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# Oracle Fleet Patching and Provisioning (FPP)

Introduction and Technical Overview

TECHNICAL BRIEF / AUGUST 2019

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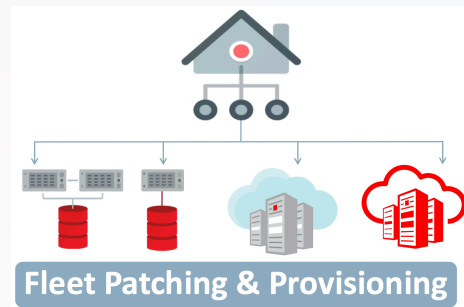
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## INTRODUCTION

The growing scale of today's data centers puts increasing demands on administrators, deployment and maintenance must be efficient and non-disruptive.

Oracle's Fleet Patching and Provisioning (FPP), formerly known as Rapid Home Provisioning (RHP), standardizes and simplifies software distribution and management. Automation and efficiency minimize the impact of maintenance and scale to large deployments.

Fleet Patching and Provisioning represents a standard method for provisioning, patching and upgrading the Oracle Database estate in a unified manner across an entire enterprise. It enables and enforces standardization while simplifying provisioning, patching and upgrading.

Software need be installed only once, then stored on the FPP Server, and from there can be provisioned to any node or cluster in the data center, whenever needed. Thus, minimizing the impact and risk of maintenance, increasing automation and reducing touch points, all while supporting large scale deployments.

## WHAT'S NEW IN ORACLE FLEET PATCHING AND PROVISIONING

The new 19c release extends the capabilities of FPP in several dimensions:

### Zero-Downtime Oracle Grid Infrastructure Patching

Zero-downtime Oracle Grid Infrastructure patching allows Oracle Grid Infrastructure patching with no interruptions to the Oracle Database. This feature is supported in Oracle Real Applications Clusters (Oracle RAC) databases with two nodes or more.

### Automated PDB Relocation

Automated relocation of a Pluggable Database from one Container Database to another CDB, thus allowing single Pluggable Databases to be patched on a more efficient fashion.

### Oracle Restart Patching & Upgrading

Oracle Restart patching and upgrading operations are now supported in Fleet Patching and Provisioning. Before Oracle FPP 19c, Oracle Restart patching and upgrading must be performed by the user, now these operations are automated.

### FPP Direct Transfer

Oracle Fleet Patching and Provisioning used temporary NFS mount points for transferring software homes to targets and for remote command execution. In Oracle FPP 19c, NFS is no longer required, thus simplifying all configurations with less port and protocol requirement while offering a superior data transfer performance.

Also, Oracle Fleet Patching and Provisioning introduced the following features and functionalities in release 18c:

### Local “Switch Home” for Applying Updates

The Fleet Patching and Provisioning automatons for updating Oracle Database and Grid Infrastructure Homes can be executed in a local mode, with no FPP Server or Client in the architecture.

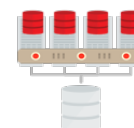
These automatons feature the same user interface, outcome, and many of the command line options as the server and client modes. This provides for a consistent, standardized maintenance approach across environments that are orchestrated with a central FPP Server and those environments that do not employ the FPP Server.

### Zero-Downtime Database Upgrade

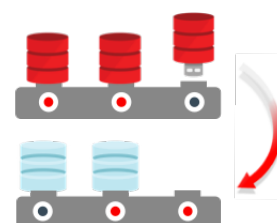
Zero-Downtime Database Upgrade automates all of the steps required for a Database upgrade. It can minimize or even eliminate application downtime during the upgrade process. It can also minimize resource requirements. It also provides a fallback path to roll back upgrades if necessary.

By automating all of the steps involved in the upgrade process, Zero-Downtime Database Upgrade reduces the effort, risk and application impact of database upgrades.

#### Zero-Downtime Oracle Grid Infrastructure Patching



#### Automated PDB Relocation



#### Oracle Restart Patching & Upgrading



## Dry Run Command Validation

The workflows encapsulated in Fleet Patching and Provisioning commands are composed of multiple smaller steps, of which some could potentially fail. The new release includes a "dry run" command mode which allows finding and fixing many potential errors prior to command execution.

While FPP allows a failed command to be resumed after an error condition is corrected, it is often preferable to address as many potential issues as possible before the command is executed. This minimizes problems and the distraction of corrective measures that could arise during a maintenance window. The new "dry run" command mode will test the preconditions for a given command, without making any changes, and report on potential problems. These can then be corrected before the command is actually executed.

## Authentication Plug-in

For authenticating communication between a Fleet Patching and Provisioning Server and target servers, Fleet Patching and Provisioning enables you to provide login credentials or, when communicating with a Fleet Patching and Provisioning Client, automatically handles authentication for most operations, internally. A new plug-in framework enables support for additional, user-defined authentication procedures.

Host-to-host authentication in customer environments, particularly in compliance-conscious industries such as financials and e-commerce, will typically leverage advanced technologies and products which are not supported natively by Fleet Patching and Provisioning. This feature enables integrating Fleet Patching and Provisioning's authentication with the mechanisms in use at a customer's data center.

## Gold Image Distribution among FPP Servers

In the Fleet Patching and Provisioning architecture, one central FPP Server operates on a set of targets within a given data center (or network segment of a data center). Large enterprises typically host multiple data centers, and within each data center there may be separate network segments. Each will need a dedicated FPP Server. For these customers, this feature provides a simple and secure mechanism for sharing Gold Images among the FPP Servers.

While each data center may have some unique requirements in terms of the Gold Images that target machines will use, the goal of standardization points to using the same Gold Images across all data centers whenever possible. To that end, FPP supports peer-to-peer sharing of Gold Images, to easily propagate Gold Images among multiple FPP Servers.

## Configuration Drift Reporting and Resolution

Provisioned copies of gold images can potentially drift from their deployed configuration, for example if one-off patches are applied. Fleet Patching and Provisioning provides two capabilities for reporting and reconciling this drift:

1. Fleet Patching and Provisioning compares a specific deployed home to its parent gold image and lists any patches that are applied to the home but that are not in the gold image.

2. Fleet Patching and Provisioning compares a specific gold image to all deployed copies and lists the aggregation of all patches applied to those homes that are not in the gold image. This provides a build specification for a new gold image that could be applied to all of the copies of the original gold image, such that no patches will be lost from any of those deployments when the new version is applied.

Operating system configurations are also at risk of drift. The Fleet Patching and Provisioning Server can collect and retain operating system configuration and the root file system contents of specified Fleet Patching and Provisioning Clients and targets. This information can then be used to:

- View current configuration
- Report any drift from the previous collection

These capabilities support the goal of maintaining standardized deployments across the database estate.

### **Command Scheduler and Bulk Operations**

Fleet Patching and Provisioning commands can now be scheduled in advance. Tasks can be scheduled to run periodically. The command queue be queried and modified. Also, commands can be applied to a list of clients.

The ability to schedule and bundle automated tasks is essential for maintenance of a large database estate. FPP now supports scheduling key tasks such as provisioning software homes, switching to a new home, and scaling a cluster. Also, a list of clients can now be added to a command, facilitating large-scale operations.

### **Oracle Exadata support**

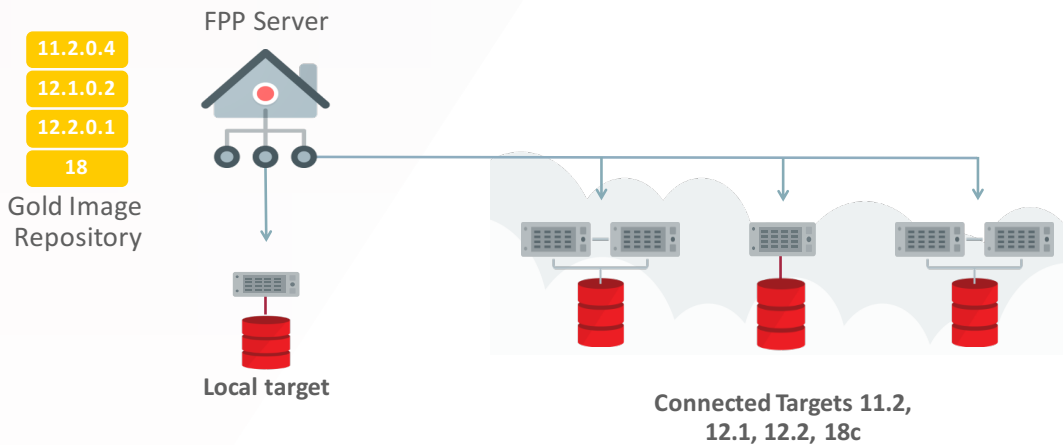
Oracle FPP introduced in 18c support for Oracle Exadata infrastructure patching. In addition to the existing support for the Oracle Database and Grid Infrastructure Homes, the software for the database nodes, storage cells and InfiniBand switches software can now be patched with FPP.

Integration of Oracle Exadata components support in to Fleet Patching and Provisioning allows the management and tracking of maintenance for these components through the centralized Fleet Patching and Provisioning Service's inventory.

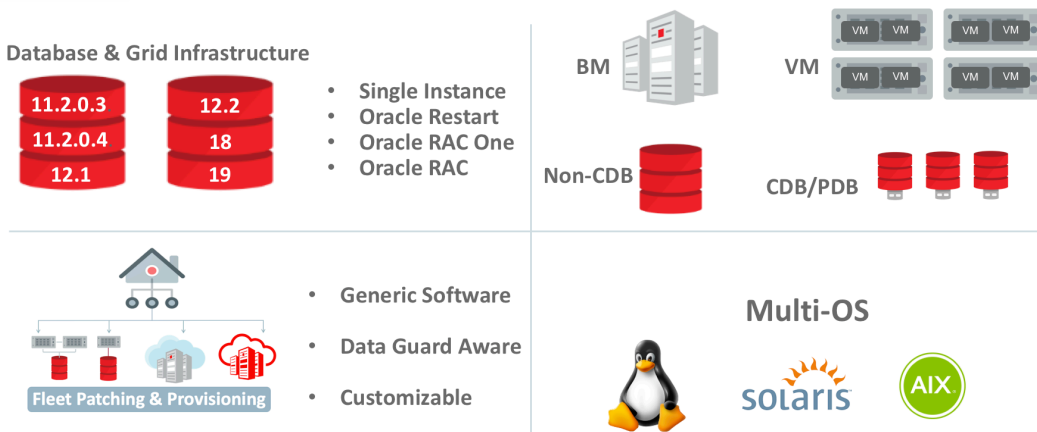
## HOW DOES FLEET PATCHING AND PROVISIONING WORK?

The architecture within a data center consists of an Oracle Grid Infrastructure (12.2 or later) deployment running the Fleet Patching and Provisioning centralized service (also referred to as the FPP Server, but in fact merely a service of the Grid Infrastructure) and any number of target deployments. The FPP Service can manage existing targets in the datacenter, and create new ones. The targets may be

- Deployments that are not running the FPP Client software (available in Grid Infrastructure 12.2 and later). These targets may be running with or without Oracle Grid Infrastructure. Supported versions of Oracle Grid Infrastructure in this case are 11.2 and 12.1. They cannot make requests to the Service, but are managed by the Service.
- Oracle Grid Infrastructure 12.2 and later running the Fleet Patching and Provisioning Client. FPP Clients can make requests to the Service, and also can be managed by the Service.



In terms of support, Oracle Fleet Patching and Provisioning is supported in multiple configurations and across different platforms:





In terms of hardware requirements, since the FPP Service is a feature of the Grid Infrastructure, the minimum hardware recommended for a Fleet Patching and Provisioning Service is the same as for any Grid Infrastructure deployment.

More details can be found in the Oracle Support Document [2126710.1 \(FPP: Fleet Patching & Provisioning Server - Minimum Requirement\)](#). For detailed steps on creating an FPP Service (and Client too), please see Oracle Support Document [2097026.1 \(How to Setup a Fleet Patching & Provisioning \(FPP\) Server and Client\)](#).

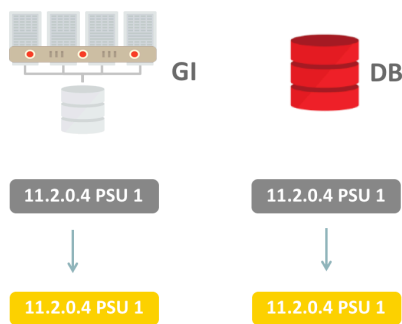
Oracle recommends hosting the FPP Service on a multi-node cluster for high availability, but it can be hosted on a single-node Grid Infrastructure deployment.

## Gold Image Management

Each gold image represents an installed home, either Oracle Database home, Grid Infrastructure home, or any other software home. Applications do not run directly on gold images. Instead, copies can be created from gold images, and these are the deployed executables.

Gold images can be imported from an installed home on the FPP Service, an FPP Client, or any node in the data center. Gold images can also be shared among FPP Services.

## Gold Image Management



- Promote existing homes to Gold Images

- Create new homes, validate and promote to Gold Images

```
- rhpctl import image -image DB122 -  
path /share/software/122/dbhome -  
imagetype ORACLEDBSOFTWARE
```

- Assign labels to Gold Images for lifecycle management

## State and Access

Fleet Patching and Provisioning allows you to define the state of an image – published, testable, or restricted. This enables life cycle management. Furthermore, access to a given image can be controlled at both the role and specific user levels.

## Series

Using an image series is a convenient way to group different gold images into a logical sequence. An image can belong to zero, one or more series. A series could represent a sequence of patch levels, with different series tailored to specific use cases.

## Notifications

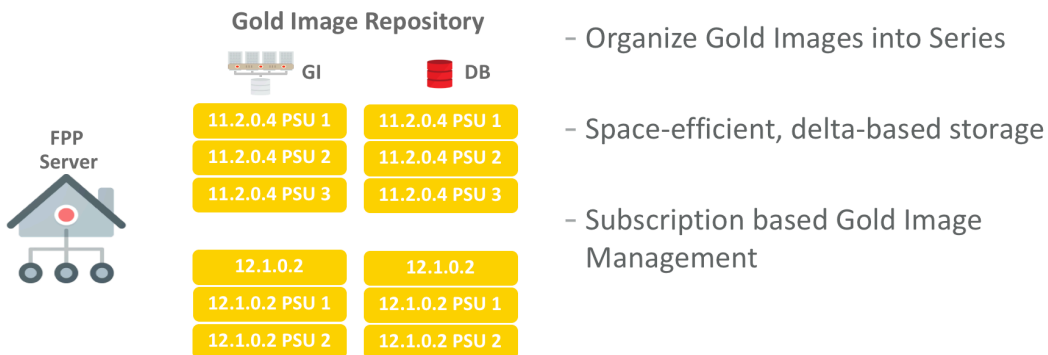
Users may subscribe to series events. Anyone subscribed will be notified by email when an image is added to or deleted from the series they are subscribed to.

## Space Efficiency

The lifecycle of a software home will include deployment of the initial image, and invariably the deployment of subsequent images containing patches. For products such as Oracle Database and Grid Infrastructure, the patched version of a given release will involve changes to only a portion of the original files. Fleet Patching and Provisioning takes advantage of this fact: when saving a patched gold image, FPP saves only the deltas from the source image.

This delta-based approach applies to Oracle Database and Grid Infrastructure Homes. For customers running multiple versions of these products, and various patch sets on each version, the overall savings will be significant.

## Gold Image Series and Delta-Based Storage



## Provisioning

The Fleet Patching and Provisioning Service can provision and configure Oracle Grid Infrastructure, Oracle Database homes (and later create Databases) & Generic Software.

## Oracle Grid Infrastructure

Oracle FPP can provision Oracle Grid Infrastructure on one or more nodes that have only the OS installed, and then configure Oracle Grid Infrastructure to form a single node or multi-node Oracle Grid Infrastructure installation. Versions 11.2 onwards are supported.

## Oracle Database

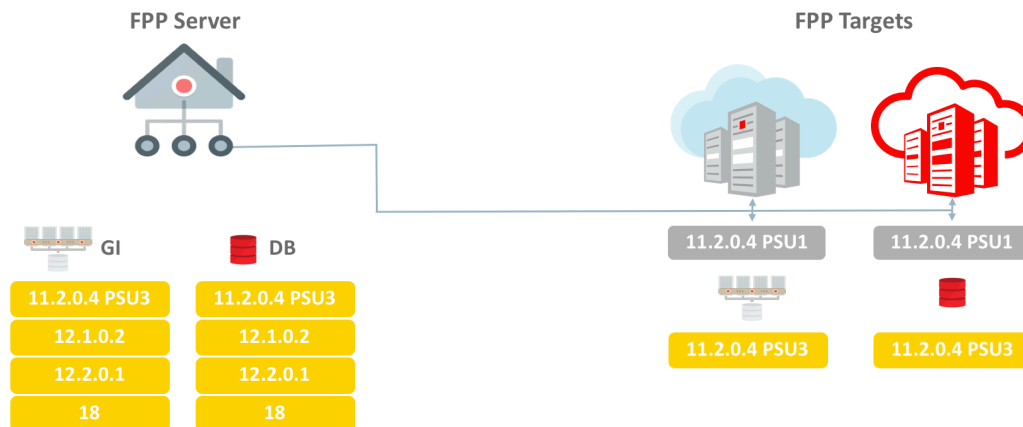
Fleet Patching and Provisioning can provision Oracle Database homes for Oracle Database 11.2 and later. Once the software is provisioned, a single FPP command will create a database with choices including:

- 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)
- Templates
- Creating Oracle Multitenant Container Databases (CDBs)
- Creating an Admin- or Policy-managed database

## Generic software

The Fleet Patching and Provisioning ecosystem is not limited to Database and Grid Infrastructure homes. Any software binary – Oracle, third-party or custom – may be used to create a gold image which can then be provisioned to any node or nodes in the data center.

## Home Provisioning with Gold Images



## Storage Options for Provisioned Software

When you provision software, the storage option determines where the software is placed:

- LOCAL (default): In a local file system not managed by Fleet Patching and Provisioning.
- FPP\_MANAGED: In a shared file system managed by Fleet Patching and Provisioning

The options do not apply to all provisioning scenarios. There are two factors: the type of home being provisioned (Database, Grid Infrastructure or arbitrary software) and where the copy is provisioned – on to the Fleet Patching and Provisioning Server itself, an FPP Client, or a target that is not an FPP Client.

**LOCAL:** Choosing this value stores copies in a local file system that is not managed by Fleet Patching and Provisioning. This is available for all provisioning scenarios.

**FPP\_MANAGED:** Choosing this value, which is available for Fleet Patching and Provisioning Servers and Fleet Patching and Provisioning Clients, stores provisioned copies in an Oracle ACFS shared file system. Oracle Database homes are the only type of software home supported with this option. This option leverages ACFS snapshot technology to minimize storage use.

## Patching & Upgrade Operations

Out-of-place patching is the best practice for applying updates. The patched environment is created in a new directory path and then the home switched to the new path. This approach allows for non-disruptive software distribution since the existing home can be active while the new home is provisioned. Also, rollback is facilitated since the old home is available if any problems are encountered after the switch.

## Patching & Upgrade Cycle with Gold Images Out-of-Place



- Build and maintain a Gold Image catalogue

- Fewer number of steps
  - Less errors
  - Easier to automate

- Standardized Method
- Easier to fall back (Plan B) if required
- Shortest Maintenance Window

One potential drawback to traditional out-of-place patching is that the home path changes. While FPP internals handle this transparently for Oracle Database and Grid Infrastructure software, some customers and third parties have developed scripts which depend on the path. To address this, Fleet Patching and Provisioning leverages a new filesystem capability which allows for separation of gold image software from the site-specific configuration changes, so the home path is persistent throughout updates.

This capability is available for Oracle Database and Oracle Grid Infrastructure versions 12.2 and later provisioned in LOCAL storage. Also, if an eligible Database or Grid Home was provisioned without using this capability, then during an `"rhpctl move database"` or `"rhpctl move gihome"` (i.e., a patching operation) it may be converted to this configuration.

Timely patching is a critical element of maintaining a secure and performing data center. However, overall maintenance windows are shrinking while availability demands from both management and application owners are increasing. Consolidation makes it more difficult to find a window in which all tenants of a shared environment can accept a maintenance window, and also increases the impact of an issue during maintenance, since a problem on a single cluster could impact multiple LOBs. Administrators may develop a fear of patching, and put off applying critical fixes until after a forcing event such as a security breach.

#### Key Features for Patching

- 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

#### Oracle Database

Out-of-place patching is the best practice for patching. The patched environment is created in a new directory path and then each database has its home switched to the new path. This approach will work whether the database home is shared with other databases or not.

Fleet Patching and Provisioning simplifies this solution for Oracle Database versions 11.2 onward, significantly reducing the impact and risk of maintenance. After the one-time activity of preparing the new (patched) gold image, each deployment in the datacenter can be patched with two commands:

1. `'rhpctl add workingcopy'` (Note: in the `rhpctl` command, copies of Gold Images are referred to as 'workingcopies')
2. `'rhpctl move database'`

Because FPP implements out-of-place patching and understands the configuration details of the Database, undoing a patching operation by rolling back to the original home is the same single command that rolled to the patched version. This capability reduces the risk of maintenance.

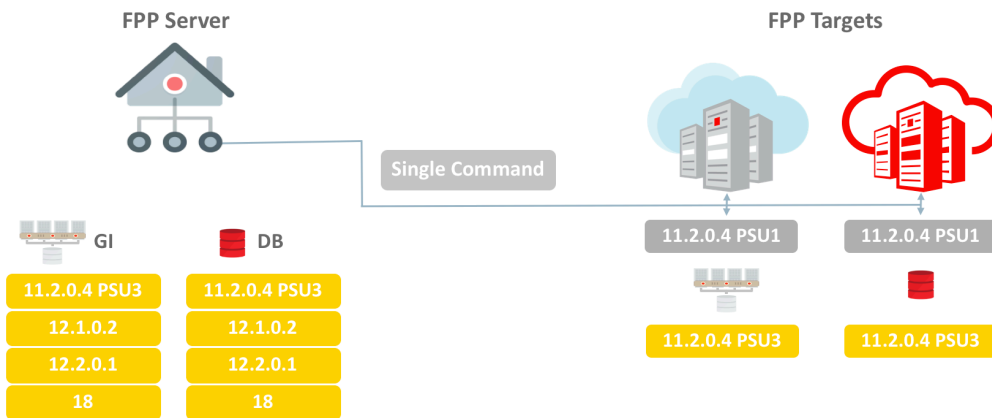
Also, the process can be restarted. If a failure occurs during the patch procedure, the operator simply corrects the problem then re-issues the patch command. It will resume where it left off.

#### Grid Infrastructure

Patching Grid Infrastructure homes versions 11.2 onwards is just as simple as for Database homes. When a gold image representing the patched home is ready for distribution, a single command provisions the home to the target. That target (FPP Client or otherwise) is not disrupted by this out-of-place provisioning – the Clusterware will continue operating without any impact.

When the maintenance window arrives, a single command switches to the patched home. By default, a rolling update is performed. And as for database patching, the operation can be safely and easily reversed with a fallback to the prior (managed) home.

# Oracle Database and Grid Infrastructure Patching



## Combined Grid Infrastructure and Database Patching

When you patch an Oracle Grid Infrastructure deployment, Fleet Patching and Provisioning enables you to simultaneously patch the Oracle Database homes on the cluster, so you can patch both types of software homes in a single maintenance operation.

As an example, to simultaneously move

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

Issue the following command in Oracle Fleet Patching and Provisioning:

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

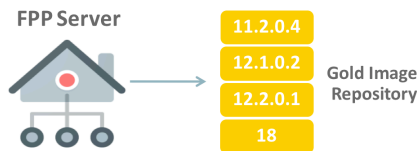
For each node in the client cluster, in the operation afore mentioned, Oracle FPP:

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).

### Flexible, Intelligent GI and DB Patching Orchestration

## Oracle Database and Grid Infrastructure Patching



- Switch subset of DB instances to new home
  - Drain services before stopping Database on each node
- 
- Process cluster nodes in batches
  - Shorten maintenance window
  - FPP computes batches to maintain specified service availability levels

- Patch GI and DB in same operation
- Patch all or subset of Database Homes

When switching a Grid Infrastructure and/or Database Home in a multi-node configuration, FPP offers several options to control the behavior of events. This enables workflows which maximize service availability and minimize disruption to applications and end users.

Switching to a new home across a cluster is performed in either rolling or non-rolling fashion.

A non-rolling update bounces the software stack on all nodes in parallel, so this provides the shortest maintenance window. However, all services will be offline for the duration of the restart. This is acceptable if all Database services are SI DB (they cannot be rolled) or possibly for non-critical deployments for which downtime is insignificant.

A rolling update operates on nodes sequentially, allowing for services to remain up on one or more nodes throughout the maintenance window. This is the default mode of operation for FPP. To maximize the availability of services during a rolling update, FPP provides several options to control the timing and outcome of operations.

## Single command to Upgrade GI or DB Homes

Fleet Patching and Provisioning provides a single command to upgrade an Oracle Database home, and a single command to upgrade a Grid Infrastructure home, replacing the numerous steps that are traditionally required. As with patching, the process is restartable: if an error occurs, the procedure stops and allows the user to repair the problem. After the issue is addressed, the command can be reissued, and it will resume where it stopped earlier.

For Grid Infrastructure, the upgrade is rolling by default; this may be overridden if you choose. After an upgrade to Grid Infrastructure 12.2 or later versions, the FPP Client is configured and started automatically.

For both DB and GI, the pre-upgrade home can be running on provisioned copy (a managed home that you provisioned with Fleet Patching and Provisioning) or on an unmanaged home.

## Database Consolidation during Patch or Upgrade

Often customers will have several database homes on a cluster, with each home running one (or a few) database instance(s). The homes may proliferate over time, and it would be desirable to reduce the number of homes by consolidating multiple instances on to one shared home. Fleet Patching and Provisioning supports this use case by design.

Suppose a cluster hosts two separate Oracle Database Homes (A and B), each running one or a few database instance(s).

You would then provision a new Database Home onto the cluster - the Database version you want to patch or upgrade the homes A and B to.

You can then switch any or all of the databases running on home A to the new home, and the same for the databases running on home B. FPP understands how to merge the configurations from homes A and B into the new home.

The source home (A or B) can be a database home that was provisioned before you brought FPP into the picture, or it can be a home that was provisioned by FPP.

If the source home was provisioned by FPP, then after a patch operation you can easily move the database instance(s) back to the source home - you simply execute the command that switched you to the patched home, but with the source and destination homes reversed.

## “FPP by osmosis” – organic uptake of the current estate

As noted earlier, a Fleet Patching and Provisioning Service can operate directly on existing deployments. No changes are required on the existing deployments. Since the targets can be 11.2.0.4, 12.1.0.2, 12.2, 18 and 19 Grid Infrastructure and Database homes, there is probably a large portion of your estate that the FPP Service can immediately provide value to.

The homes on the existing deployments are referred to as unmanaged homes – i.e., homes that were not provisioned by FPP. Converting these to managed homes will take place seamlessly as part of the maintenance cycle: when you use FPP to provision the new home and then patch or upgrade to that copy, the target will organically become a managed target with all the benefits that accrue.



FPP Clients can be created several ways.

1. When a pre-12.2 cluster (unmanaged or managed) is upgraded to 12.2 or later versions, the client will automatically be configured and started.
2. When an unmanaged 12.2 or later cluster is patched, the FPP Client will be automatically configured and started.
3. An unmanaged 12.2 or later cluster can be configured and started as a Client by the FPP Service with the 'rhpctl add client' command.
4. When the FPP Service deploys new 12.2 or later clusters, the FPP Client is automatically configured and started.

Also, recall that any homes in the data center can be imported as Gold Images, so you can choose which images will be your standardized deployment foundations.

## Other Operations

### Notifications

The Fleet Patching and Provisioning Service is the central repository for the software homes available to the data center. Therefore, it is essential that administrators throughout the data center be aware of changes to the inventory which might impact their areas of responsibility. In addition to the notification for image series changes described above, users can be notified by email when a copy is provisioned or deleted.

### Custom Workflow Support with User Action scripts

For various Fleet Patching and Provisioning operations, such as importing images, adding or deleting copies, and managing a software home, you can create scripts that will become part of the workflow. You can define different actions for each operation, and further differentiate by the type of image to which the operation applies. Actions that you define can be executed before or after the given operation, and are executed on the target the operation applies to, whether it is the Fleet Patching and Provisioning Service, a target that is not running a Fleet Patching and Provisioning Client, or a target that is running a Fleet Patching and Provisioning Client.

User-defined actions are shell scripts which are stored on the Fleet Patching and Provisioning Service. When a script runs, it is given relevant information about the operation on the command line, including a free-form string in which you can pass any information you wish. Also, you can associate a file with the script. The Fleet Patching and Provisioning Service will copy that file to the same location where the script is run on the target.

Custom scripts can apply to a variety of use cases. For example, after creating a new database instance, you may wish to register it with an RMAN catalog. This could be done in a custom script. Or, you may wish to disable a monitor while a Database is being upgraded, and re-enable it afterwards. And, workflows for any type of software home can be created, allowing you to leverage FPP to provision and configure middleware and applications.

## Administrative Roles

An authorized administrator assigns roles to FPP users, with access-level permissions defined for each role. This applies to users on both FPP Services and Clients. Fleet Patching and Provisioning includes basic and composite built-in roles to simplify the assignment of administrative and end-user capabilities.

The composite role GH\_CA includes all the basic roles needed to administer an FPP Client. The Oracle Grid Infrastructure user on a Fleet Patching and Provisioning Client automatically inherits this role.

Similarly, the composite role GH\_SA includes all the basic roles needed to administer an FPP Service. This role includes the roles available to GH\_CA, plus the ability to administer roles and everything related to FPP clients. The Oracle Grid Infrastructure user on a Fleet Patching and Provisioning Service automatically inherits the GH\_SA role.

There is a need for security and isolation if there are multiple user-communities involved in a single domain of an FPP Service and FPP Clients. The roles-based approach controls access to various entities, providing the necessary separation and security within the deployment. Assigning roles to a community prevents other community users from acting on entities not belonging to them.

## Managing Clients

Fleet Patching and Provisioning Client management tasks include:

- Enabling and disabling FPP Clients. If an FPP client is disabled, all `rhpcctl` commands from that client cluster will be rejected by the FPP Service.
- Creating users and assigning roles on FPP Clients
- Managing the FPP Client Password. Each FPP Client uses a password stored internally to authenticate itself with the FPP Service. The GH\_CA user on the client cannot query this password. If there is a need to reset this password, this task is done by the GH\_SA user on the FPP Service.

All of the above operations are performed on the FPP Service.


## Auditing

The Fleet Patching and Provisioning Service records the execution of all Fleet Patching and Provisioning operations and also records their outcome (whether success or failure). An audit mechanism enables you to query the audit log in a variety of dimensions, and also to manage its contents and size.

## Zero Downtime Database Upgrade

Zero-Downtime Database Upgrade (ZDU), automates all of the steps required for a Database upgrade. It can minimize or even eliminate application downtime during the upgrade process. It can also minimize resource requirements. It also provides a fallback path to roll back upgrades if necessary. By automating all of the steps involved in the upgrade process, Zero-Downtime Database Upgrade reduces the effort, risk and application impact of database upgrades.





### Zero Downtime Upgrade (ZDU)

<p><b>Zero DB Downtime Upgrade</b></p>  <p>Zero-Downtime Upgrade</p> <p><b>Zero DB downtime</b></p>	<p><b>Fully Automated Workflow</b></p> <p>Clone</p> <p>Switch Over</p> <p>Upgrade</p> <p>Sync Up</p> <p>Switch Back</p>	<p><b>Robust, Fast &amp; Space Efficient</b></p> <p><b>Robust</b></p> <ul style="list-style-type: none"> <li>Resume-able after failures</li> <li>Revertible for fast rollback / fall back.</li> </ul> <p><b>Fast &amp; Space Efficient</b></p> <ul style="list-style-type: none"> <li>Fast cloning with Snapshots for databases hosted on ACFS</li> <li>Full database copy also supported</li> </ul>
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ZDU leverages Oracle Data Guard TLS and Oracle GoldenGate to perform the upgrades and it is up to the customer to decide the preferred option. Furthermore, ZDU leverages ACFS for fast database cloning with snapshot technology, this, however is optional, the customer can always opt to perform full database copies if preferred.

### Zero Downtime Upgrade (ZDU)

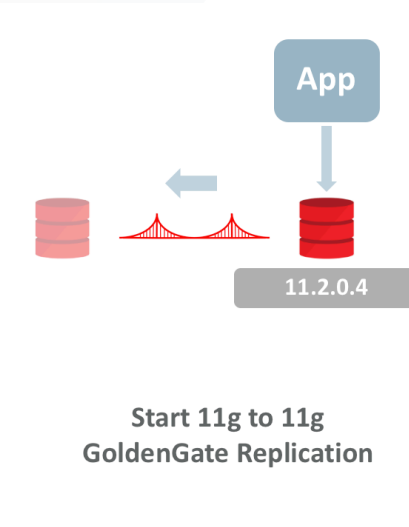
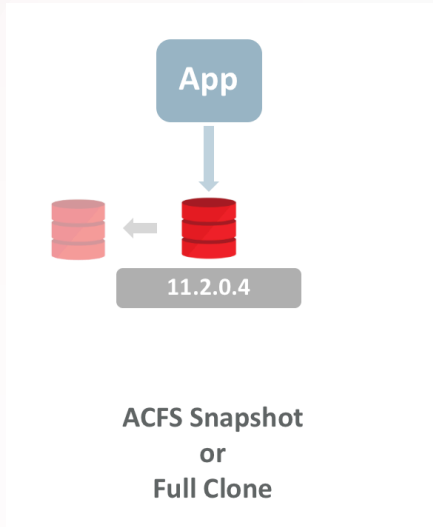


 <p>GoldenGate based synchronization &amp; switchover</p>	 <p>Data Guard Transient Logical Standby (TLS) based synchronization &amp; switchover</p>
<p>End-to-End Automation</p> <p>No extra hardware needed</p> <p>Fleet level capability</p>	<p>Automatic setup/teardown and configuration of GG and DG. No prior knowledge required.</p>  

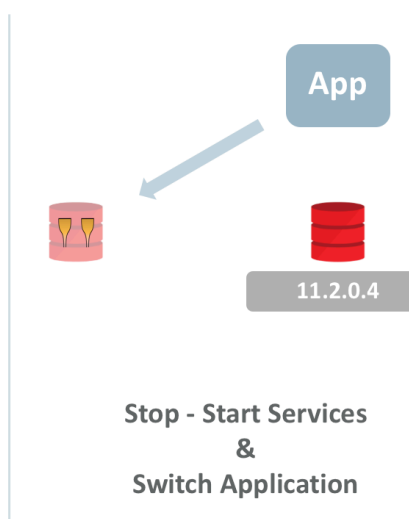
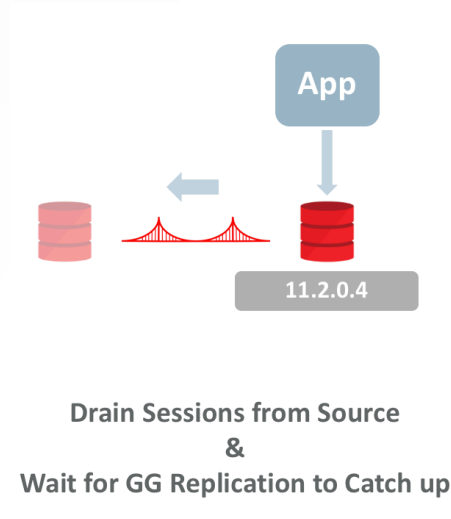
## Zero Downtime Upgrade with GoldenGate

Zero Downtime Upgrade with GoldenGate workflows is as follows, provided the customer issues the ZDU command within the FPP framework:

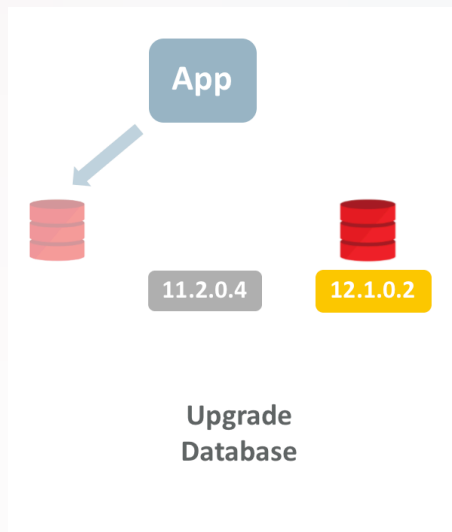
1. ACFS Snapshot of Full Clone of the database to be updated
2. Setup and initiate replication between the source database and the clone database



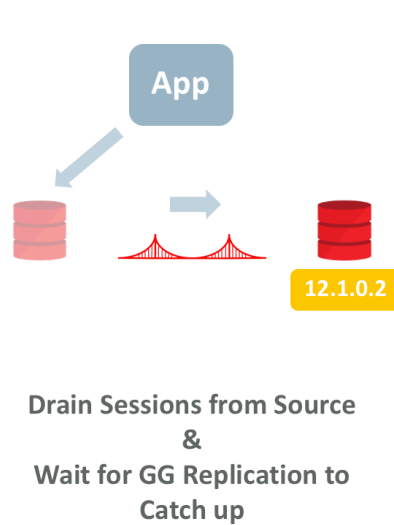
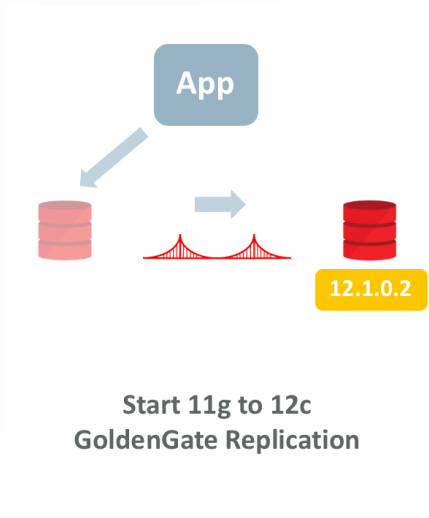
3. Drain Sessions from the source database and wait for GoldenGate replication to catch up
4. Stop services on the source database and start services on the clone database and perform the switchover



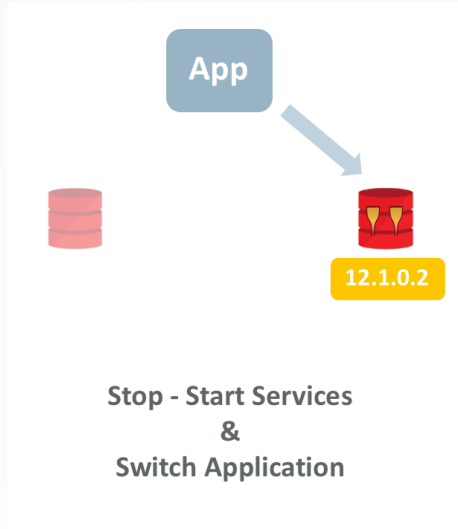
5. Upgrade the source database



6. Start GoldenGate Replication from the clone database to the upgraded source database
7. Drain Sessions from the source (clone) database and wait for GoldenGate replication to catch up



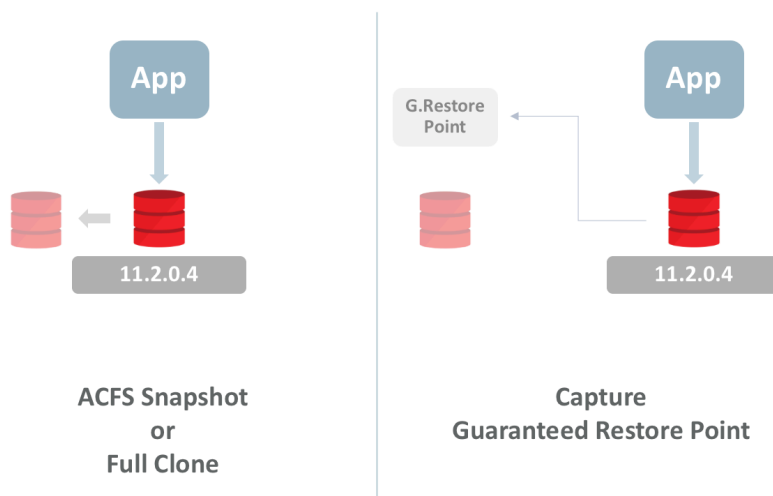
- Stop services on the source (clone) database and start services on the upgraded source database and perform the final switchover



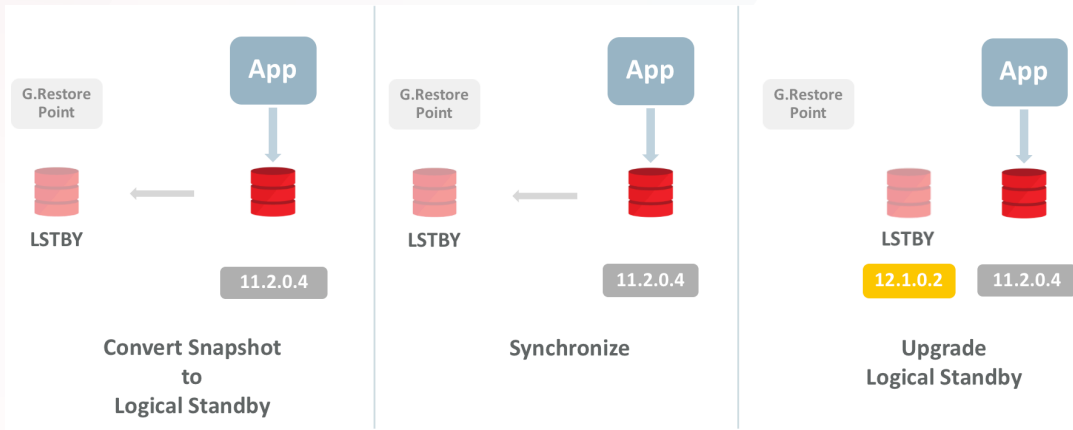
### Zero Downtime Upgrade with Data Guard

Zero Downtime Upgrade with Data Guard workflows is as follows, provided the customer issues the ZDU command within the FPP framework:

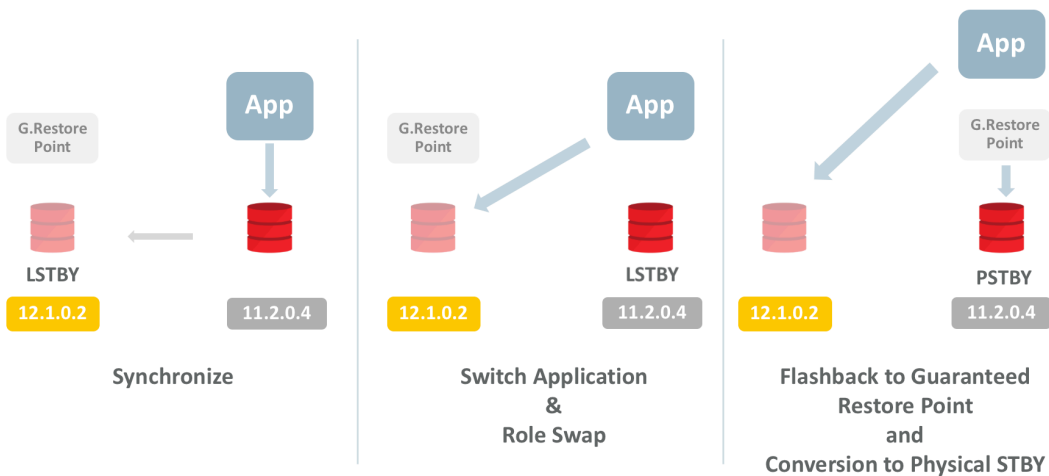
- ACFS Snapshot of Full Clone of the database to be updated
- Capture a Guaranteed Restore Point



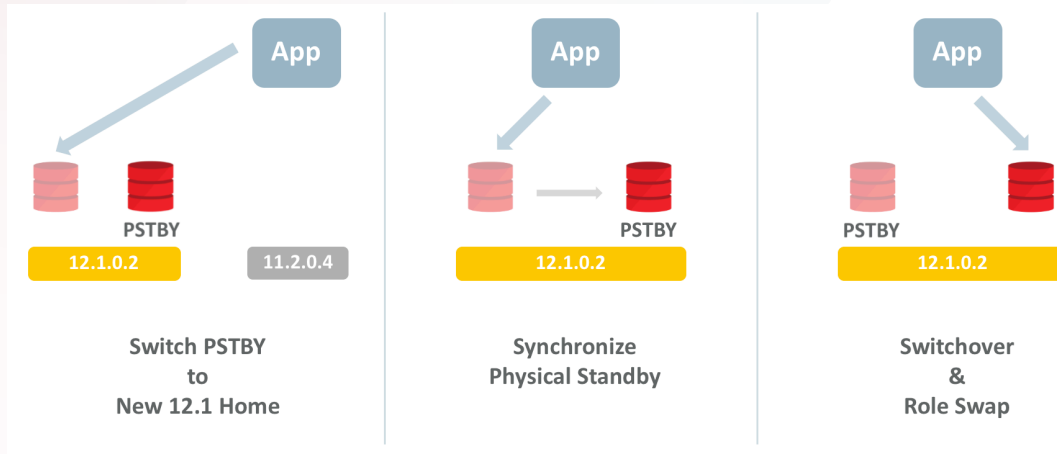
3. Convert the clone database to a Logical Standby
4. Synchronize the source database with the Logical Standby
5. Upgrade the Logical Standby



6. Synchronize the source database with the upgraded Logical Standby
7. Switch the Application and perform a role swap (the source is now a logical standby)
8. Flashback to the Guaranteed Restore Point and convert the source to a physical standby



9. Switch the Physical standby to the new home
10. Synchronize the Physical standby
11. Switchover the application and role swap, the clone database is now the physical standby



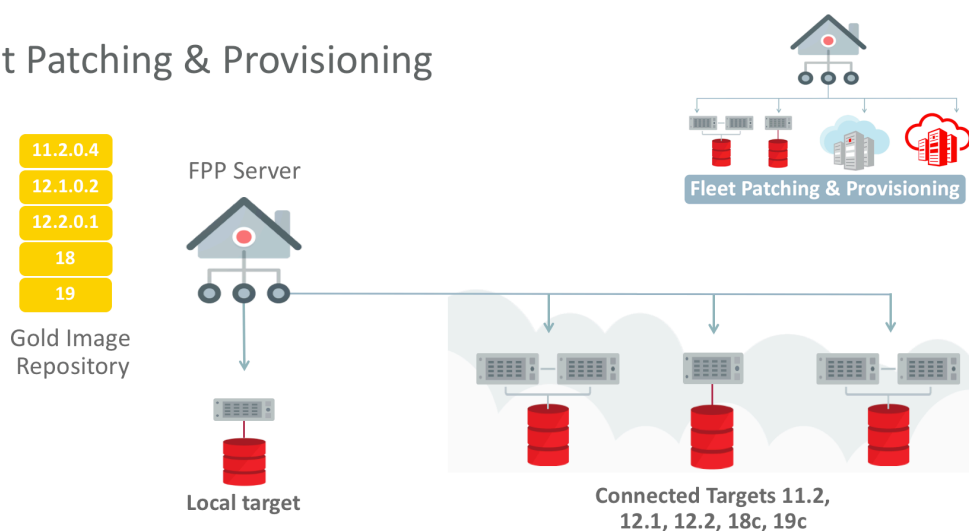
As you can see, Fleet Patching and Provisioning automates the upgrade process, leveraging Oracle Data Guard and GoldenGate, providing a zero downtime migration for your Oracle Databases.



## CONCLUSION

Fleet Patching and Provisioning is a single tool for provisioning, patching and upgrading software homes at an organizational level, in a unified manner, across all architectural layers of software infrastructure.

## Fleet Patching & Provisioning



Key benefits include:

- Enables and enforces standardization
- Simplifies provisioning, patching and upgrading
- Minimizes the impact and risk of maintenance
- Increases automation and reduces touch points » Supports large scale deployments

An FPP Service can manage existing and create new Grid Infrastructure and Database deployments, so you can leverage its benefits today with your Oracle estate.

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## Integrated Cloud Applications & Platform Services

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Technical Brief Oracle Fleet Patching and Provisioning (FPP)

Date: August 2019

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