署的 HOME 都属于被托管（managed）的，不是通过 rhpctl 部署的 HOME 都统称为非托管（unmanaged）的。例如，在一个非托管的 HOME 下，在补丁或升级过程中，可以通过 rhpctl 部署新的 HOME，然后通过 rhpctl 做升级或迁移，非托管（unmanaged）的 HOME 可以很容易的切换到被托管（managed），纳入 RHP 的管理框架。

邮件通知

用户可以订阅事件。当订阅的 image 被添加到或从订阅的 Series 中删除时，任何订阅者都会收到电子邮件通知。

角色管理

经过授权的管理员可以将角色授权给 RHP 用户。适用于 RHP Service 端和 RHP Client 端的用户。RHP 包括基本角色和复合的内置角色。

- 复合内置角色 GH_CA 包括管理 RHP Client 所需的所有基本角色
- 复合内置角色 GH_SA 包含管理 RHP Service 所需的所有基本角色，还包括了 GH_CA 可用的角色，以及管理员角色和与 RHP Client 相关的一切的能力。RHP 服务器端上的 Oracle Grid 用户自动继承 GH_SA 角色。

RHP 在 18c 中的角色信息

```
[root@ohs1 ~]# rhpctl query role
ohs1.ohsdba.cn: Audit ID: 101
Role name: GH_ROLE_ADMIN
Role name: GH_AUDIT_ADMIN
Role name: GH_USER_ADMIN
Role name: GH_SITE_ADMIN
Role name: GH_WC_ADMIN
Role name: GH_WC_OPER
Role name: GH_WC_USER
Role name: GH_IMG_ADMIN
Role name: GH_IMG_USER
Role name: GH_SUBSCRIBE_USER
Role name: GH_SUBSCRIBE_ADMIN
Role name: GH_IMGTYPE_ADMIN
Role name: GH_IMGTYPE_ALLOW
Role name: GH_IMGTYPE_OPER
Role name: GH_SERIES_ADMIN
Role name: GH_SERIES_CONTRIB
```

Role name: GH_IMG_TESTABLE
Role name: GH_IMG_RESTRICT
Role name: GH_IMG_PUBLISH
Role name: GH_IMG_VISIBILITY
Role name: GH_JOB_USER
Role name: GH_JOB_ADMIN
Role name: GH_OPER
Role name: GH_CA
Role name: GH_SA
Role name: OTHER

客户端管理

RHP Client 管理任务包括以下几种情况（注意所有操作都在 RHP 服务端执行）

- 启用和禁用 RHP Client。如果禁用了 client。那么在客户端执行的所以 rhpctl 命令会被服务端拒绝。
- 在 RHP Client 上创建用户并分配角色
- 管理 RHP Client 的密码。每个 RHP Client 使用内部存储的密码通过 RHP Service 进行身份验证。客户机上的 GH_CA 用户无法查询此密码。如果需要重置此密码，则此任务由 RHP Service 上的 GH_SA 用户来完成。

登录凭证

一些 rhpctl 命令将 root 或 sudo 作为参数。在 RHP Client 上执行 rhpctl 命令时不需要密码验证，但在 RHP 服务端上执行 rhpctl 命令时可能需要凭据。

在 12.2 RHP 服务端，对于下面这些命令总是需要密码验证

- addnode gihome
- add workingcopy of a Grid Infrastructure Home (unless “-local” is used OR if “-softwareonly” is used and the target is a 12.2 RHP Client)
- deletenode gihome
- discover client
- verify client

在 12.2 RHP 服务端，如果目标端是 11.2 或 12.1 Grid Infrastructure，或是独立的服务器(no Grid Infrastructure installed)，下面这些命令是需要密码验证的。如果是 12.2 RHP Client，下面这些命令是不需要密码验证的（除了 rhpctl delete workingcopy 且这个 workingcopy 就是 RHP Client 上一个活动的 Grid Infrastructure）。

- add workingcopy (when the workingcopy is not a Grid Infrastructure home - see above)
- add database
- addnode database
- addnode workingcopy
- delete workingcopy
- delete database
- deletenode database
- deletenode workingcopy
- move database
- move gihome
- upgrade database
- upgrade gihome
- import image

审计功能

RHP Service 记录所有 RHP 操作的执行情况，并记录其结果（成功或失败）。审计机制允许您在不同的维度中查询审计日志，并管理其内容。

命令行工具 rhpctl

```
[root@ohs1 ~]# rhpctl -h
Performs Rapid Home Provisioning operations and manages Rapid Home Provisioning Servers and Clients.

Usage:
        rhpctl add                  Adds a resource, type or other entity.
        rhpctl addnode              Adds nodes or instances of specific resources.
        rhpctl addpdb               Adds a pluggable database to the specified multitenant container database.
        rhpctl allow                Allows access to the image, series or image type.
        rhpctl collect              Collects backup of operating system configuration for the cluster.
        rhpctl compare              Compares operating system configurations for the specified cluster.
        rhpctl delete               Deletes a resource, type or other entity.
        rhpctl deleteimage          Deletes an image from a series.
        rhpctl deletenode           Deletes nodes or instances of specific resources.
        rhpctl deletepdb            Removes a pluggable database from the specified multitenant container database.
```

```
        rhpctl deploy               Deploys OS image for the cluster.
        rhpctl disable              Disables the scheduled daily backup of operating system configuration for the cluster.
        rhpctl disallow             Disallows access to the image, series or image type.
        rhpctl discover             Validates and discovers parameters to generate a response file.
        rhpctl enable               Enables the scheduled daily backup of operating system configuration for the cluster.
        rhpctl export               Exports data from the repository to a client or server data file.
        rhpctl grant                Grants a role to a client user.
        rhpctl import               Creates a new image from the specified path.
        rhpctl insertimage          Inserts a new image into a series.
        rhpctl instantiate          Requests images from another server.
        rhpctl modify               Modifies a resource, type or other entity.
        rhpctl move                 Moves a resource from a source path to a destination path.
        rhpctl promote              Promotes an image.
        rhpctl query                Gets information of a resource, type or other entity.
        rhpctl recover              Recovers a node after its failure.
        rhpctl register             Registers an image, user or server.
        rhpctl replicate            Replicate image from server to a specified client.
        rhpctl revoke               Revokes a role of a client user.
        rhpctl subscribe            Subscribes the specified user to an image series.
        rhpctl uninstantiate        Stops updates for previously requested images from another server.
        rhpctl unregister           Unregisters an image, user or server.
        rhpctl unsubscribe          Unsubscribes the specified user to an image series.
        rhpctl upgrade              Upgrades a resource.
        rhpctl verify               Validates and creates or completes a response file.
        rhpctl zdtupgrade           Performs zero downtime upgrade of a database.

For detailed help on each command use:
        rhpctl <command> -help
[root@ohs1 ~]#
```

其中比较常用的是 add rhpclient, import image, add workingcopy, upgrade, move 等

```
[orgrid@ohs1 ~]$ rhpctl add -h
Adds a resource, type or other entity.

Usage:
```

```
        rhpctl add client             Adds a Rapid Home Provisioning Client to the Rapid Home Provisioning Server configuration.
        rhpctl add credentials        Adds credentials to the OCR.
        rhpctl add database           Creates a database using the specified working copy.
        rhpctl add image              Creates a new image from an existing working copy.
        rhpctl add imagetype          Configures a new image type of the specified name and its associated user actions.
        rhpctl add role               Adds a new role to list of existing roles on the Rapid Home Provisioning Server configuration.
        rhpctl add series             Adds a series.
        rhpctl add useraction         Configures a new user action of the specified name with its associated script and action file.
        rhpctl add workingcopy        Adds a working copy.

For detailed help on each command and object and its options use:
  rhpctl <command> <object> -help
[orgrid@ohs1 ~]$
```

rhpctl import image

可以从已安装的 HOME 中生成“Gold Image”。也可以直接从 zip 文件导入。

rhpctl add workingcopy

提供基于“Gold Image”的 GI、DB 或其他软件的副本

rhpctl add database

创建一个新的数据库

```
[orgrid@ohs1 ~]$ rhpctl add database -h

Creates a database using the specified working copy.

Usage: rhpctl add database -workingcopy <workingcopy_name> -dbname <unique_db_name>
        [-datafileDestination <datafileDestination_path>]
        {-node <node_list> |
         -serverpool <pool_name>
                [-pqpool <pool_name> |
                 -newpqpool <pool_name> -pqcardinality <cardinality>] |
         -newpool <pool_name> -cardinality <cardinality>
                [-pqpool <pool_name> |
                 -newpqpool <pool_name> -pqcardinality <cardinality>]}
```

```
      [-dbtype
              {RACONENODE |
               RAC |
               SINGLE}]
      [-dbtemplate
              {<file_path> |
               <image_name>:<relative_file_path>}]
      [-cdb]
      [-pdbName <pdb_prefix>
              [-numberOfPDBs <pdb_count>]]
      [-sudouser <username> -sudopath <sudo_binary_path> |
       -root |
       -cred <cred_name> |
       -auth <plugin_name>
              [-arg1 <name1>:<value1>
                     [-arg2 <name2>:<value2>...]]]
      [-targetnode <node_name>]
      [-useractiondata <user_action_data>]
      [-eval]
      [-schedule <timer_value>]

  -workingcopy <workingcopy_name>        Name of the working copy
  -dbname <unique_db_name>               Name of database (DB_UNIQUE_NAME) to be provisioned
  -datafileDestination <datafileDestination_path>
                                         Data file destination location or ASM disk group name
  -node <node_list>                      Comma-separated list of nodes on which database will be created
  -serverpool <pool_name>                Comma-separated list of existing server pool names
  -newpool <pool_name>                   Server pool name for pool to be created
  -cardinality <cardinality>             Cardinality for new server pool
  -pqpool <pool_name>                    Existing PQ pool name
  -newpqpool <pool_name>                 PQ pool name for pool to be created
  -pqcardinality <cardinality>           Cardinality for new PQ pool
  -dbtype {RACONENODE | RAC | SINGLE}    Type of database: Oracle RAC One Node or Oracle RAC or Single Instance
  -dbtemplate <filepath> | <image_name>:<relative_file_path>
```

```
                                    Absolute file path for the template file or relative path to the image home directory on
Rapid Home Provisioning Server
    -cdb                            To create database as container database
    -pdbName <pdb_prefix>           The pdbName prefix if one or more PDBs need to be created
    -numberOfPDBs <pdb_count>       Number of PDBs to be created
    -sudouser <username>            perform super user operations as sudo user name
    -sudopath <sudo_binary_path>    location of sudo binary
    -cred <cred_name>               Credential name to associate the user/password credentials to access a remote node
    -root                           Use root credentials to access the remote node
    -auth <plugin_name> [<plugin_args>]  Use an authentication plugin to access the remote node
    -targetnode <node_name>         Node on which operation needs to be executed
    -eval                           Evaluate without executing the command.
    -useractiondata <user_action_data>   Value to be passed to useractiondata parameter of useraction script
    -schedule <timer_value>         Preferred time to execute the operation, in ISO-8601 format. For example:
2016-12-21T19:13:17+05

[orgrid@ohs1 ~]$
```

rhpctl move

适用于在大版本相同，小版本不同下的 HOME 切换

```
[orgrid@ohs1 ~]$ rhpctl move -help
Moves a resource from a source path to a destination path.

Usage:
        rhpctl move database        Moves a database from source working copy to the patched working copy.
        rhpctl move gihome          Moves the Oracle Grid Infrastructure from the source working copy or source home path to the
destination working copy.

For detailed help on each command and object and its options use:
  rhpctl <command> <object> -help
[orgrid@ohs1 ~]$
```

rhpctl upgrade

用于数据库、集群的升级

```
[orgrid@ohs1 ~]$ rhpctl upgrade -help
Upgrades a resource.

Usage:
         rhpctl upgrade database         Upgrades a database to the version of the destination working copy.
         rhpctl upgrade gihome           Upgrades the Oracle Grid Infrastructure from the source working copy or source home path to
the destination working copy.

For detailed help on each command and object and its options use:
  rhpctl <command> <object> -help
[orgrid@ohs1 ~]$
```

rhpctl zdtupgrade upgrade

用于零宕机数据库升级，需要借助 OGG 或 DG 来实现

```
[orgrid@ohs1 ~]$ rhpctl zdtupgrade database -h

Performs zero downtime upgrade of a database.

Usage: rhpctl zdtupgrade database -dbname <unique_db_name> -destwc <workingcopy_name>
        [-sourcewc <workingcopy_name> |
         -sourcehome <oracle_home_path>]
        [-ggsrcwc <workingcopy_name> -ggdstwc <workingcopy_name>]
        [-clonedatadg <diskgroup_name>
                [-cloneredodg <diskgroup_name>]
                [-clonerecodg <diskgroup_name>] |
         -clonedatafs <acfs_mountpoint>
                [-cloneredofs <acfs_mountpoint>]
                [-clonerecofs <acfs_mountpoint>]]
        [-targetnode <node_name>
                {-root |
                 -cred <cred_name> |
                 -sudouser <username> -sudopath <sudo_binary_path> |
                 -auth <plugin_name>
                        [-arg1 <name1>:<value1>
```

```
                              [-arg2 <name2>:<value2>...]]}]
        [-eval]
        [-useractiondata <user_action_data>]

    -dbname <unique_db_name>              Name of database (DB_UNIQUE_NAME) to be upgraded
    -destwc <workingcopy_name>            Name of the destination working copy to which the database needs to be upgraded
    -sourcewc <workingcopy_name>          Name of the source working copy from which the database needs to be upgraded.
    -sourcehome <oracle_home_path>        Source Oracle home path
    -ggsrcwc <workingcopy_name>           Name of the Oracle GoldenGate source working copy
    -ggdstwc <workingcopy_name>           Name of the Oracle GoldenGate destination working copy
    -clonedatadg <diskgroup_name>         Name of disk group to use as data file location for the clone database
    -cloneredodg <diskgroup_name>         Name of disk group to use as redo log location for the clone database
    -clonerecodg <diskgroup_name>         Name of disk group to use as recovery area for the clone database
    -clonedatafs <acfs_mountpoint>        Mount point of ACFS file system to use as data file location for the clone database
    -cloneredofs <acfs_mountpoint>        Mount point of ACFS file system to use as redo log location for the clone database
    -clonerecofs <acfs_mountpoint>        Mount point of ACFS file system to use as recovery area for the clone database
    -targetnode <node_name>               Name of a node in a remote cluster with no Rapid Home Provisioning Client
    -cred <cred_name>                     Credential name to associate the user/password credentials to access a remote node
    -root                                 Use root credentials to access the remote node
    -sudouser <username>                  perform super user operations as sudo user name
    -sudopath <sudo_binary_path>          location of sudo binary
    -auth <plugin_name> [<plugin_args>]   Use an authentication plugin to access the remote node
    -eval                                 Evaluate without executing the command.
    -useractiondata <user_action_data>    Value to be passed to useractiondata parameter of useraction script
[orgrid@ohs1 ~]$
```

rhpctl add imagetype

支持自定义 imagetype。但必须基于 basetype, 下面的 imagetype 就是内置的 basetype

```
[orgrid@ohs1 ~]$ rhpctl add imagetype -imagetype TBD -basetype SOFTWARE
ohs1.ohsdba.cn: Audit ID: 103
[orgrid@ohs1 ~]$ rhpctl query imagetype
ohs1.ohsdba.cn: Audit ID: 104
Image type: BASE_SOFTWARE
```

```
Image type: ODAPATCHSOFTWARE
Image type: EXAPATCHSOFTWARE
Image type: SOFTWARE
Image type: ORACLEDBSOFTWARE
Image type: ORACLEGISOFTWARE
Image type: ORACLEGGSOFTWARE
Image type: LINUXOS
[orgrid@ohs1 ~]$
```

RHP 可提供标准化的部署

Cluster（集群）

Rapid Home Provisioning Service 可以在仅安装 OS（已安装相关安装包、网络等）的一个或多个节点上供应和配置 Oracle Grid Infrastructure，并组件集群。支持 11.2 以上的版本。

Database（数据库）

Rapid Home Provisioning Service 可以为 Oracle database 11.2 或更高版本提供 Oracle HOME。一旦供应了软件，一个 RHP 命令将创建一个数据库，其中包括以下选项

- Oracle Real Application Clusters (Oracle RAC)
- Oracle Real Application Clusters One Node (Oracle RAC One Node)
- single instance (with or without Grid Infrastructure or Oracle Restart on the target)
- using templates
- creating Oracle Multitenant Container Databases (CDBs)
- creating an Admin- or Policy-managed database

通用软件

RHP 生态系统不限于 Oracle Database 和 Grid Infrastructure。任何软件二进制 Oracle、第三方或自定义软件，都可以用于创建“Gold Image”，然后将其供应给数据中心中的任何节点。

支持的集群和数据库版本列表

Rapid Home Provisioning Service 12.2.0.1 支持以下 database 和 GI 的部署、补丁、伸缩（增加或减少节点）和升级。

Target Home	Provision and Patch	Scale Up / Scale Down	Upgrade to
Database		RAC home	
11.2.0.3	N	N	11.2.0.4, 12.1.0.2, 12.2.0.1
11.2.0.4	Y	Y	12.1.0.2, 12.2.0.1
12.1.0.1	N	N	N/A
12.1.0.2	Y	Y	12.2.0.1
12.2.0.1	Y	Y	Future
Grid Infrastructure		Cluster	
11.2.0.3	N	N	N/A
11.2.0.4	Y	Y	12.1.0.2, 12.2.0.1
12.1.0.1	N	N	N/A
12.1.0.2	Y	Y	12.2.0.1
12.2.0.1	Y	Y	Future

RHP 支持以上 RAC One Node 和 RAC 版本，也支持 Single Instance Databases，以及运行在 Oracle Restart 的数据库。

还要注意，RHP 不支持 Oracle Restart homes。因此，如果要升级运行在 Oracle Restart（SIHA）上的数据库，需要先手动的把 Oracle Restart 的 Oracle Home 升级到相应版本，然后再通过 RHP 将数据库升级到相应的版本。

注意：对于 11.2.0.3，不支持直接通过 RHP 部署，但可以将该数据库升级升级到更高版本

部署的软件的存储选项

当您部署软件时，存储选项决定软件的位置:

Local (默认):在存储在本地文件系统中，不是由 RHP 管理，适用所有部署选项。

RHP_MANAGED:在一个由 RHP 管理的共享文件系统中，是存储在 RHP 服务端，然后通过 NFS 的方式挂载，可以节省本地空间。只有在 RHP 服务端或者有 RHP Client 的客户端才能使用，并且仅限于 Oracle Database Homes

打补丁方式的改变

传统方式下打补丁

下面是在 RHP 之前，在打数据库的补丁时，一般的操作步骤如下:

1. Prepare home for out of place patching

a. Run OPatch version check
b. Run Inventory check
c. Run conflicts check
d. Run components check
e. Run Space check
f. As software owner, tar the existing software home
g. As software owner, untar the tarball into a new home

2. Apply the Patch

a. Run Opatch apply to install the patch
b. Attach the new home to inventory
c. Update the node list to the inventory

3. Orchestrate switching the database to the new home

a. Stop the database instance on the node
b. Modify the configuration of database CRS resource to start the instance from newly cloned (patched) Oracle home
c. Start the database instance

4. REPEAT THE LEFTHAND COLUMN FOR EVERY DATABASE IN THIS HOME

5. Apply SQL

a. Run datapatch.pl or SQLs necessary for the patch

6. Fix Dependent Scripts

a. Fix static settings of ORACLE_HOME paths in wrapper scripts

通过 RHP 打补丁

企业级补丁：简单，自动化，可恢复，可继续（从失败的地方），RHP 对补丁的关键特性

- Out-of-place, non-disruptive distribution of new homes
- Rolling by default
- Dry-run evaluation
- Resumable in case of errors during operation
- Simple rollback
- Data Guard support
- Control over service draining and relocation to maximize availability

现在上面的这些操作都可以通过下面的两条命令搞定

1. rhpctl add workingcopy (copies of Gold Images are referred to as ‘workingcopies’)
2. rhpctl move database

因为 RHP 在 out-of-place（异地）的方式打补丁，她理解数据库的配置细节，所以应用补丁和回滚补丁的方式基本相关，只需要把 ORACLE_HOME 换换就好。这种能力降低了维修的风险。此外，该过程是可重新启动的。如果在补丁程序中发生故障，管理员只需解决问题，然后重新执行修补程序命令。它将在停止的地方恢复。

对 Data Guard 的支持

在 Data Guard 下应用补丁，要求所有的 primary 和 standby 数据库先完成补丁的变更，然后再执行 Datapatch。RHP 对 Data Guard 是有感知的，所以当你在 standby 上应用补丁时，只会做 binary 的变更，而不会执行 Datapatch。在补丁的最后阶段会在主库上执行 Datapatch。

GI 和 Database 补丁一起打

当您对 Oracle Grid Infrastructure HOME 打补丁时，RHP 使您能够同时对集群上的 Oracle 数据库 Home 进行补丁，因此您可以在一次维护操作中对两种类型的软件 Home（GI_HOME,ORACLE_HOME）进行补丁。

已部署的副本

例如，假设 RHP 服务在 Oracle Grid Infrastructure 12c 发行版 1(12.1.0.2)目标集群上部署了以下所提供的副本（workingcopy）：

GI121WC1: The active Grid home on the Oracle Grid Infrastructure 12c release 1 (12.1.0.2) cluster
GI121WC2: A software-only Grid home on the Oracle Grid Infrastructure 12c release 1 (12.1.0.2) cluster

DB121WC1: An Oracle RAC 12c release 1 (12.1.0.2.0) database home running database" alpha"
DB121025WC1: An Oracle RAC 12c release 1 (12.1.0.2.5) database home with no database instances (this is the patched home)

DB112WC1: An Oracle RAC 11g release 2 (11.2.0.4.0) database home running database "bravo"
DB112045WC1: An Oracle RAC 11g release 2 (11.2.0.4.5) database home with no database instances (this is the patched home)

要完成的迁移

要完成下面 GI Home 和 Oracle Database Home 的迁移
Oracle Grid Infrastructure from copy GI121WC1 to copy GI121WC2
Oracle RAC Database "alpha" from copy DB121WC1 to copy DB121025WC1
Oracle RAC Database "bravo" from copy DB112WC1 to copy DB112045WC1

要执行的命令

只要执行下面的命令即可:

```
$ rhpctl move gihome -sourcewc GI121WC1 -destwc GI121WC2 -auto -dbhomes DB121WC1=DB121025WC1,DB112WC1=DB112045WC1 -targetnode test_749
```

操作步骤解析

对于客户端集群中的每个节点，RHP 将做下面的操作:

1) Runs any configured pre-operation user actions for moving the Oracle Grid Infrastructure (move gihome).
2) Runs any configured pre-operation user actions for moving the database copies (move database).
3) Copies or merges configuration files such as listener.ora and tnsnames.ora (move database).
4) Switches Oracle Home resource attribute of the Databases (move database).
5) Relocates Database services to available instances; applying drain and disconnect options (move database).
6) Stops remaining services running on the node; applying drain and disconnect options (move database).
7) Stops database instances (move database)
8) Executes GI pre-patch and post-patch (move gihome).

9) Starts database instances (move database)
10) Applies SQL patches if the current node is the last node (move database)
11) Updates central inventory (move gihome)
12) Runs any configured post-operation user actions for moving the database copies (move database).
13) Runs any configured post-operation user actions for moving the Oracle Grid Infrastructure copy (move gihome).
14) Note that Grid Infrastructure and Database patching can be performed separately as well.

如何节省 Gold Image 存储空间

软件 HOME 的生命周期包含初始化的文件，和后续的包含补丁的更新。对 Oracle Database 和 Grid Infrastructure 来说，以 11204 为例，在 11204 基础之上的包含补丁的版本比 11204 的初始化版本的变化不大。RHP 就可以在保存补丁过的“Gold Image”时只保存在初始化“Gold Image”版本之上变化的部分。这样就可以省出很多空间。请注意，这个方法是可选的：您可以自由创建每个“Gold Image”，并将每个“Gold Image”存储为完整的大小。 除了存储消耗之外，没有缺点。

一般的方法制作 Image

当一个新补丁或 PSU 释出的时候，你想部署到目标端上，然后通过“switch home”的方式来切换。你需要创建一个包含补丁或 PSU 的新 Image。
为了创建这个新的 Image，你可以在任何服务器上安装这个补丁过的 HOME，然后通过“import image”的方式在补丁过的 HOME 上创建新的 Image。这个 Image 是“full-sized”。

节省空间的方法来制作 Image

随着时间的推移，您可能会构建一个大型“Gold Image”库，因此 RHP 提供的了一个仅存储新“Gold Image”与之前“Gold Image”的增量。 这可以节省大量空间。 此方法适用于 Oracle Database HOME 和 Grid Infrastructure HOME。

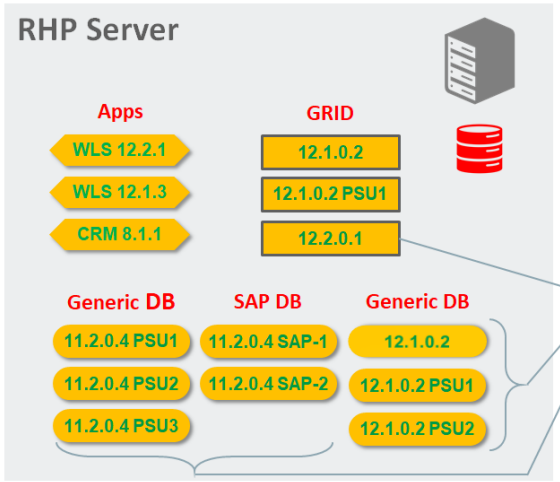
步骤如下：
1. 在 RHP 服务端上供应一个基于初始化“Gold Image”需要打补丁的 workingcopy。这个 workingcopy 位于。这个 workingcopy 只是暂时用用，最好会被删除。
    1a. 如果供应的是 Database home。请继续做 step 2.
    1b. 如果供应的是 Grid home，rhpctl add workingcopy 时请使用‘-local’ 和‘-softwareonly’
2 在供应的新 workingcopy（临时用）上打安装补丁
3 用 rhpctl **add image** 在补丁过的 workingcopy 上创建新“Gold Image”
4 为了验证新“Gold Image”，可以通过 rhpctl add workingcopy 在测试机上部署基于新“Gold Image”的副本，并做测试
5 验证完成之后，通过 rhpctl delete workingcopy 删除在 Step 1 中创建的 workingcopy。注意，不要使用诸如’rm’之类的命令，因为这会绕过’delete workingcopy’而不会在 MGMTDB 中更新。
这种方法的好处是 RHP 将新“Gold Image”存储为先前“Gold Image”的增量。 在一次测试中观察到的节省如下：

```
[orgrid@ohs1 ~]$ acfsutil snap info
/mnt/oracle/rhpimages/images/i11204DB499920
snapshot name:idb11204CPU snapshot location:
/mnt/oracle/rhpimages/images/i11204DB499920/.ACFS/snaps/idb11204CPU RO snapshot or RW snapshot: RO
parent name:    wwc_db11204PSU
snapshot creation time:Tue Sep 13 09:43:03 2016 storage added to snapshot:358854656 ( 342.23 MB )
```

Oracle Database 11.2.0.4 HOME (Gold Image) 大约为 4.5 GB。 当我们使用最近的 CPU 补丁创建新的“Gold Image”时，生成的 delta 只消耗了 340 MB 的存储空间，节省了超过 4 GB。

支持用户自定义脚本

用户自定义的操作是存储在 RHP 服务端上的 shell 脚本。对于 RHP 的多种操作，例如 import image、add/delete workingcopy 和管理软件 Home，您可以创建脚本将成为其工作流一部分。



- Script runs on target cluster pre or post
  - Import image
  - Add, delete working copy
  - Add, delete, move, upgrade Database
  - Move, upgrade GI Home

Type	Add wc, pre	Add wc, post	Move DB, pre	...
12.2 GI	Add_122GI_pre.sh	Add_122GI_post.sh		
12.1 DB	Add_121DB_pre.sh	Add_121DB_post.sh	Mv_121DB_pre.sh	
11.2 DB	Add_112DB_pre.sh	Add_112DB_post.sh	Mv_112DB_pre.sh	
...				

下面的样例只是创建了一个文件。其实还可以实现很多功能，比如

- 数据库创建完成后，将数据库注册到 RMAN catalog
- 升级之前关闭对数据库的监控，在完成升级之后把监控打开
- 软化部署完毕之后，配置和启动应用。和一些后续步骤等

测试脚本内容

```
/home/orgrid/useractionscripts/movepre.sh
#!/bin/sh
PATH= DBNAME=
for var in $@ do
if [[ $var == *"RHP_PATH="* ]] then
IFS='=' read -ra PATHARR <<< "$var" PATH=${PATHARR[1]}
fi
if [[ $var == *"RHP_DBNAME="* ]] then
IFS='=' read -ra DBARR <<< "$var"
fi
done
DBNAME=${DBARR[1]}
timestamp=$(/bin/date +%Y-%m-%d-%I-%M-%S%p) FILEDIR=$PATH/srvm/admin/ PREUSER=_pre_useraction_done_
FILENAME=$FILEDIR$DBNAME$PREUSER$timestamp
/bin/touch $FILENAME for var in $@
do
done
/bin/echo $var >> $FILENAME
```

创建和查询 useraction

```
[orgrid@ohs1 ~]$ rhpctl add useraction -optype MOVE_DATABASE -pre -onerror ABORT -useraction movedbpre -actionscript
/home/orgrid/useractionscripts/movepre.sh -runscope ONENODE

[orgrid@ohs1 ~]$ rhpctl query useraction
User action name: movedbpre

[orgrid@ohs1 ~]$ rhpctl query useraction -useraction movedbpre
User action name: movedbpre
Action script: movepre.sh
Action file:
Operation type: MOVE_DATABASE
Pre-operation or post-operation: PRE
On error: ABORT
```

Run scope: ONENODE
[orgrid@ohs1 ~]$

```
[orgrid@ohs1 ~]$ rhpctl add useraction -optype MOVE_DATABASE -pre -onerror ABORT -useraction movedbpre -actionscript /home/orgrid/useractionscripts/movepre.sh -runscope ONENODE
ohs1.ohsdba.cn: Audit ID: 152
[orgrid@ohs1 ~]$ rhpctl query useraction
ohs1.ohsdba.cn: Audit ID: 153
User action name: movedbpre
[orgrid@ohs1 ~]$ rhpctl query useraction -useraction movedbpre
ohs1.ohsdba.cn: Audit ID: 154
User action name: movedbpre
Action script: movepre.sh
Action file:
Operation type: MOVE_DATABASE
Pre-operation or post-operation: PRE
On error: ABORT
Run scope: ONENODE
[orgrid@ohs1 ~]$
```

这个命令将在移动数据库之前执行。如果失败，移动操作将中止。(我们也可以选择忽略任何错误并继续移动)。还要注意，脚本将只运行目标集群的一个节点。我们还可以指定它在所有节点上运行。
在上面的输出中，可以看到“Action file:”是空的。因为我们还没有使用用户操作的其他功能，即定义一个文件(您选择的任何格式)，该文件放在脚本执行的相同目录中。

将 useraction 和 imagetype 关联

当前我们没有在 image 类型为 ORACLEDBSOFTWARE 关联 user action

```
rhpctl query imagetype -imagetype ORACLEDBSOFTWARE
rhpctl modify imagetype -imagetype ORACLEDBSOFTWARE -useractions movedbpre
rhpctl query imagetype -imagetype ORACLEDBSOFTWARE
rhpctl query useraction -imagetype ORACLEDBSOFTWARE
```

在 RHP 服务端查看脚本信息

```
[orgrid@ohs1 ~]$ srvctl config rhpserver
Storage base path: /rhpstorage
Disk Groups: DATA
Port number: 23795
Transfer port range:
Rapid Home Provisioning Server is enabled
Rapid Home Provisioning Server is individually enabled on nodes:
Rapid Home Provisioning Server is individually disabled on nodes:
Email address:
Mail server address:
```

```
Mail server port:
Transport Level Security disabled
HTTP Secure is enabled
[orgrid@ohs1 ~]$ cd /rhpstorage/chkbase/useractions/movedbpre/
[orgrid@ohs1 movedbpre]$ ls -l
total 4
-rwxr-xr-x 1 orgrid oinstall 4 Oct 10 18:22 movepre.sh
[orgrid@ohs1 movedbpre]$
```

```
[orgrid@ohs1 ~]$ srvctl config rhpserver
Storage base path: /rhpstorage
Disk Groups: DATA
Port number: 23795
Transfer port range:
Rapid Home Provisioning Server is enabled
Rapid Home Provisioning Server is individually enabled on nodes:
Rapid Home Provisioning Server is individually disabled on nodes:
Email address:
Mail server address:
Mail server port:
Transport Level Security disabled
HTTP Secure is enabled
[orgrid@ohs1 ~]$ cd /rhpstorage/chkbase/useractions/movedbpre/
[orgrid@ohs1 movedbpre]$ ls -l
total 4
-rwxr-xr-x 1 orgrid oinstall 4 Oct 10 18:22 movepre.sh
[orgrid@ohs1 movedbpre]$
```

对所有 Imagetype 为 ORACLEDBSOFTWARE 的镜像，useraction 都会执行脚本里面的操作。如果我们想为 ORACLEDBSOFTWARE 类型中的某个“Gold Image”指定不同的用户操作。例如，从“Gold Image” DB122_PATCH1 开始，我们可以通过下面的方式来实现

```
rhpctl add imagetype -imagetype DB122_PATCH_TYPE -basetype ORACLEDBSOFTWARE
```

注意：“rhpctl add imagetype”中使用-basetype 时，basetype 必须是内置的 image type

```
rhpctl query imagetype -imagetype DB122_PATCH_TYPE
rhpctl query imagetype -imagetype ORACLEDBSOFTWARE
rhpctl modify image -image DB122_PATCH1 -imagetype DB122_PATCH_TYPE
rhpctl query image -image DB122_PATCH1
```

如何删除 useraction

rhpctl delete useraction，通过这个命令可以从所有关联的 imagetype 移除 useraction。

如果 useraction 被不止一个 imagetype 引用，你又不希望从所有关联的 imagetype 移除，可以使用“rhpctl modify imagetype”命令来实现。

RHP 相关服务用到的端口

Applies to	Protocol	Port(s)	Direction	Traffic and encryption (if applicable)	Description and notes
11.2 and 12.1 Targets	TCP	22	RHP Client/Target to accept incoming connection	SSH - TLSv1.1 and 1.2	Authentication-based executions for all operations involving client-less targets.
12.2.0.1 Clients (all revision levels)	TCP	22	RHP Client/Target to accept incoming connection	SSH - TLSv1.1 and 1.2	Grid Infrastructure provisioning of new 12.2 clusters. (All other Server / Client commands use the JMX path.)
12.2.0.1 Clients (all revision levels)	TCP	23795	Bidirectional	JMX communication (Registry and Server) Connection authenticated with encrypted password (Oracle Wallet). TLSv1.1 and 1.2, SHA_256 cipher suites	For communication between RHP Server and RHP Clients. Port is configurable using srvctl modify rhpserver -port <port> Note: Need RHP Server to be stopped when this command is executed, or, specify "-force" which bounces RHPS
12.2.0.1 Clients (all revision levels)	UDP	53	RHP Server to accept incoming connection	GNS port	Used for RHP Clients to locate the RHP Server. GNS can be configured with or without zone delegation.
11.2 and 12.1 Targets and 12.2.0.1 Clients (all revisions)	TCP/UDP	One port per rhpctl command from ephemeral port range	To be opened to accept incoming connection on machine where rhpctl is run - can be RHP Server or RHP client	Progress listener	Each rhpctl command opens a random port from the ephemeral range to monitor progress of the operation running on the client / target.
12.2.0.1 + Jan 2018 RU Clients	TCP	Six ports chosen randomly from ephemeral port range	RHP Client/Target to accept incoming connection	Gold Image provisioning to Client (execution of "rhpctl add workingcopy" on RHPS)	Provisioning a copy of a gold image from RHPS to a 12.2.0.1 + Jan 2018 RU Client opens six ports on the Client. Ports chosen randomly from

					the ephemeral range.
11.2 and 12.1 Targets and 12.2.0.1 Clients (all revision levels, see last column for details)	TCP/UDP	2049 111 Six additional ports from ephemeral range or as defined in config file	Bidirectional	NFS - fixed port rpc portmapper (universal port) - fixed port Ephemeral or configurable with config file parameter as shown: (Item) (Config file entry) rpc status --> STATD_PORT rpc status out --> STATD_OUTGOING_PORT rpc quota --> RQUOTAD_PORT rpc mountd --> MOUNTD_PORT rpc lockd tcp --> LOCKD_TCPPORT rpc lockd udp --> LOCKD_UDPPORT	RHP Server uses NFS for provisioning copies of gold images to 11.2 and 12.1 targets and to pre-Jan 2018 RU Clients. For all target / client versions, NFS is used internally to support various rhpctl command executions Ports 2049 and 111 are fixed ports, not configurable. The other ports are chosen from the ephemeral range unless they are defined in/etc/sysconfig/nfs .

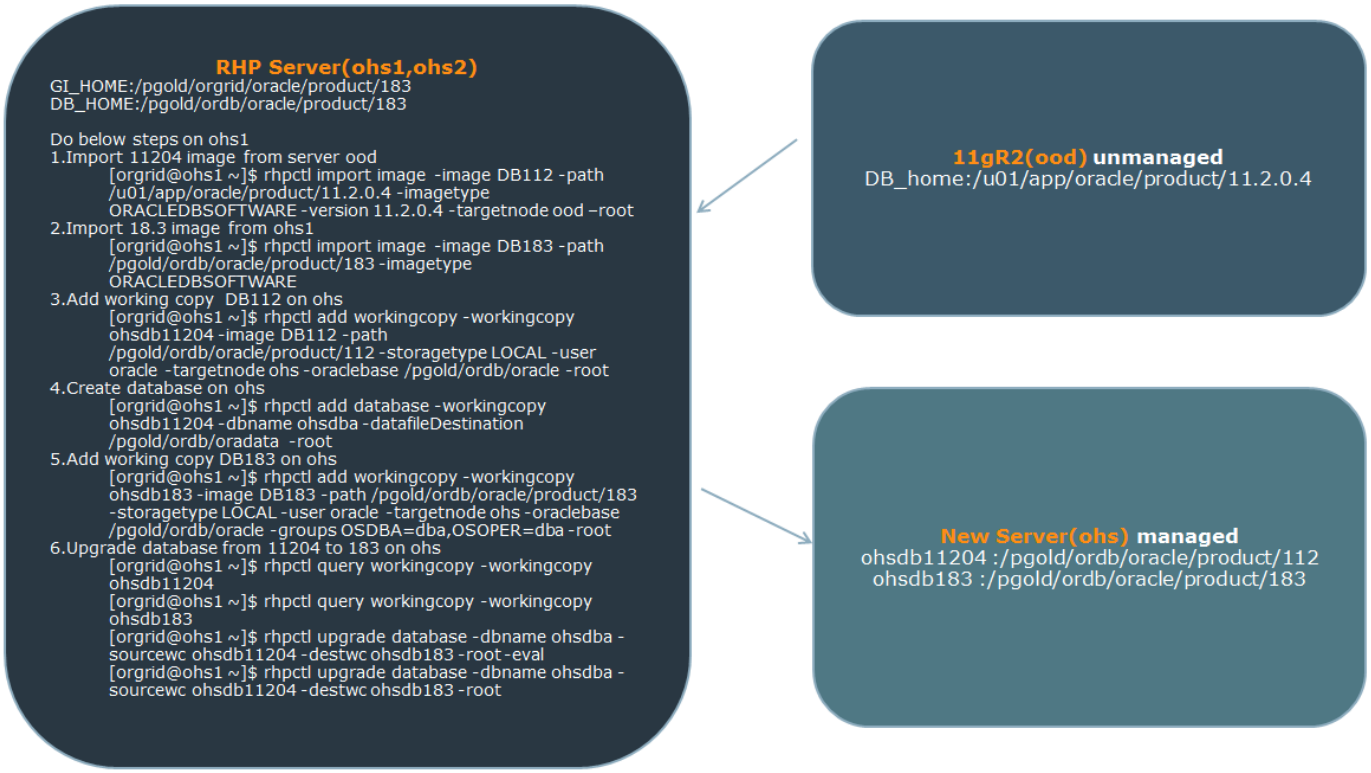
通过 rhpctl 部署和升级数据库

下面是原始环境的信息。我们通过在 RHP Server ohs1 上导入 ood 11204 的 ORACLE_HOME，在 ohs1 上导入 183 的 ORACLE HOME。然后在 ohs1 上通过 RHP 为 ohs 部署 11204 的 ORACLE_HOME，并创建数据库，然后再部署 183 的 ORACLE_HOME，最后将 11204 的数据库升级都 183。

原始环境信息

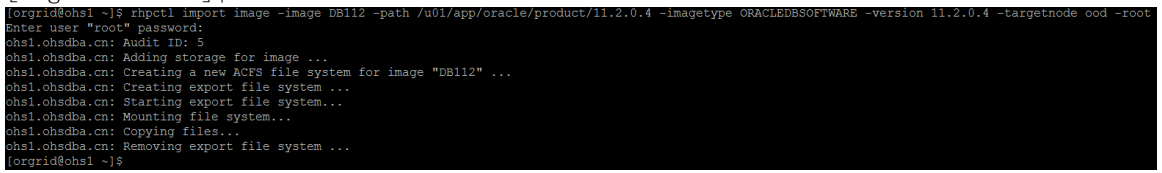
OS Server	ohs1, ohs2 RHP Server	ood	ohs
GI HOME	/pgold/orgrid/oracle/product/183	N/A	N/A
Database HOME	/pgold/ordb/oracle/product/183	/u01/app/oracle/product/11204	N/A

部署架构图



从 ood 上导入 11204 的 Image

```
[orgrid@ohs1 ~]$ rhpctl import image -image DB112 -path /u01/app/oracle/product/11.2.0.4 -imagetype ORACLEDBSOFTWARE -version 11.2.0.4
-targetnode ood -root
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 5
ohs1.ohsdba.cn: Adding storage for image ...
ohs1.ohsdba.cn: Creating a new ACFS file system for image "DB112" ...
ohs1.ohsdba.cn: Creating export file system ...
ohs1.ohsdba.cn: Starting export file system...
ohs1.ohsdba.cn: Mounting file system...
ohs1.ohsdba.cn: Copying files...
ohs1.ohsdba.cn: Removing export file system ...
[orgrid@ohs1 ~]$
```



从 ohs1 上导入 183 的 Image

```
[orgrid@ohs1 ~]$ rhpctl import image -image DB183 -path /pgold/ordb/oracle/product/183 -imagetype ORACLEDBSOFTWARE
ohs1.ohsdba.cn: Audit ID: 6
ohs1.ohsdba.cn: Creating a new ACFS file system for image "DB183" ...
ohs1.ohsdba.cn: Copying files...
ohs1.ohsdba.cn: Copying home contents...
ohs1.ohsdba.cn: Changing the home ownership to user oracle...
ohs1.ohsdba.cn: Changing the home ownership to user orgrid...
[orgrid@ohs1 ~]$
```

在 ohs 上部署 11204 的 ORACLE HOME

```
[orgrid@ohs1 ~]$ rhpctl add workingcopy -workingcopy ohsdb11204 -image DB112 -path /pgold/ordb/oracle/product/112 -storagetype LOCAL
-user oracle -targetnode ohs -oraclebase /pgold/ordb/oracle -root
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 26
ohs1.ohsdba.cn: Storing metadata in repository for working copy "ohsdb11204" ...
ohs1.ohsdba.cn: Connecting to node ohs ...
ohs1.ohsdba.cn: Starting transfer for remote copy ...
ohs1.ohsdba.cn: Starting clone operation...
ohs1.ohsdba.cn: Using inventory file /etc/oraInst.loc to clone ...
ohs: ./runInstaller -clone -waitForCompletion  "ORACLE_HOME=/pgold/ordb/oracle/product/112" "ORACLE_HOME_NAME=ohsdb11204"
"ORACLE_BASE=/pgold/ordb/oracle" "oracle_install_OSDBA=dba" "oracle_install_OSOPER=dba" -silent -noConfig -nowait
ohs: Starting Oracle Universal Installer...
ohs:
ohs: Checking swap space: must be greater than 500 MB.   Actual 3967 MB    Passed
ohs: Preparing to launch Oracle Universal Installer from /tmp/OraInstall2018-10-02_12-18-58AM. Please wait ...Oracle Universal Installer,
Version 11.2.0.4.0 Production
ohs: Copyright (C) 1999, 2013, Oracle. All rights reserved.
ohs:
ohs: You can find the log of this install session at:
ohs:  /pgold/ordb/oraInventory/logs/cloneActions2018-10-02_12-18-58AM.log
ohs: ..................................................................................... 100% Done.
ohs:
ohs:
ohs:
ohs: Installation in progress (Tuesday, October 2, 2018 12:19:24 AM CST)
ohs: ..........................................................................  78% Done.
ohs: Install successful
ohs:
ohs: Linking in progress (Tuesday, October 2, 2018 12:19:27 AM CST)
ohs: Link successful
ohs:
ohs: Setup in progress (Tuesday, October 2, 2018 12:19:46 AM CST)
```

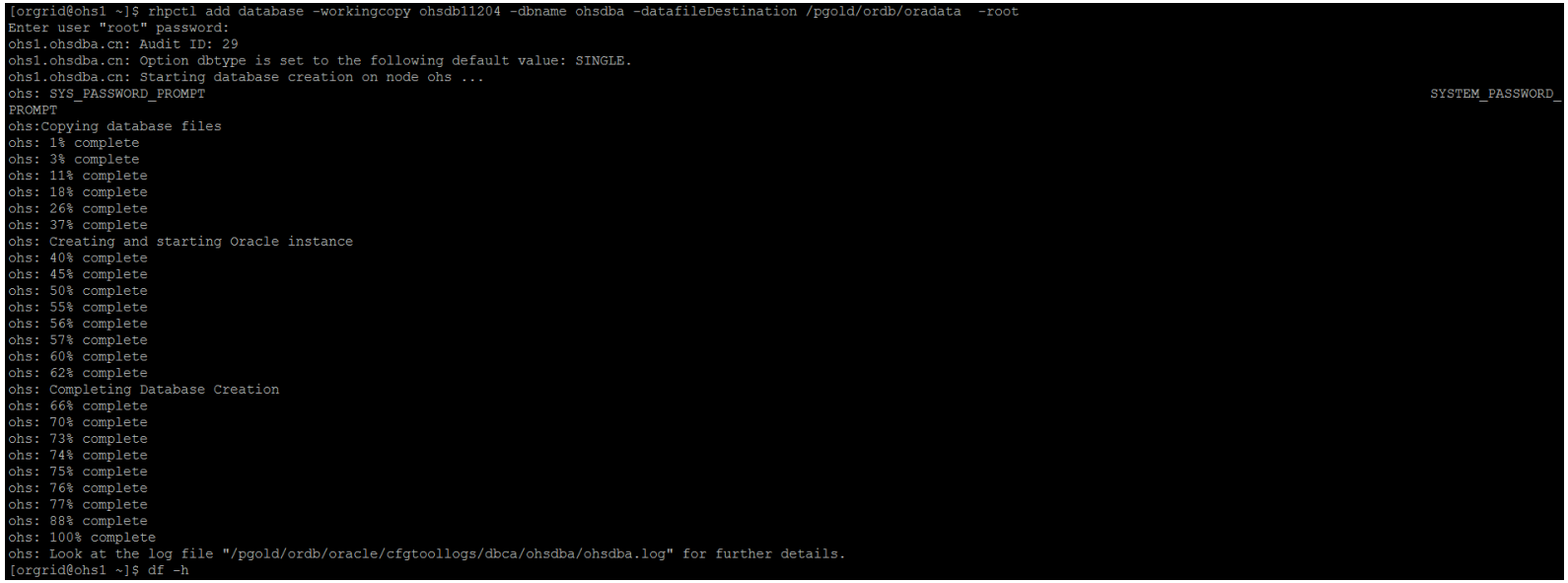
```
ohs: Setup successful
ohs:
ohs: End of install phases.(Tuesday, October 2, 2018 12:20:08 AM CST)
ohs: WARNING:
ohs: The following configuration scripts need to be executed as the "root" user.
ohs: /pgold/ordb/oracle/product/112/root.sh
ohs: To execute the configuration scripts:
ohs:     1. Open a terminal window
ohs:     2. Log in as "root"
ohs:     3. Run the scripts
ohs:
ohs: The cloning of ohsdb11204 was successful.
ohs: Please check '/pgold/ordb/oraInventory/logs/cloneActions2018-10-02_12-18-58AM.log' for more details.
ohs1.ohsdba.cn: Successfully executed clone operation.
ohs1.ohsdba.cn: Executing root script on nodes ohs.
ohs: Check /pgold/ordb/oracle/product/112/install/root_ohs.ohsdba.cn_2018-10-02_00-20-09.log for the output of root script
ohs1.ohsdba.cn: Successfully executed root script on nodes ohs.
ohs1.ohsdba.cn: Working copy creation completed.
[orgrid@ohs1 ~]$
```

```
[orgrid@ohs1 ~]$ rhpctl add workingcopy -workingcopy ohsdb11204 -image DB112 -path /pgold/ordb/oracle/product/112 -storagetype LOCAL -user oracle -targetnode ohs -oraclebase /pgold/ordb/ora
cle -root
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 26
ohs1.ohsdba.cn: Storing metadata in repository for working copy "ohsdb11204" ...
ohs1.ohsdba.cn: Connecting to node ohs ...
ohs1.ohsdba.cn: Starting transfer for remote copy ...
ohs1.ohsdba.cn: Starting clone operation...
ohs1.ohsdba.cn: Using inventory file /etc/oraInst.loc to clone ...
ohs: ./runInstaller -clone -waitForCompletion  "ORACLE_HOME=/pgold/ordb/oracle/product/112" "ORACLE_HOME_NAME=ohsdb11204" "ORACLE_BASE=/pgold/ordb/oracle" "oracle_install_OSDBA=dba" "oracle
_install_OSOPER=dba" -silent -noConfig -nowait
ohs: Starting Oracle Universal Installer...
ohs:
ohs: Checking swap space: must be greater than 500 MB.   Actual 3967 MB    Passed
ohs: Preparing to launch Oracle Universal Installer from /tmp/OraInstall2018-10-02_12-18-58AM. Please wait ...Oracle Universal Installer, Version 11.2.0.4.0 Production
ohs: Copyright (C) 1999, 2013, Oracle. All rights reserved.
ohs:
ohs: You can find the log of this install session at:
ohs:  /pgold/ordb/oraInventory/logs/cloneActions2018-10-02_12-18-58AM.log
ohs: ..................................................................................................... 100% Done.
ohs:
ohs:
ohs:
ohs: Installation in progress (Tuesday, October 2, 2018 12:19:24 AM CST)
ohs: ..........................................................................                                 78% Done.
ohs: Install successful
ohs:
ohs: Linking in progress (Tuesday, October 2, 2018 12:19:27 AM CST)
ohs: Link successful
ohs:
ohs: Setup in progress (Tuesday, October 2, 2018 12:19:46 AM CST)
ohs: Setup successful
ohs:
ohs: End of install phases.(Tuesday, October 2, 2018 12:20:08 AM CST)
ohs: WARNING:
ohs: The following configuration scripts need to be executed as the "root" user.
ohs: /pgold/ordb/oracle/product/112/root.sh
ohs: To execute the configuration scripts:
ohs:     1. Open a terminal window
ohs:     2. Log in as "root"
ohs:     3. Run the scripts
ohs:
ohs: The cloning of ohsdb11204 was successful.
ohs: Please check '/pgold/ordb/oraInventory/logs/cloneActions2018-10-02_12-18-58AM.log' for more details.
ohs1.ohsdba.cn: Successfully executed clone operation.
ohs1.ohsdba.cn: Executing root script on nodes ohs.
ohs: Check /pgold/ordb/oracle/product/112/install/root_ohs.ohsdba.cn_2018-10-02_00-20-09.log for the output of root script
ohs1.ohsdba.cn: Successfully executed root script on nodes ohs.
ohs1.ohsdba.cn: Working copy creation completed.
```

在 ohs 上创建 11204 的数据库

```
[orgrid@ohs1 ~]$ rhpctl add database -workingcopy ohsdb11204 -dbname ohsdba -datafileDestination /pgold/ordb/oradata  -root
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 29
ohs1.ohsdba.cn: Option dbtype is set to the following default value: SINGLE.
ohs1.ohsdba.cn: Starting database creation on node ohs ...
ohs:SYS_PASSWORD_PROMPT
SYSTEM_PASSWORD_PROMPT
ohs:Copying database files
ohs: 1% complete
ohs: 3% complete
ohs: 11% complete
ohs: 18% complete
```

```
ohs: 26% complete
ohs: 37% complete
ohs: Creating and starting Oracle instance
ohs: 40% complete
ohs: 45% complete
ohs: 50% complete
ohs: 55% complete
ohs: 56% complete
ohs: 57% complete
ohs: 60% complete
ohs: 62% complete
ohs: Completing Database Creation
ohs: 66% complete
ohs: 70% complete
ohs: 73% complete
ohs: 74% complete
ohs: 75% complete
ohs: 76% complete
ohs: 77% complete
ohs: 88% complete
ohs: 100% complete
ohs: Look at the log file "/pgold/ordb/oracle/cfgtoollogs/dbca/ohsdba/ohsdba.log" for further details.
[orgrid@ohs1 ~]$
```

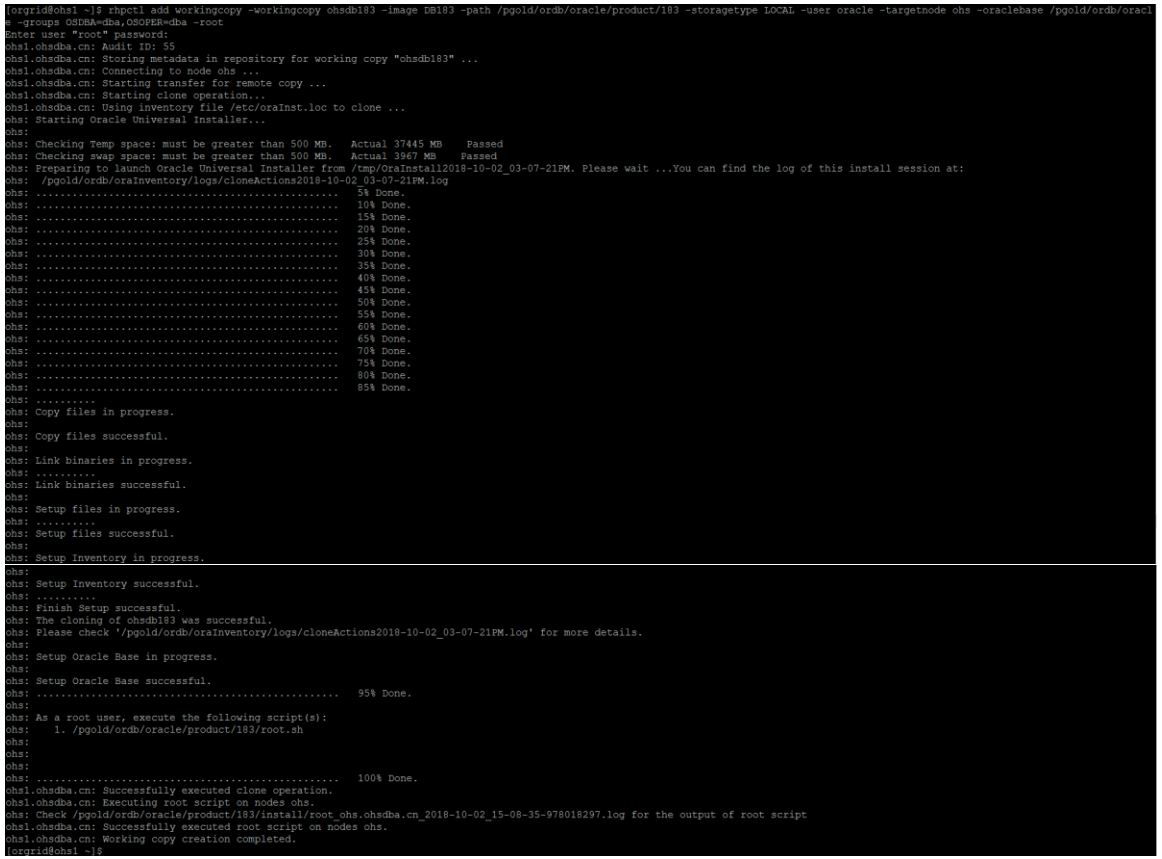


在 ohs 上部署 183 的 ORACLE HOME

[orgrid@ohs1 ~]$ rhpctl add workingcopy -workingcopy ohsdb183 -image DB183 -path /pgold/ordb/oracle/product/183 -storagetype LOCAL -user oracle -targetnode ohs -oraclebase /pgold/ordb/oracle -groups OSDBA=dba,OSOPER=dba -root
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 55
ohs1.ohsdba.cn: Storing metadata in repository for working copy "ohsdb183" ...
ohs1.ohsdba.cn: Connecting to node ohs ...
ohs1.ohsdba.cn: Starting transfer for remote copy ...
ohs1.ohsdba.cn: Starting clone operation...
ohs1.ohsdba.cn: Using inventory file /etc/oraInst.loc to clone ...
ohs: Starting Oracle Universal Installer...
ohs:
ohs: Checking Temp space: must be greater than 500 MB. Actual 37445 MB Passed
ohs: Checking swap space: must be greater than 500 MB. Actual 3967 MB Passed
ohs: Preparing to launch Oracle Universal Installer from /tmp/OraInstall2018-10-02_03-07-21PM. Please wait ...You can find the log of this install session at:

```
ohs:  /pgold/ordb/oraInventory/logs/cloneActions2018-10-02_03-07-21PM.log
ohs: .....   5% Done.
ohs: .....   10% Done.
ohs: .....   15% Done.
ohs: .....   20% Done.
ohs: .....   25% Done.
ohs: .....   30% Done.
ohs: .....   35% Done.
ohs: .....   40% Done.
ohs: .....   45% Done.
ohs: .....   50% Done.
ohs: .....   55% Done.
ohs: .....   60% Done.
ohs: .....   65% Done.
ohs: .....   70% Done.
ohs: .....   75% Done.
ohs: .....   80% Done.
ohs: .....   85% Done.
ohs: ..........
ohs: Copy files in progress.
ohs:
ohs: Copy files successful.
ohs:
ohs: Link binaries in progress.
ohs: ..........
ohs: Link binaries successful.
ohs:
ohs: Setup files in progress.
ohs: ..........
ohs: Setup files successful.
ohs:
ohs: Setup Inventory in progress.
ohs:
ohs: Setup Inventory successful.
```

```
ohs: ..........
ohs: Finish Setup successful.
ohs: The cloning of ohsdb183 was successful.
ohs: Please check '/pgold/ordb/oraInventory/logs/cloneActions2018-10-02_03-07-21PM.log' for more details.
ohs:
ohs: Setup Oracle Base in progress.
ohs:
ohs: Setup Oracle Base successful.
ohs: .................................................   95% Done.
ohs:
ohs: As a root user, execute the following script(s):
ohs:    1. /pgold/ordb/oracle/product/183/root.sh
ohs:
ohs:
ohs:
ohs: .................................................   100% Done.
ohs1.ohsdba.cn: Successfully executed clone operation.
ohs1.ohsdba.cn: Executing root script on nodes ohs.
ohs: Check /pgold/ordb/oracle/product/183/install/root_ohs.ohsdba.cn_2018-10-02_15-08-35-978018297.log for the output of root script
ohs1.ohsdba.cn: Successfully executed root script on nodes ohs.
ohs1.ohsdba.cn: Working copy creation completed.
[orgrid@ohs1 ~]$
```



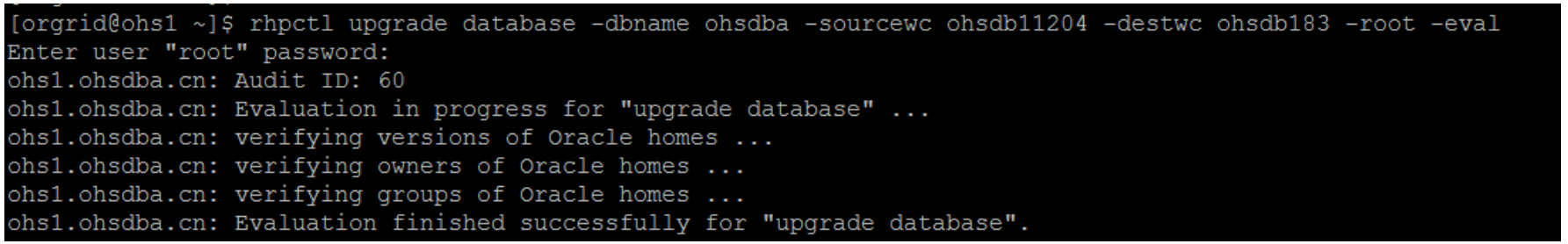
在 ohs1 上查询部署的 workingcopy 的信息

```
[orgrid@ohs1 ~]$ rhpctl query workingcopy -workingcopy ohsdb11204
ohs1.ohsdba.cn: Audit ID: 36
Working copy name: ohsdb11204
Image name: DB112
Groups configured in the working copy: OSDBA=dba,OSOPER=dba
Owner: oracle@STANDALONE_ohs
Site: STANDALONE_ohs
Access control: USER:oracle@STANDALONE_ohs
```

```
Access control: USER:orgrid@ohs-cluster
Access control: ROLE:GH_WC_ADMIN
Software home path: /pgold/ordb/oracle/product/112
Storage type: LOCAL
Image Type: ORACLEDBSOFTWARE
Gold image path:
Work path:
Additional patches compared to the image:
Additional bug fixes that are not in the image:
Complete: TRUE
[orgrid@ohs1 ~]$ rhpctl query workingcopy -workingcopy ohsdb183
ohs1.ohsdba.cn: Audit ID: 37
Working copy name: ohsdb183
Image name: DB183
Groups configured in the working copy: OSDBA=dba,OSOPER=oper,OSBACKUP=dba,OSDG=dba,OSKM=dba,OSRAC=dba
Owner: oracle@STANDALONE_ohs
Site: STANDALONE_ohs
Access control: USER:oracle@STANDALONE_ohs
Access control: USER:orgrid@ohs-cluster
Access control: ROLE:GH_WC_ADMIN
Software home path: /pgold/ordb/oracle/product/183
Storage type: LOCAL
Image Type: ORACLEDBSOFTWARE
Gold image path:
Work path:
Additional patches compared to the image:
Additional bug fixes that are not in the image:
Complete: TRUE
[orgrid@ohs1 ~]$
```

模拟数据库 11204 到 183 的升级

```
[orgrid@ohs1 ~]$ rhpctl upgrade database -dbname ohsdba -sourcewc ohsdb11204 -destwc ohsdb183 -root -eval
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 60
ohs1.ohsdba.cn: Evaluation in progress for "upgrade database" ...
ohs1.ohsdba.cn: verifying versions of Oracle homes ...
ohs1.ohsdba.cn: verifying owners of Oracle homes ...
ohs1.ohsdba.cn: verifying groups of Oracle homes ...
ohs1.ohsdba.cn: Evaluation finished successfully for "upgrade database".
[orgrid@ohs1 ~]$
```



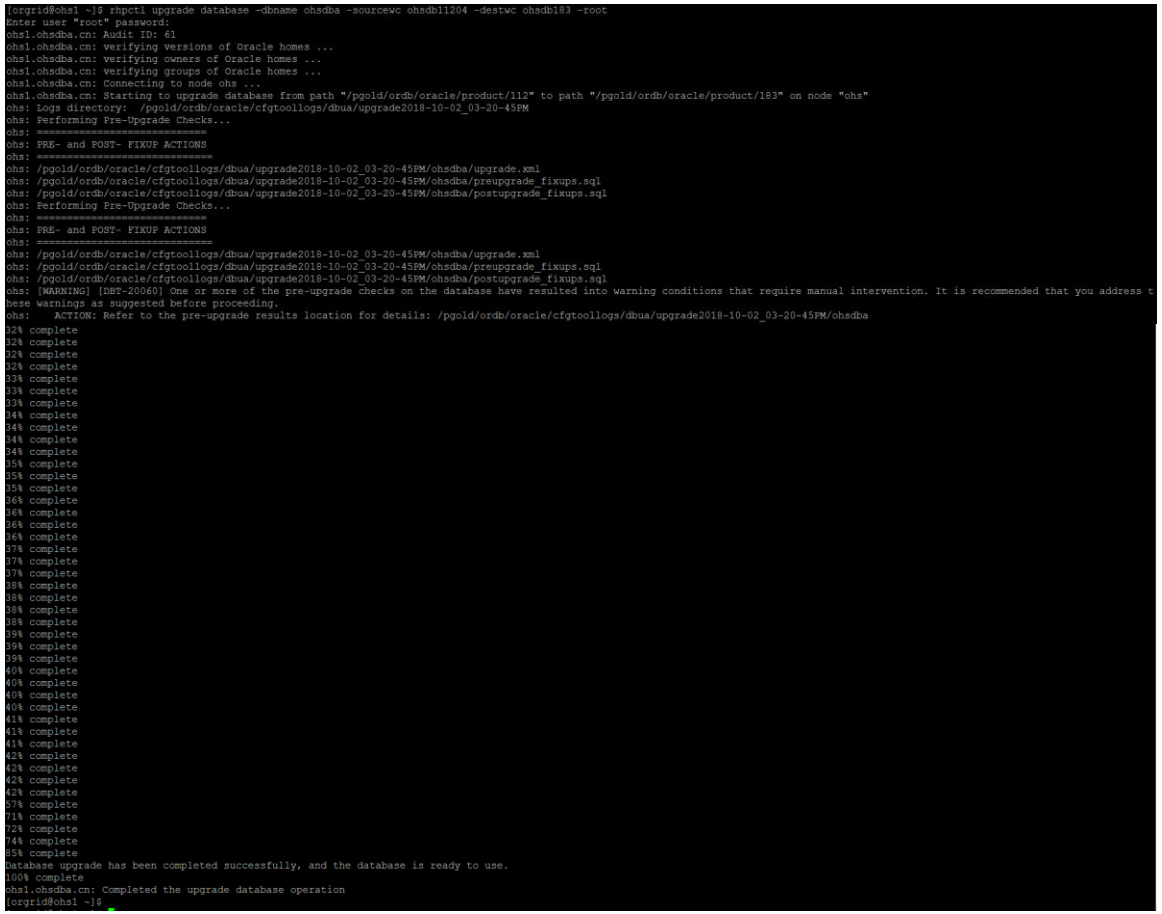
升级数据库 (from 11204 to 183)

```
[orgrid@ohs1 ~]$ rhpctl upgrade database -dbname ohsdba -sourcewc ohsdb11204 -destwc ohsdb183 -root
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 61
ohs1.ohsdba.cn: verifying versions of Oracle homes ...
ohs1.ohsdba.cn: verifying owners of Oracle homes ...
ohs1.ohsdba.cn: verifying groups of Oracle homes ...
ohs1.ohsdba.cn: Connecting to node ohs ...
ohs1.ohsdba.cn: Starting to upgrade database from path "/pgold/ordb/oracle/product/112" to path "/pgold/ordb/oracle/product/183" on
node "ohs"
ohs: Logs directory:  /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM
ohs: Performing Pre-Upgrade Checks...
ohs: ============================
ohs: PRE- and POST- FIXUP ACTIONS
ohs: ============================
```

```
ohs: /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/upgrade.xml
ohs: /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/preupgrade_fixups.sql
ohs: /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/postupgrade_fixups.sql
ohs: Performing Pre-Upgrade Checks...
ohs: ============================
ohs: PRE- and POST- FIXUP ACTIONS
ohs: ============================
ohs: /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/upgrade.xml
ohs: /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/preupgrade_fixups.sql
ohs: /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/postupgrade_fixups.sql
ohs: [WARNING] [DBT-20060] One or more of the pre-upgrade checks on the database have resulted into warning conditions that require
manual intervention. It is recommended that you address these warnings as suggested before proceeding.
ohs:    ACTION: Refer to the pre-upgrade results location for details:
/pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba
ohs: 2% complete
14% complete
28% complete
28% complete
29% complete
29% complete
29% complete
30% complete
30% complete
30% complete
30% complete
31% complete
31% complete
31% complete
32% complete
32% complete
32% complete
32% complete
33% complete
33% complete
```

33% complete
34% complete
34% complete
34% complete
34% complete
35% complete
35% complete
35% complete
36% complete
36% complete
36% complete
36% complete
36% complete
37% complete
37% complete
37% complete
38% complete
38% complete
38% complete
38% complete
38% complete
39% complete
39% complete
39% complete
40% complete
40% complete
40% complete
40% complete
41% complete
41% complete
41% complete
42% complete
42% complete
42% complete
42% complete
57% complete

71% complete
72% complete
74% complete
85% complete
Database upgrade has been completed successfully, and the database is ready to use.
100% complete
ohs1.ohsdba.cn: Completed the upgrade database operation
[orgrid@ohs1 ~]$



在 ohs 上查看升级的相关日志

```
[oracle@ohs ~]$ ps -ef|grep upgrade
oracle    1166  3440  0 15:34 pts/0    00:00:00 grep upgrade
oracle   30844 30843  1 15:20 ?        00:00:10 /pgold/ordb/oracle/product/183/jdk/jre/bin/java -Doracle.installer.not_bootstrap=true -DCV_HOME=/pgold/ordb/oracle/product/183 -DORACLE_HOME=
/pgold/ordb/oracle/product/183 -XX:-OmitStackTraceInFastThrow -XX:CompileCommand=quiet -XX:CompileCommand=exclude,javax/swing/text/GlyphView,getBreakSpot -Djava.security.egd=file:/dev/urand
om -Dsun.java2d.font.DisableAlgorithmicStyles=true -DSET_LAF= -Dice.pilots.html4.ignoreNonGenericFonts=true -classpath /pgold/ordb/oracle/product/183/assistants/dbua/jlib/dbua.jar:/pgold/or
db/oracle/product/183/assistants/jlib/asstcommonext.jar:/pgold/ordb/oracle/product/183/assistants/dbua/jlib/dbma.jar:/pgold/ordb/oracle/product/183/jlib/ewt3.jar:/pgold/ordb/oracle/product/
183/jlib/ewtcompat-3_3_15.jar:/pgold/ordb/oracle/product/183/jlib/swingall-1_1_1.jar:/pgold/ordb/oracle/product/183/jlib/share.jar:/pgold/ordb/oracle/product/183/jlib/orai18n.jar:/pgold/ord
b/oracle/product/183/assistants/jlib/assistantsCommon.jar:/pgold/ordb/oracle/product/183/assistants/jlib/rconfig.jar:/pgold/ordb/oracle/product/183/assistants/netca/jlib/netca.jar:/pgold/or
db/oracle/product/183/jlib/help4.jar:/pgold/ordb/oracle/product/183/oui/jlib/jewt4.jar:/pgold/ordb/oracle/product/183/jlib/oracle_ice.jar:/pgold/ordb/oracle/product/183/jlib/ldapjclnt18.jar
:/pgold/ordb/oracle/product/183/jlib/netcfg.jar:/pgold/ordb/oracle/product/183/jlib/oraclepki.jar:/pgold/ordb/oracle/product/183/jlib/ojmisc.jar:/pgold/ordb/oracle/product/183/lib/xmlparser
v2.jar:/pgold/ordb/oracle/product/183/jdbc/lib/ojdbc6.jar:/pgold/ordb/oracle/product/183/jlib/srvm.jar:/pgold/ordb/oracle/product/183/jlib/srvmhas.jar:/pgold/ordb/oracle/product/183/jlib/sr
vmasm.jar:/pgold/ordb/oracle/product/183/oui/jlib/OraInstaller.jar:/pgold/ordb/oracle/product/183/oui/jlib/OraPrereq.jar:/pgold/ordb/oracle/product/183/inventory/prereqs/oui/OraPrereqChecks
.jar:/pgold/ordb/oracle/product/183/oui/jlib/OraPrereqChecks.jar:/pgold/ordb/oracle/product/183/jlib/cvu.jar:/pgold/ordb/oracle/product/183/install/jlib/installcommons_1.0.0b.jar:/pgold/ord
b/oracle/product/183/install/jlib/instcommon.jar:/pgold/ordb/oracle/product/183/dv/jlib/dvca.jar:/pgold/ordb/oracle/product/183/jlib/gns.jar:/pgold/ordb/oracle/product/183/rdbms/admin/preup
grade.jar oracle.assistants.dbua.driver.StartDBUA -silent -dbname ohsdba -oracleHome /pgold/ordb/oracle/product/112 -emConfiguration NONE
oracle   31481 30844  0 15:21 ?        00:00:04 /pgold/ordb/oracle/product/183/perl/bin/perl /pgold/ordb/oracle/product/183/rdbms/admin/catctl.pl -n 4 -a -d /pgold/ordb/oracle/product/183/r
dbms/admin -l /pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba catupgrd.sql
[oracle@ohs ~]$
```

```
[oracle@ohs ohsdba]$ ls -ltr
total 73324
drwxr-x--- 3 oracle oinstall     4096 Oct  2 15:20 oracle
drwxr-x--- 3 oracle oinstall     4096 Oct  2 15:20 upgrade
-rw-r----- 1 oracle oinstall    14846 Oct  2 15:21 dbms_registry_extended.sql
-rw-r----- 1 oracle oinstall     7963 Oct  2 15:21 preupgrade_driver.sql
-rw-r----- 1 oracle oinstall   422048 Oct  2 15:21 preupgrade_package.sql
-rw-r----- 1 oracle oinstall    14383 Oct  2 15:21 parameters.properties
-rw-r----- 1 oracle oinstall    83854 Oct  2 15:21 preupgrade_messages.properties
-rw-r----- 1 oracle oinstall    50172 Oct  2 15:21 components.properties
-rw-r----- 1 oracle oinstall        1 Oct  2 15:21 checksBuffer.tmp
-rw-r----- 1 oracle oinstall    11765 Oct  2 15:21 preupgrade_fixups.sql
-rw-r----- 1 oracle oinstall     9357 Oct  2 15:21 postupgrade_fixups.sql
-rw-r----- 1 oracle oinstall    13934 Oct  2 15:21 upgrade.xml
-rw-r----- 1 oracle oinstall     2005 Oct  2 15:21 PreUpgradeResults.html
-rw-r----- 1 oracle oinstall      398 Oct  2 15:21 PreUpgrade.log
-rw-r----- 1 oracle oinstall       69 Oct  2 15:21 Migrate_Sid.log
-rw------- 1 oracle oinstall      535 Oct  2 15:21 catupgrd_catcon_31481.lst
-rw-r----- 1 oracle oinstall      577 Oct  2 15:21 catupgrd_catcon_31481_gen_inst_conn_strings_query.sql
-rw-r----- 1 oracle oinstall        0 Oct  2 15:42 catupgrd_datapatch_upgrade.err
-rw-r----- 1 oracle oinstall     1413 Oct  2 15:43 catupgrd_datapatch_upgrade.log
-rw-r----- 1 oracle oinstall        0 Oct  2 15:45 catupgrd_datapatch_normal.err
-rw-r----- 1 oracle oinstall     1433 Oct  2 15:45 catupgrd_datapatch_normal.log
-rw-r----- 1 oracle oinstall  8824177 Oct  2 15:47 catupgrd1.log
-rw-r----- 1 oracle oinstall  7220048 Oct  2 15:47 catupgrd2.log
-rw-r----- 1 oracle oinstall  6707873 Oct  2 15:47 catupgrd3.log
-rw-r----- 1 oracle oinstall     1709 Oct  2 15:47 upg_summary.log
-rw-r----- 1 oracle oinstall 51493217 Oct  2 15:47 catupgrd0.log
-rw-r----- 1 oracle oinstall    10181 Oct  2 15:47 Oracle_Server.log
-rw-r----- 1 oracle oinstall      115 Oct  2 15:54 Utlprp.log
-rw-r----- 1 oracle oinstall     2852 Oct  2 15:56 UpgradeTimezone.log
-rw-r----- 1 oracle oinstall      301 Oct  2 15:57 PostUpgrade.log
-rw-r----- 1 oracle oinstall     5720 Oct  2 15:57 UpgradeResults.html
-rw-r----- 1 oracle oinstall    89849 Oct  2 15:57 sqls.log
```

```
[oracle@ohs ohsdba]$ tail -20 catupgrd0.log

catcon: See [/pgold/ordb/oracle/cfgtoollogs/dbua/upgrade2018-10-02_03-20-45PM/ohsdba/catupgrd_*.lst] files for spool files, if any


!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

catcon version: /st_rdbms_18.0/7
        catconInit2: start logging catcon output at 2018-10-02 15:21:51

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!




End of catcon Errors
------------------------------------------------------
========== PROCESS ENDED ==========
SQL> ========== Process Terminated by catcon ==========
SQL> Disconnected from Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.3.0.0.0
[oracle@ohs ohsdba]$ cat /etc/oratab
#



# This file is used by ORACLE utilities.  It is created by root.sh
# and updated by either Database Configuration Assistant while creating
# a database or ASM Configuration Assistant while creating ASM instance.

# A colon, ':', is used as the field terminator.  A new line terminates
# the entry.  Lines beginning with a pound sign, '#', are comments.
#
# Entries are of the form:
#   $ORACLE_SID:$ORACLE_HOME:<N|Y>:
#
# The first and second fields are the system identifier and home
# directory of the database respectively.  The third filed indicates
# to the dbstart utility that the database should , "Y", or should not,
# "N", be brought up at system boot time.
#
# Multiple entries with the same $ORACLE_SID are not allowed.
#
#
ohsdba:/pgold/ordb/oracle/product/183:N
[oracle@ohs ohsdba]$ . oraenv
ORACLE_SID = [ohsdba] ?
The Oracle base remains unchanged with value /pgold/ordb/oracle
[oracle@ohs ohsdba]$
```

注意事项

Note:可能碰到下面的错误。需要把 183 的 workingcopy 删除（rhpctl delete workingcopy），在 add workingcopy 时，使用 groups 参数

```
[orgrid@ohs1 ~]$ rhpctl upgrade database -dbname ohsdba -sourcewc ohsdb11204 -destwc ohsdb183 -root -eval
Enter user "root" password:
ohs1.ohsdba.cn: Audit ID: 39
ohs1.ohsdba.cn: Evaluation in progress for "upgrade database" ...
ohs1.ohsdba.cn: verifying versions of Oracle homes ...
ohs1.ohsdba.cn: verifying owners of Oracle homes ...
ohs1.ohsdba.cn: verifying groups of Oracle homes ...
ohs1.ohsdba.cn: PRGO-1774 : The evaluation revealed potential failure for command "upgrade database".
PRGO-1618 : The groups "OSOPER=dba" of the source home do not match the groups "OSOPER=oper" of the patched working copy.
[orgrid@ohs1 ~]$
```

18c 在本地模式下通过 rhpctl move 切换 ORACLE HOME

注意 move 只适合于大版本相同，小版本不同的情况。比如这里是介绍从 Oracle 18.2 切换到 18.3。

查看情况环境

```
[oracle@sdb09] /home/oracle> env |grep ORACLE
ORACLE_BASE=/u01/app/oracle
ORACLE_HOME=/u01/app/oracle/product/18.0.0/dbhome_1
ORACLE_HOSTNAME=sdb09
ORACLE_PATH=/home/oracle/scripts
ORACLE_SID=cdb2
ORACLE_UNQNAME=cdb2
[oracle@sdb09] /home/oracle> sqlplus "/as sysdba"
SQL*Plus: Release 18.0.0.0.0 - Production on Tue Jul 24 16:43:00 2018
Version 18.2.0.0.0
Copyright (c) 1982, 2018, Oracle.  All rights reserved.
Connected to:
Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.2.0.0.0

CDB$ROOT@cdb2>show pdbs
```

```
    CON_ID CON_NAME                        OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  YES
         3 PDB2                           READ WRITE NO
CDB$ROOT@cdb2>exit
Disconnected from Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.2.0.0.0
[oracle@sdb09] /home/oracle>
```

安装 18.3 ORACLE HOME

18.3 ORACLE_HOME 的安装（略）

执行切换命令

一条命令搞定，真的很简单。在 18.2 下执行 rhpctl move database

```
[oracle@sdb09] /home/oracle> rhpctl move database -dbname cdb2              \
>                       -sourcehome /u01/app/oracle/product/18.0.0/dbhome_1  \
>                       -desthome /u01/app/oracle/product/18.0.0/dbhome_3    \
>                       -stopoption IMMEDIATE
Running RHPCTL for Stand Alone Home
SQL*Plus: Release 18.0.0.0.0 - Production on Tue Jul 24 16:46:23 2018
Version 18.2.0.0.0
Copyright (c) 1982, 2018, Oracle.  All rights reserved.
Connected to:
Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.2.0.0.0

SQL> Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> Disconnected from Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.2.0.0.0
SQL*Plus: Release 18.0.0.0.0 - Production on Tue Jul 24 16:46:55 2018
```

```
Version 18.3.0.0.0
Copyright (c) 1982, 2018, Oracle.  All rights reserved.
Connected to an idle instance.

SQL> ORACLE instance started.
Total System Global Area 1073741304 bytes
Fixed Size                  8904184 bytes
Variable Size             771751936 bytes
Database Buffers          289406976 bytes
Redo Buffers                3678208 bytes
Database mounted.
Database opened.
SQL> Disconnected from Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.3.0.0.0
/u01/app/oracle/product/18.0.0/dbhome_3
cdb2
SQL Patching tool version 18.0.0.0.0 Production on Tue Jul 24 16:47:19 2018
Copyright (c) 2012, 2018, Oracle.  All rights reserved.

Log file for this invocation: /u01/app/oracle/cfgtoollogs/sqlpatch/sqlpatch_533_2018_07_24_16_47_19/sqlpatch_invocation.log

Connecting to database...OK
Gathering database info...done

Note:  Datapatch will only apply or rollback SQL fixes for PDBs
       that are in an open state, no patches will be applied to closed PDBs.
       Please refer to Note: Datapatch: Database 12c Post Patch SQL Automation
       (Doc ID 1585822.1)

Bootstrapping registry and package to current versions...done
Determining current state...done

Current state of interim SQL patches:
Interim patch 27923415 (OJVM RELEASE UPDATE: 18.3.0.0.180717 (27923415)):
```

```
  Binary registry: Installed
  PDB CDB$ROOT: Rolled back with errors on 24-JUL-18 04.30.06.505223 PM
  PDB PDB$SEED: Rolled back with errors on 24-JUL-18 04.30.06.873780 PM
  PDB PDB2: Rolled back with errors on 24-JUL-18 04.30.07.119076 PM

Current state of release update SQL patches:
  Binary registry:
    18.3.0.0.0 Release_Update 1806280943: Installed
  PDB CDB$ROOT:
    Rolled back to 18.2.0.0.0 Release_Update 1804041635 successfully on 24-JUL-18 04.30.06.555634 PM
  PDB PDB$SEED:
    Rolled back to 18.2.0.0.0 Release_Update 1804041635 successfully on 24-JUL-18 04.30.06.951502 PM
  PDB PDB2:
    Rolled back to 18.2.0.0.0 Release_Update 1804041635 successfully on 24-JUL-18 04.30.07.155698 PM

Adding patches to installation queue and performing prereq checks...done
Installation queue:
  For the following PDBs: CDB$ROOT PDB$SEED PDB2
    No interim patches need to be rolled back
    Patch 28090523 (Database Release Update : 18.3.0.0.180717 (28090523)):
      Apply from 18.2.0.0.0 Release_Update 1804041635 to 18.3.0.0.0 Release_Update 1806280943
    The following interim patches will be applied:
      27923415 (OJVM RELEASE UPDATE: 18.3.0.0.180717 (27923415))

Installing patches...
Patch installation complete.  Total patches installed: 6

Validating logfiles...done
Patch 28090523 apply (pdb CDB$ROOT): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/28090523/22329768/28090523_apply_CDB2_CDBROOT_2018Jul24_16_49_17.log (no errors)
Patch 27923415 apply (pdb CDB$ROOT): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/27923415/22239273/27923415_apply_CDB2_CDBROOT_2018Jul24_16_51_54.log (no errors)
Patch 28090523 apply (pdb PDB$SEED): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/28090523/22329768/28090523_apply_CDB2_PDBSEED_2018Jul24_16_52_15.log (no errors)
```

```
Patch 27923415 apply (pdb PDB$SEED): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/27923415/22239273/27923415_apply_CDB2_PDBSEED_2018Jul24_16_55_08.log (no errors)
Patch 28090523 apply (pdb PDB2): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/28090523/22329768/28090523_apply_CDB2_PDB2_2018Jul24_16_52_16.log (no errors)
Patch 27923415 apply (pdb PDB2): SUCCESS
  logfile: /u01/app/oracle/cfgtoollogs/sqlpatch/27923415/22239273/27923415_apply_CDB2_PDB2_2018Jul24_16_55_01.log (no errors)
SQL Patching tool complete on Tue Jul 24 16:55:24 2018
[oracle@sdb09] /home/oracle>
```

检查、编译下失效对象

```
[oracle@sdb09] /home/oracle> export ORACLE_HOME=/u01/app/oracle/product/18.0.0/dbhome_3
[oracle@sdb09] /home/oracle> sqlplus "/as sysdba"

SQL*Plus: Release 18.0.0.0.0 - Production on Tue Jul 24 16:56:30 2018
Version 18.2.0.0.0
Copyright (c) 1982, 2018, Oracle.  All rights reserved.
Connected to:
Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.3.0.0.0
CDB$ROOT@cdb2>show pdbs

    CON_ID CON_NAME                       OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  YES
         3 PDB2                           READ WRITE YES
CDB$ROOT@cdb2>shutdown immediate;
Database closed.
Database dismounted.
ORACLE instance shut down.
CDB$ROOT@cdb2>startup
ORACLE instance started.

Total System Global Area 1073741304 bytes
```

```
Fixed Size                  8904184 bytes
Variable Size             780140544 bytes
Database Buffers          281018368 bytes
Redo Buffers                3678208 bytes
Database mounted.
Database opened.
CDB$ROOT@cdb2>show pdbs

    CON_ID CON_NAME                        OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  NO
         3 PDB2                           READ WRITE YES
CDB$ROOT@cdb2>
select count(*) from dba_objects where status='INVALID';
start ?/rdbms/admin/utlrp.sql
CDB$ROOT@cdb2>conn /as sysdba
Connected.
CDB$ROOT@cdb2>show pdbs

    CON_ID CON_NAME                        OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  NO
         3 PDB2                           READ WRITE YES
CDB$ROOT@cdb2>alter pluggable database pdb2 close;

Pluggable database altered.

CDB$ROOT@cdb2>alter pluggable database pdb2 open;

Pluggable database altered.

CDB$ROOT@cdb2>show pdbs

    CON_ID CON_NAME                        OPEN MODE  RESTRICTED
```

```
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  NO
         3 PDB2                           READ WRITE NO
CDB$ROOT@cdb2>
```

查看 bug 信息

```
[oracle@sdb09] /home/oracle> cd $ORACLE_HOME/inventory
[oracle@sdb09] /u01/app/oracle/product/18.0.0/dbhome_3/inventory> grep -r "bug description" * | wc -l
634
[oracle@sdb09] /u01/app/oracle/product/18.0.0/dbhome_3/inventory> grep -r "bug description" * | grep -i "wrong result" | wc -l
7
[oracle@sdb09] /u01/app/oracle/product/18.0.0/dbhome_3/inventory>
CDB$ROOT@cdb2>set serveroutput on
CDB$ROOT@cdb2>exec dbms_qopatch.get_sqlpatch_status;

Patch Id : 27676517
        Action : APPLY
        Action Time : 20-APR-2018 12:53:50
        Description : Database Release Update : 18.2.0.0.180417 (27676517)
        Logfile :
/u01/app/oracle/cfgtoollogs/sqlpatch/27676517/22097537/27676517_apply_CDB1_CDBRO
OT_2018Apr20_12_48_09.log
        Status : SUCCESS

Patch Id : 28090523
        Action : APPLY
        Action Time : 24-JUL-2018 23:28:28
        Description : Database Release Update : 18.3.0.0.180717 (28090523)
        Logfile :
/u01/app/oracle/cfgtoollogs/sqlpatch/28090523/22329768/28090523_apply_CDB1_CDBRO
OT_2018Jul24_23_14_26.log
        Status : SUCCESS

Patch Id : 27923415
```

```
        Action : APPLY
        Action Time : 24-JUL-2018 23:28:28
        Description : OJVM RELEASE UPDATE: 18.3.0.0.180717 (27923415)
        Logfile :
/u01/app/oracle/cfgtoollogs/sqlpatch/27923415/22239273/27923415_apply_CDB1_CDBRO
OT_2018Jul24_23_20_20.log
        Status : SUCCESS

PL/SQL procedure successfully completed.

CDB$ROOT@cdb2>
CDB$ROOT@cdb2>host $ORACLE_HOME/OPatch/opatch lspatches
27908644;UPDATE 18.3 DATABASE CLIENT JDK IN ORACLE HOME TO JDK8U171
27923415;OJVM RELEASE UPDATE: 18.3.0.0.180717 (27923415)
28090553;OCW RELEASE UPDATE 18.3.0.0.0 (28090553)
28090523;Database Release Update : 18.3.0.0.180717 (28090523)

OPatch succeeded.

CDB$ROOT@cdb2>
CDB$ROOT@cdb2>host $ORACLE_HOME/OPatch/datapatch
SQL Patching tool version 18.0.0.0.0 Production on Tue Jul 24 23:52:52 2018
Copyright (c) 2012, 2018, Oracle.  All rights reserved.

Log file for this invocation: /u01/app/oracle/cfgtoollogs/sqlpatch/sqlpatch_15428_2018_07_24_23_52_52/sqlpatch_invocation.log

Connecting to database...OK
Gathering database info...done

Note:  Datapatch will only apply or rollback SQL fixes for PDBs
       that are in an open state, no patches will be applied to closed PDBs.
       Please refer to Note: Datapatch: Database 12c Post Patch SQL Automation
       (Doc ID 1585822.1)
```

```
Bootstrapping registry and package to current versions...done
Determining current state...done

Current state of interim SQL patches:
Interim patch 27923415 (OJVM RELEASE UPDATE: 18.3.0.0.180717 (27923415)):
  Binary registry: Installed
  PDB CDB$ROOT: Applied successfully on 24-JUL-18 11.28.28.587966 PM
  PDB PDB$SEED: Applied successfully on 24-JUL-18 11.28.32.210358 PM
  PDB PDB1: Applied successfully on 24-JUL-18 11.28.35.718716 PM

Current state of release update SQL patches:
  Binary registry:
    18.3.0.0.0 Release_Update 1806280943: Installed
  PDB CDB$ROOT:
    Applied 18.3.0.0.0 Release_Update 1806280943 successfully on 24-JUL-18 11.28.28.554240 PM
  PDB PDB$SEED:
    Applied 18.3.0.0.0 Release_Update 1806280943 successfully on 24-JUL-18 11.28.32.201333 PM
  PDB PDB1:
    Applied 18.3.0.0.0 Release_Update 1806280943 successfully on 24-JUL-18 11.28.35.701923 PM

Adding patches to installation queue and performing prereq checks...done
Installation queue:
  For the following PDBs: CDB$ROOT PDB$SEED PDB1
    No interim patches need to be rolled back
    No release update patches need to be installed
    No interim patches need to be applied

SQL Patching tool complete on Tue Jul 24 23:53:19 2018

CDB$ROOT@cdb2>
```

本地模式下 rhpctl move 命令参考

```
[oracle@sdb09] /home/oracle> rhpctl move database -help
```

Running RHPCTL for Stand Alone Home

Moves a database from source working copy to the patched working copy.

```
Usage: rhpctl move database -dbname <db_name_list> -sourcehome <oracle_home_path> -desthome <destination_oracle_home_path>
        [-eval]
        [-ignorewcpatches]
        [-stopoption <stop option>]
        [-drain_timeout <time>]

    -dbname <db_name_list>                Comma-separated list of names of databases (DB_UNIQUE_NAME) to be moved
    -sourcehome <oracle_home_path>        Source Oracle home path
    -desthome <destination_oracle_home_path>
                                          Path to destination for move of Oracle home
    -eval                                 Evaluate without executing the command.
    -ignorewcpatches                      Ignores if the patched working copy is missing some patches which are present in the source
path or working copy
    -stopoption <stop_option>             Stop option for database: ABORT, IMMEDIATE, NORMAL, TRANSACTIONAL, TRANSACTIONAL_LOCAL
    -drain_timeout <session drain time>   Service drain timeout specified in seconds

[oracle@sdb09] /home/oracle>
```

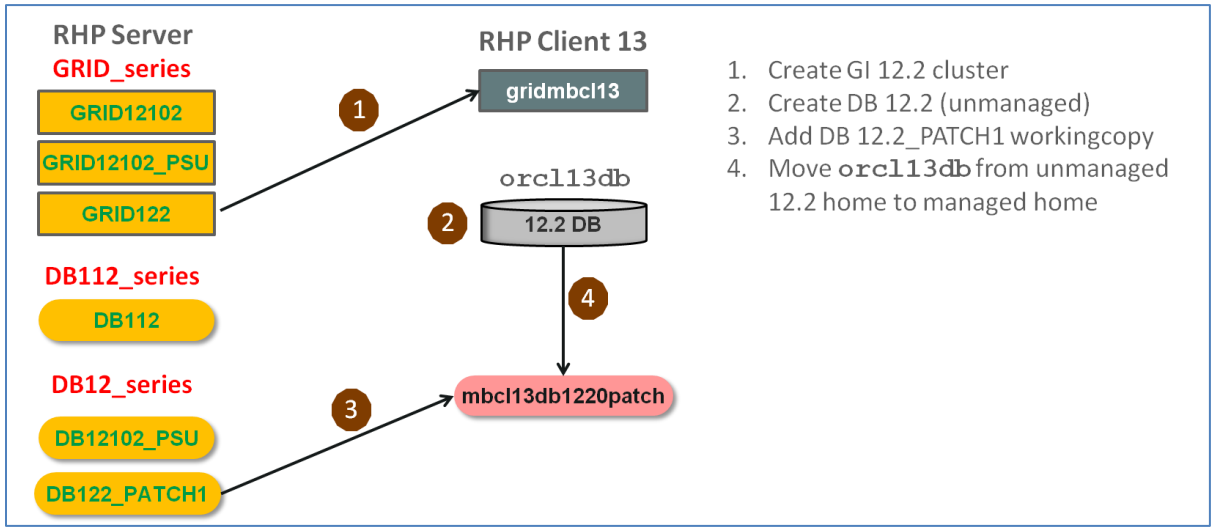
附 2: 18.3 rhpctl 命令

```
[oracle@sdb06] /home/oracle> rhpctl move database -help

Moves a database from source Oracle home to the patched Oracle home.

Usage: rhpctl move database -sid <sid_list> -sourcehome <oracle_home_path> -desthome <destination_oracle_home_path>
        [-eval]
        [-ignorewcpatches]
        [-stopoption <stop option>]
        [-drain_timeout <time>]

    -sid <ORACLE_SID>                     SID of Oracle Single Instance Database
    -sourcehome <oracle_home_path>        Source Oracle home path
```

```
    -desthome <destination_oracle_home_path>
                                        Path to destination for move of Oracle home
    -eval                               Evaluate without executing the command.
    -ignorewcpatches                    Ignores if the patched working copy is missing some patches which are present in the source
path or working copy
    -stopoption <stop_option>           Stop option for database: ABORT, IMMEDIATE, NORMAL, TRANSACTIONAL, TRANSACTIONAL_LOCAL
    -drain_timeout <session drain time> Service drain timeout specified in seconds

[oracle@sdb06] /home/oracle> rhpctl
```

通过 rhpctl 部署 12.2 集群

我们有两台机器，vmsvr041 和 vmsvr042，配置了操作系统，存储和网络，以支持 Grid Infrastructure 安装。 在执行以下步骤之前，两台机器上没有 GI 软件。 然后，这两个节点将作为 12.2 GI 集群启动并运行，并作为 RHP Client 启用。下图是整个实验流程。这部分使用了 Image series，具体操作方法，可参看“Gold Images 的相关操作”中“Image Series”部分。



1.部署 12.2 GI Cluster

```
rhpctl add workingcopy -workingcopy gridmbcl13 -image GRID122 -responsefile /home/grid/stdcluster-13.rsp -path /u01/app/12.2.0/grid -oraclebase /u01/app/gridbase -user grid -root  -ignoreprereq
[grid@rhps101 bin]$ /rhpctl add workingcopy -workingcopy gridmbcl13 -image GRID122 -responsefile /home/grid/stdcluster-13.rsp -path /u01/app/12.2.0/grid -oraclebase /u01/app/gridbase -user grid -root -ignoreprereq
Enter user "root" password:
rhps101: Changing the home ownership to user grid...
…
rhps101: Executing root script on nodes [vmsvr041, vmsvr042].
vmsvr041: Changing permissions of /u01/app/oraInventory.
vmsvr041: Adding read,write permissions for group.
……
vmsvr041: The execution of the script is complete.
vmsvr042: Changing permissions of /u01/app/oraInventory.
```

```
....
vmsvr042: Changing groupname of /u01/app/oraInventory to oinstall.
vmsvr042: The execution of the script is complete.
rhps101: Successfully executed root script on nodes [vmsvr041, vmsvr042].
rhps101: Executing configuration script on nodes [vmsvr041]
rhps101: Successfully executed configuration script on nodes [vmsvr041]
rhps101: Executing root script on nodes [vmsvr041].
vmsvr041: Check /u01/app/12.2.0/grid/install/root_vmsvr041.oracle.com_2016-02-16_17-32-16.log for the output of root script
rhps101: Successfully executed root script on nodes [vmsvr041].
rhps101: Executing root script on nodes [vmsvr042].
vmsvr042: Check /u01/app/12.2.0/grid/install/root_vmsvr042.oracle.com_2016-02-16_17-43-46.log for the output of root script
rhps101: Successfully executed root script on nodes [vmsvr042].
rhps101: Executing post configuration script on nodes [vmsvr041]
rhps101: Successfully executed post configuration script on nodes [vmsvr041]
rhps101: Working copy creation completed.
rhps101: Creating client data ...
rhps101: Client data created for client "stdcluster-13".
rhps101: Executing Rapid Home Provisioning Client add operation on node [vmsvr041]
rhps101: Executing Rapid Home Provisioning Client start operation on node [vmsvr041]
rhps101: Oracle home provisioned.

rhpctl query client -client stdcluster-13
[grid@rhps101 bin]$ ./rhpctl query client -client stdcluster-13
Site: stdcluster-13
Rapid Home Provisioning Client Version: 12.2.0.0.0
Enabled: true ==> (1)
Host from which RHPC last registered: vmsvr041.us.oracle.com
Port number last registered by RHPC: 23795
RHP Enabled: true   ==> (2)
Standalone: false
Managed: true  ==> (3)
[grid@rhps101 bin]$
```

2.用 DBCA 创建数据库

接下来，我们在此集群上部署和配置名为 orcl13db 的 12.2 RAC 数据库。 我们以传统的非 RHP 方式（例如使用 DBCA）来创建。此步骤省略。

3.部署基于 image DB122_PATCH1 的副本

接下来,我们将基于 DB122_PATCH1 黄金映像的 workingcopy(mbcl13db1220patch)提供给客户端集群。这将使我们准备将 orcl13db 数据库从 Unmanaged Home 移动到这个 workingcopy。

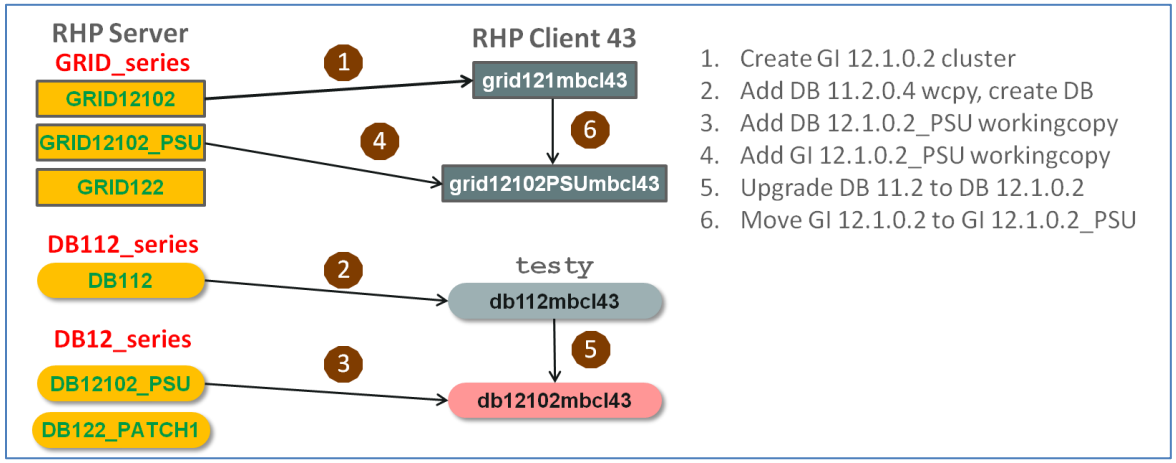
```
rhpctl add workingcopy -workingcopy mbcl13db1220patch -image DB122_PATCH1 -path /u01/app/orabase/product/12.2.0/mbcl13db1220patch
-client stdcluster-13
[GRID:grid@rhps101:~]> rhpctl query workingcopy -client stdcluster-13
Working copy name: gridmbcl13
Working copy name: mbcl13db1220patch

[GRID:grid@rhps101:~]> rhpctl query workingcopy -workingcopy mbcl13db1220patch
Working copy name: mbcl13db1220patch
Image name: DB122_PATCH1
Groups configured in the working copy:
OSDBA=oinstall,OSBACKUP=asmadmin,OSDG=asmadmin,OSKM=asmadmin,OSRAC=asmadmin
Owner: oracle@stdcluster-13
Site: stdcluster-13
Access control: USER:oracle@stdcluster-13
Access control: USER:grid@dscluster1
Access control: ROLE:GH_WC_ADMIN
Software home path: /u01/app/orabase/product/12.2.0/mbcl13db1220patch
Storage type: LOCAL
Image Type: ORACLEDBSOFTWARE
Oracle base: /u01/app/orabase
Configured databases:
All patches available in this home: 22222222
Additional patches compared to the image:
Additional bug fixes that are not in the image:
Complete: TRUE
[GRID:grid@rhps101:~]>
```

4.移动数据库 orcl13db 从 Unmanaged 到 Managed

```
[GRID:grid@vmsvr041 bin]$ ./rhpctl move database -sourcehome /u01/app/orabase/product/12.2.0/dbhome_1 -patchedwc mbcl13db1220patch
-dbname orcl13db
vmsvr041.us.oracle.com: Starting to move database from "/u01/app/orabase/product/12.2.0/dbhome_1" to
"/u01/app/orabase/product/12.2.0/mbcl13db1220patch" on client cluster
vmsvr041.us.oracle.com: starting to move the following databases: "orcl13db"
========================================
vmsvr041.us.oracle.com:
SQL Patching tool version 12.2.0.0.3 Production on Sat Feb 20 15:42:21 2016
Copyright (c) 2012, 2016, Oracle.  All rights reserved.

Connecting to database...OK
Note:  Datapatch will only apply or rollback SQL fixes for PDBs
       that are in an open state, no patches will be applied to closed PDBs.
       Please refer to Note: Datapatch: Database 12c Post Patch SQL Automation
       (Doc ID 1585822.1)
Determining current state...done
Adding patches to installation queue and performing prereq checks...done
Installation queue:
  For the following PDBs: CDB$ROOT PDB$SEED PROD1 PROD2
    Nothing to roll back
    Nothing to apply
SQL Patching tool complete on Sat Feb 20 15:45:32 2016
vmsvr041.us.oracle.com: Completed the 'move database' operation on client cluster

[GRID:grid@vmsvr041:~]> rhpctl query workingcopy -workingcopy mbcl13db1220patch
```

通过 rhpctl 部署 12.1 集群并做数据库的升级

我们有两台机器，vmsvr141 和 vmsvr142，配置了操作系统，存储和网络，以支持 Grid Infrastructure 安装。 在执行以下步骤之前，两台机器上没有 GI 软件。下图是整个实验流程。



1. 部署 12.2GI Cluster

```
[GRID:grid@rhps101:~]> rhpctl add workingcopy -workingcopy grid121mbc143 -image GRID12102 -responsefile /home/grid/stdcluster-43.rsp
-path /u01/app/12102/grid -oraclebase /u01/app/gridbase -user grid -root -ignoreprereq
   Enter user "root" password:
   rhps101: Changing the home ownership to user grid...
   rhps101: Mounting file system...
   rhps101: Executing root script on nodes [vmsvr141.oracle.com, vmsvr142.oracle.com].
   vmsvr142.oracle.com: Changing permissions of /u01/app/oraInventory.
   vmsvr142.oracle.com: Adding read,write permissions for group.
....
   rhps101: Successfully executed post configuration script on nodes [vmsvr141.oracle.com]
   rhps101: Working copy creation completed.
   rhps101: Creating client data ...
   rhps101: Client data created for client "stdcluster-43".
   rhps101: Executing Rapid Home Provisioning Client add operation on node [vmsvr141.oracle.com]
   rhps101: Oracle home provisioned.
```

```
[GRID:grid@rhps101:~]> rhpctl query client -client stdcluster43
Site: stdcluster43
Rapid Home Provisioning Client Version: 12.1.0.2.0
Enabled: true
Host from which RHPC last registered:
Port number last registered by RHPC:
RHP Enabled: false
Standalone: false
Managed: true
[GRID:grid@rhps101:~]>
```

2.部署基于 image DB112 的副本，并创建数据库

```
[GRID:grid@rhps101:/scratch]>  rhpctl add workingcopy -workingcopy db112mbcl43 -image DB112 -path
/u01/app/orabase/product/11.2/wcdb112 -root -targetnode vmsvr141 -oraclebase /u01/app/orabase -user oracle

[GRID:grid@rhps101:/scratch]>  rhpctl add database -workingcopy db112mbcl43  -dbname testy -node vmsvr141  -root -user oracle
```

3.部署基于 image DB12102_PSU 的副本

```
[GRID:grid@rhps101:/scratch]> rhpctl add workingcopy -workingcopy db12102mbcl43 -image DB12102_PSU -path
/u01/app/orabase/product/12.1/wcdb12102 -root -targetnode vmsvr141 -oraclebase /u01/app/orabase -user oracle
```

4.部署基于 image GRID12102_PSU 的副本

```
[GRID:grid@rhps101:/scratch]>  rhpctl add workingcopy -softwareonly -image GRID12102_PSU -path /u01/app/12102_psu/grid -oraclebase
/u01/app/gridbase -targetnode vmsvr141 -root -workingcopy grid12102PSUmbcl43
```

5.把数据库从 11.2 升级到 12.1.0.2

```
[GRID:grid@rhps101:/scratch]>  rhpctl upgrade database -dbname testy -sourcewc db112mbcl43 -destwc db12102mbcl43 -root -targetnode
vmsvr141
Enter user "root" password:
vmsvr141: Log files for the upgrade operation are located at: /u01/app/orabase/cfgtoollogs/dbua/testy/upgrade1
vmsvr141: Performing Pre Upgrade
vmsvr141: 5% complete
vmsvr141: 25% complete
vmsvr141: Performing RDBMS Upgrade
```

```
vmsvr141: 25% complete
vmsvr141: 26% complete
....
vmsvr141: 50% complete
vmsvr141: Performing Post Upgrade
vmsvr141: 52% complete
vmsvr141: 55% complete
vmsvr141: 75% complete
vmsvr141: Generating Summary
vmsvr141: Database upgrade has been completed successfully, and the database is ready to use.
vmsvr141: 100% complete
vmsvr141: Check the log file "/u01/app/orabase/cfgtoollogs/dbua/logs/silent.log_1421792176768" for upgrade details.
rhps101: Completed the upgrade database operation on server cluster
[GRID:grid@rhps101:/scratch]>
```

6.把 GI 从 12.1 移动到 12.1 PSU

```
rhpctl move gihome -sourcewc grid121mbc143 -destwc grid12102PSUmbc143 -root -targetnode vmsvr141
```

零宕机升级数据库

零停机升级：所有升级步骤的自动化，最大限度地减少甚至消除了升级 Oracle 数据库时的应用程序停机时间。 它还可以最大限度地减少资源需求，并在必须回滚升级时提供回退路径。 您可以在 11.2.0.4 以上的版本 Oracle RAC 和 Oracle RAC One Node 数据库上运行零停机升级。

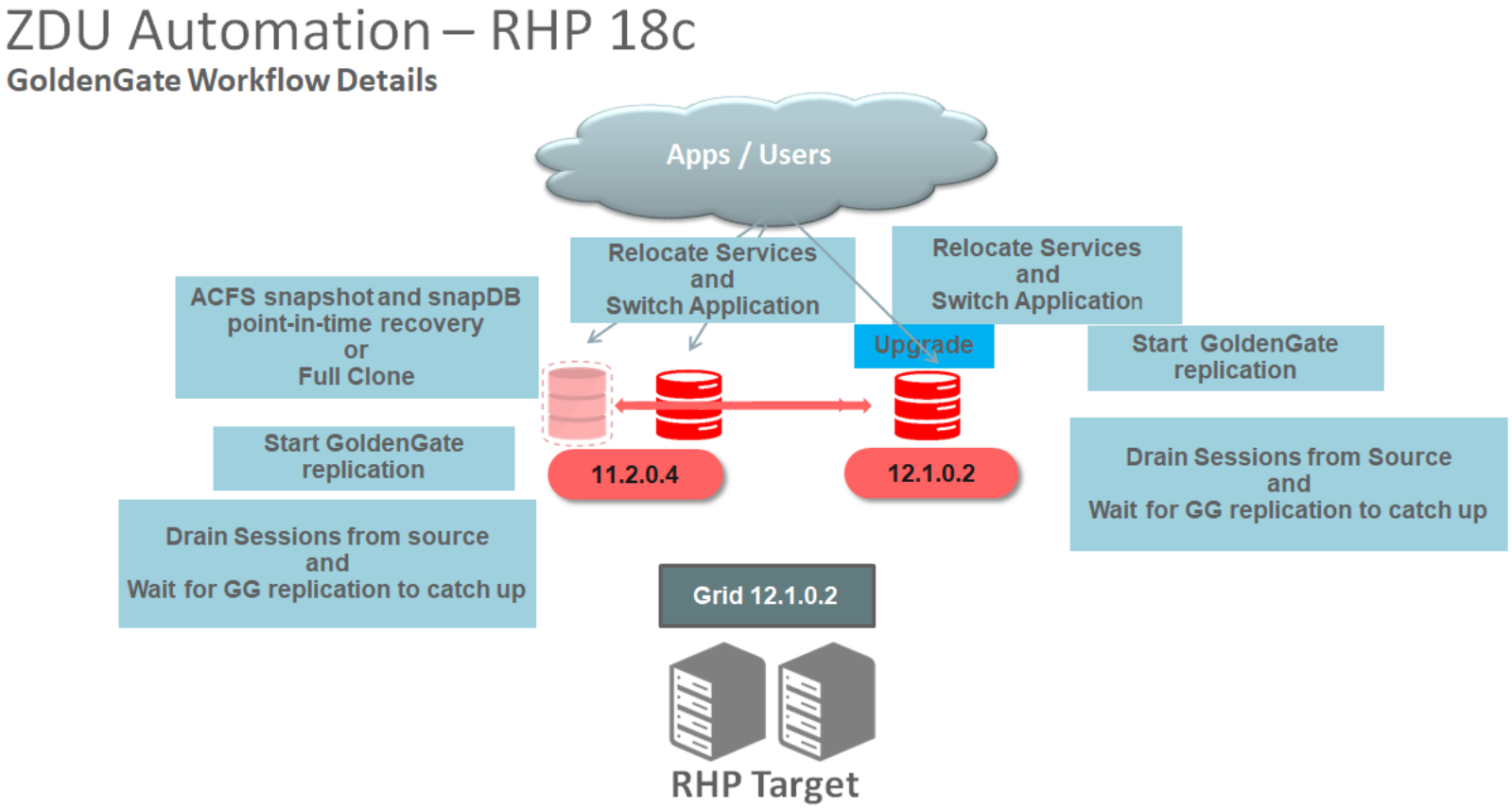
- DB Upgrade Paths
  - 11.2.0.4 -> 12.1.0.2 / 12.2.0.1
  - 12.1.0.2 -> 12.2.0.1
- All operations within host - no extra hardware needed
- Complete Upgrade Automation or prompt step-by-step
- Space efficient Database snapshot or Full clone
- Golden Gate or Data Guard TLS replication coordinated by ZDU
- Fall back and failover capability
- Customizable workflow
- Database must be in archive log mode

```
[orgrid@ohs1 ~]$ rhpctl zdtupgrade database -h

Performs zero downtime upgrade of a database.

Usage: rhpctl zdtupgrade database -dbname <unique_db_name> -destwc <workingcopy_name>
       [-sourcewc <workingcopy_name> |
        -sourcehome <oracle_home_path>]
       [-ggsrcwc <workingcopy_name> -ggdstwc <workingcopy_name>]
       [-clonedatadg <diskgroup_name>
              [-cloneredodg <diskgroup_name>]
              [-clonerecodg <diskgroup_name>] |
        -clonedatafs <acfs_mountpoint>
              [-cloneredofs <acfs_mountpoint>]
              [-clonerecofs <acfs_mountpoint>]]
       [-targetnode <node_name>
              {-root |
               -cred <cred_name> |
               -sudouser <username> -sudopath <sudo_binary_path> |
               -auth <plugin_name>
                     [-arg1 <name1>:<value1>
                            [-arg2 <name2>:<value2>...]]}]
       [-eval]
       [-useractiondata <user_action_data>]

    -dbname <unique_db_name>              Name of database (DB_UNIQUE_NAME) to be upgraded
    -destwc <workingcopy_name>            Name of the destination working copy to which the database needs to be upgraded
    -sourcewc <workingcopy_name>          Name of the source working copy from which the database needs to be upgraded.
    -sourcehome <oracle_home_path>        Source Oracle home path
    -ggsrcwc <workingcopy_name>           Name of the Oracle GoldenGate source working copy
    -ggdstwc <workingcopy_name>           Name of the Oracle GoldenGate destination working copy
    -clonedatadg <diskgroup_name>         Name of disk group to use as data file location for the clone database
    -cloneredodg <diskgroup_name>         Name of disk group to use as redo log location for the clone database
    -clonerecodg <diskgroup_name>         Name of disk group to use as recovery area for the clone database
    -clonedatafs <acfs_mountpoint>        Mount point of ACFS file system to use as data file location for the clone database
    -cloneredofs <acfs_mountpoint>        Mount point of ACFS file system to use as redo log location for the clone database
    -clonerecofs <acfs_mountpoint>        Mount point of ACFS file system to use as recovery area for the clone database
    -targetnode <node_name>               Name of a node in a remote cluster with no Rapid Home Provisioning Client
    -cred <cred_name>                     Credential name to associate the user/password credentials to access a remote node
    -root                                 Use root credentials to access the remote node
    -sudouser <username>                  perform super user operations as sudo user name
    -sudopath <sudo_binary_path>          location of sudo binary
    -auth <plugin_name> [<plugin_args>]   Use an authentication plugin to access the remote node
    -eval                                 Evaluate without executing the command.
    -useractiondata <user_action_data>    Value to be passed to useractiondata parameter of useraction script

[orgrid@ohs1 ~]$
```

可以通过 OGG 或 Data guard (transient logical standby) 两种方式来实现。更多详细内容，请参考 https://docs.oracle.com/en/database/oracle/oracle-database/18/cwadd/rapid-home-provisioning.html#GUID-40D3B039-92D9-4325-908B-C40C7FA9B805

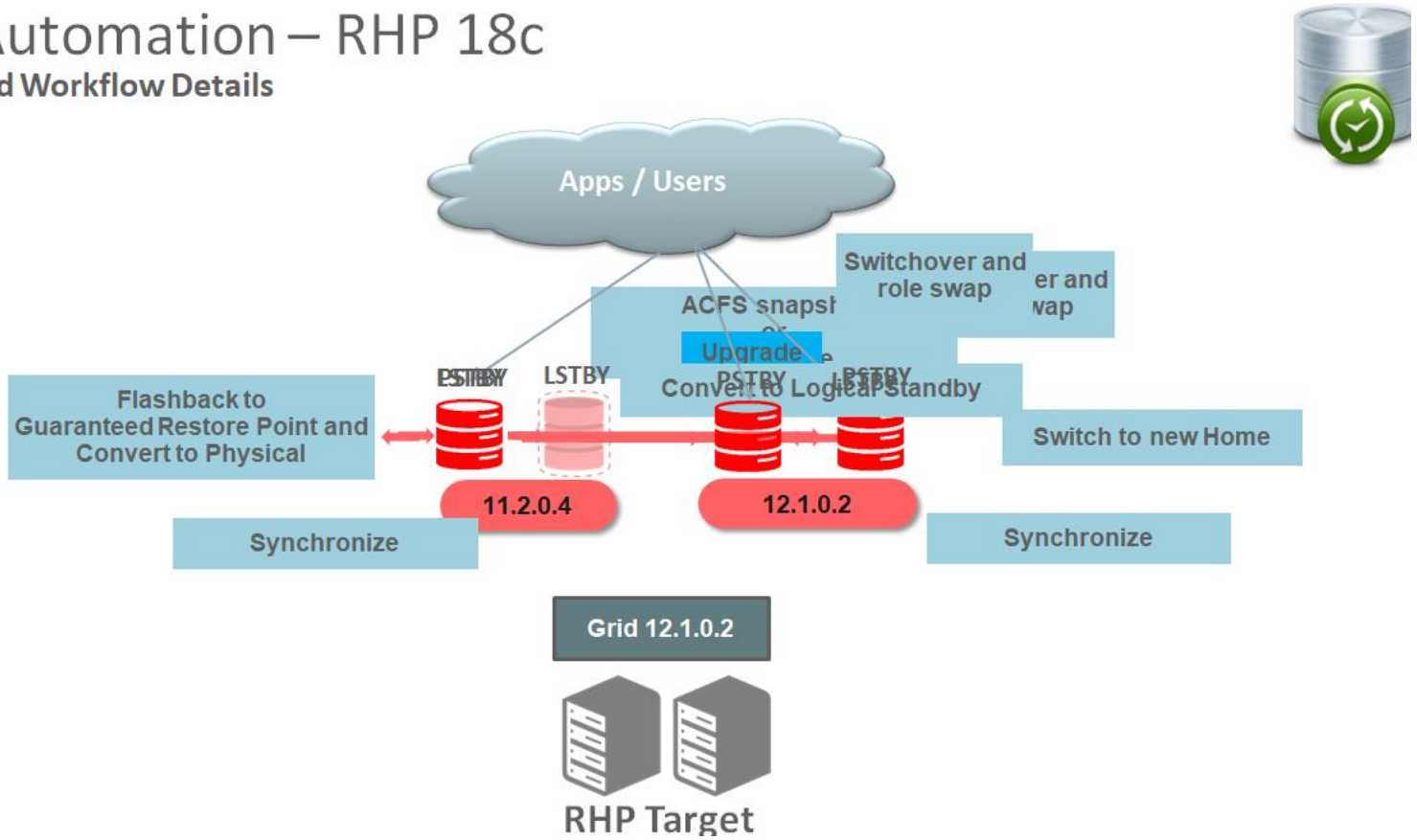
OGG 命令行

```
rhpctl zdtupgrade database -dbname sierra -destwc DB_Wcopy_121 -ggsrcwc GG_Wcopy_11g -ggdstwc GG_Wcopy_12c -targetnode
12102_cluster_node  -root
```



Data Guard 命令行

```
rhpctl zdtupgrade database -dbname sierra -destwc WC121DB4344 -clonedatadg DBDATA -targetnode node90743 -root
```



Reference

https://www.oracle.com/technetwork/database/database-cloud/private/index.html
https://www.oracle.com/assets/rapid-home-provisioning-2405191.pdf
https://blogs.oracle.com/db_maintenance/rapid-home-provisioning-simplifies-oracle-database-estate-management
https://blogs.oracle.com/db_maintenance/whats-new-in-122-for-rapid-home-provisioning-and-maintenance
https://blogs.oracle.com/db_maintenance/rapid-home-provisioning-and-maintenance-whats-new-in-18c
https://www.oracle.com/technetwork/database/database-cloud/private/rhp-datasheet-2529714.pdf
https://docs.oracle.com/en/database/oracle/oracle-database/18/sprhp/rapid-home-provisioning-use-cases.html
https://docs.oracle.com/en/database/oracle/oracle-database/18/sprhp/rhp_upgrading-oracle-database-12c-release-2.html

12.1 Reference

https://docs.oracle.com/database/121/CWADD/GUID-CCEC5960-EDA4-4A3F-9643-0CA308EA49AA.htm#CWADD92402
https://docs.oracle.com/database/121/CWADD/GUID-CDF55B0E-85FE-48A6-9329-EC3D78252F29.htm#CWADD-GUID-CDF55B0E-85FE-48A6-9329-EC3D78252F29

12.2 Reference

https://docs.oracle.com/en/database/oracle/oracle-database/12.2/cwadd/rapid-home-provisioning.html#GUID-CCEC5960-EDA4-4A3F-9643-0CA308EA49AA
https://docs.oracle.com/en/database/oracle/oracle-database/12.2/cwadd/rapid-home-provisioning-and-server-control-command-reference.html#GUID-CDF55B0E-85FE-48A6-9329-EC3D78252F29

18c Reference

https://docs.oracle.com/en/database/oracle/oracle-database/18/cwadd/rapid-home-provisioning.html#GUID-CCEC5960-EDA4-4A3F-9643-0CA308EA49AA
https://docs.oracle.com/en/database/oracle/oracle-database/18/cwadd/rapid-home-provisioning-and-server-control-command-reference.html#GUID-66345667-F035-4ADB-A25F-5530299E04B7

Rapid Home Provisioning Use Cases

下面是常用的操作，点击链接可查看官方文档

- Getting Started with Rapid Home Provisioning
  Understand how you can get started and use Rapid Home Provisioning in your standard deployment.

- Adding Gold Images for Rapid Home Provisioning
  Create gold images of software home and store them on the Rapid Home Provisioning Server, to use later to provision Oracle homes.
- Creating an Oracle Grid Infrastructure 12c Release 2 Deployment
  Provision Oracle Grid Infrastructure software on two nodes that do not currently have a Grid home, and then configure Oracle Grid Infrastructure to form a multi-node Oracle Grid Infrastructure installation.
- Provisioning an Oracle Database Home and Creating a Database
  This procedure provisions Oracle Database 12c release 2 (12.2) software and creates Oracle Database instances.
- Upgrading to Oracle Grid Infrastructure 12c Release 2
  This procedure uses Rapid Home Provisioning to upgrade your Oracle Grid Infrastructure cluster from 11g release 2 (11.2.0.4) to 12c release 2 (12.2).
- Patching Oracle Grid Infrastructure Without Changing the Grid Home Path
  This procedure explains how to patch Oracle Grid Infrastructure without changing the Grid home path.
- Patching Oracle Grid Infrastructure and Oracle Databases Simultaneously
  This procedure patches Oracle Grid Infrastructure and Oracle Databases on the cluster to the latest patch level without cluster downtime.
- Patching Oracle Database 12c Release 1 Without Downtime
  This procedure explains how to patch Oracle Database 12c release 1 (12.1.0.2) with the latest patching without bringing down the database.
- Upgrading to Oracle Database 12c Release 2
  This procedure describes how to upgrade an Oracle database from Oracle Database 11g release 2 (11.2) to 12c release 2 with a single command, using Rapid Home Provisioning, both for managed and unmanaged Oracle homes.
- Adding a Node to a Cluster and Scaling an Oracle RAC Database to the Node
  You can add a node to your two-node cluster by using Rapid Home Provisioning to add the node, and then extend an Oracle RAC database to the new node.
- Creating a User Action to Deploy a Web Server
  You can install and configure any type of software using Rapid Home Provisioning user actions. Review this procedure to automate deployment of Apache Web Server using Rapid Home Provisioning.

附录一：rhpctl add workingcopy 命令参考

下面是通过 rhpctl 部署 ORACLE_HOME 的几种方式，以及和这几种方式相关的参数。我们用 R、O、-来表示。

- R 代表是必须的选项
- O 代表是可选项
- -表示不不可用

数据库相关参数选项

	Database provisioning scenario			
	R = always required	O = optional	'- ' = never valid	
command option	Provision from the RHPS to itself	Provision from the RHPS to a 12.2 RHPC	Command executed on a 12.2 RHPC	Provision from the RHPS to a target that is not RHPC-enabled (11.2 or 12.1)
Workingcopy	R	R	R	R
Image	R	R	R	R
Oraclebase	R	R	R	R
Storagetype	LOCAL or RHP_MANAGED	NFS, LOCAL or RHP_MANAGED		LOCAL
Path (*)	R for LOCAL and NFS. Invalid for RHP_MANAGED			
If agpath and/or aupath are specified (to provide persistent Home path), -storagetype must be LOCAL.				
Agpath	O	O	O	-
Aupath	O	O	O	-
user	O	O	O	O
client	-	R	-	-
targetnode	-	-	-	R
clusternodes	-	-	-	-
groups	O (see Groups section below)			
ignoreprereq	O	O	O	O
Notify	O	O	O	O
cc	O w/ notify	O w/ notify	O w/ notify	O w/ notify

Root or sudouser	-	-	-	R
sudopath	-	-	-	R w/ sudouser else '- '
useractiondata	0	0	0	0
inventory	-	-	-	R if the target has no Oracle software inventory (e.g., first time provisioning). Else '- '.
Items below apply only if you create a database on the new workingcopy as part of the 'add workingcopy' command. Refer to the 'add database' command for details.				
Dbname	Dbtemplate	newpool	Newpqpool	Pdbname
Dbtype	Node	Cardinality	Pqcardinality	Numberofpdbs
Datafiledestinati	Serverpool	Pqpool	Cdb	

集群相关参数选项

下面是通过 rhpctl 部署 GI_HOME 的几种方式，以及和这几种方式相关的参数。我们用 R、O、-来表示。

- R 代表是必须的选项
- O 代表是可选项
- -表示不不可用

	Grid Infrastructure Provisioning scenario		
command option	RHPS installs and configures GI for first time on a target	RHPS provisions GI software to a target where cluster already exists	Command executed on 12.2 RHPC To install s/w only, no configuration
Workingcopy	R	R	R
Image	R	R	R
Oraclebase	O	R	R
Softwareonly	-	R	R
Inventory	R if not in response file, else O to override	-	-
Storagetype	LOCAL	LOCAL	LOCAL
Path (*)	R	R	R

Agpath, aupath	O if target will be 12.2 RHPC enabled else '- '	O if target is 12.2 RHPC enabled else '- '	O
User	O	O	O
Client	R	R if target is 12.2 RHPC enabled else '- '	-
node	-	-	-
clusternodes	O (overrides values in responsefile)	-	-
Targetnode	-	R if target is not 12.2 RHPC enabled else '- '	-
ignoreprereq	O	O	O
responsefile	R	-	-
Root or sudouser	R	R if target is not 12.2 RHPC enabled	-
Sudopath	R w/ sudouser else '- '	R w/ sudouser else '- '	-
Notify	O	O	O
cc	O with notify	O with notify	O with notify
Asmclientdata	O	-	-
Gnsclientdata	O	-	-
Clustermanifest	O for Domain clusters	-	-
Useractiondata	O	O	O
groups	O (see Groups below)		
Local see **Note 1**	-	-	-

If an option is not listed in a table, it is never valid for that use case. (For example, 'responsefile' is not in the Database table since it applies to Grid Infrastructure only.)

(*) In cases where you specify the -path parameter, if the file system is shared among all of the nodes in the target, then the working copy gets created on this shared storage. If the file system is not shared, then the working copy gets created in the location of the given path on every node in the cluster.

For online assistance with 'rhpctl add workingcopy', there is a '-help' option to the command. The '-help' option accepts several values, and guidance is provided on the selected deployment option: REMOTEPROVISIONING, STORAGETYPE, ADMINDB, POLICYDB, DBWITHPQPOOLS,

DBTEMPLATE, PDB, GRIDHOMEPROV, SWONLYGRIDHOMEPROV, STANDALONEPROVISIONING.

Note 1: ‘-local’ is a special case of Grid Infrastructure provisioning. It supports the creation of space-efficient gold images of patched Grid Infrastructure homes.
‘-local’ is valid for provisioning onto the RHP Service only. It performs a software-only GI provisioning onto the RHPS.
The workingcopy you create with ‘add workingcopy -local’ option is for temporary use and is not used as an active home. You use it with the workflow described in Appendix B: Workflow for creating delta Gold Images of patched DB and GI homes

软件 Home 组权限熟悉

When an ORACLEDBSOFTWARE or ORACLEGISOFTWARE gold image is created from a source home (with “import image”) or from a working copy (with “add image”), it will inherit the groups that were configured in the source. There are no options to override this.
When creating an image of type SOFTWARE, any groups in the source are not inherited. SOFTWARE images never contain groups information.
When a working copy is provisioned with ‘add workingcopy’, the default groups configured in the working copy can in some cases be overridden with the optional “-groups” parameter.

The simplest case is for gold images of type SOFTWARE. Gold images of SOFTWARE do not contain any groups information. When a working copy is created from a SOFTWARE gold image, the working copy will be provisioned with any groups specified in the “add workingcopy” command. (None are required.)
The behavior for ORACLEDBSOFTWARE and ORACLEGISOFTWARE gold images and their working copies is as follows.

First, be aware that when you “move” or “upgrade” a source home (unmanaged or workingcopy) to an existing destination working copy that was created with “add workingcopy”, the groups configured in the destination working copy must match those of the source home.

[Note: “move database/gihome” and “upgrade database/gihome” will create the destination working copy if it does not exist and the “-image” option is used. Groups are handled as follows: the destination working copy will inherit the groups configured in the source home (whether unmanaged home or managed working copy). The groups configured in the specified gold image are not used.]

Now we need to understand the different ways groups can be defined with “rhpctl add workingcopy”:

数据库软件

ORACLEDBSOFTWARE			
	11.2	12.1	12.2
Groups	OSDBA OSOPER	OSDBA OSOPER OSBACKUP OSDG OSKM	OSDBA OSOPER OSBACKUP OSDG OSKM OSRAC
Action for each group	Use value from command line if provided If not provided, retrieve from the gold image as follows: If the “-user” option was specified in “add workingcopy” Then if the user specified in that option belongs to the group retrieved from the gold image, use it. Otherwise use the installer default. Else if the user executing “add workingcopy” belongs to the retrieved group, use it. Otherwise use the installer default.		

集群软件

	ORACLEGISOFTWARE versions 11.2, 12.1, 12.2	
	Provision and configure new cluster, working copy is created with information from response file	“-softwareonly” option, working copy based on a gold image
OSDBA and OSASM	Use value from command line if provided If not provided, use the value from the response file. Note: Values for OSDBA and OSASM must be provided in the response file, even if they are overridden by the command line.	The “-groups” option is not valid in this case. The new workingcopy will inherit the groups specified in the active Grid Infrastructure on the target machine. The active GI may be a managed or unmanaged home.
OSOPER	Use value from command line if provided Else use value from response file, if provided Otherwise leave undefined	
Installer defaults	OSDBA - group 'dba' if the user is a member of the group, else user's primary group. OSBACKUP - group 'backupdba' if the user is a member of the group, else OSDBA default (that is group 'dba' or the primary group). OSDG - group 'dg dba' if the user is a member of the group, else OSDBA default. OSKM - group 'km dba' if the user is a member of the group, else OSDBA default. OSRAC - group 'rac dba' if the user is a member of the group, else OSDBA default.	

附录二：部署 12.2 GI Cluster 的响应文件样本

rhp12.2GI-sample-rsp.txt

附录三：部署 12.1.0.2 GI Cluster 的响应文件样本

rhp12.1GI-sample-rsp.txt

附录四：部署 11.2.0.4 GI Cluster 的响应文件样本

rhp11.2GI-sample-rsp.txt