12

Oracle Compute Cloud Service Orchestrations

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Objectives

After completing this lesson, you should be able to:

- Describe how to use orchestrations
- Explain the structure of an orchestration
- List the objects that you can create using an orchestration
- Create an orchestration file using JSON
- Create an instance using an orchestration
- Delete an instance by stopping an orchestration

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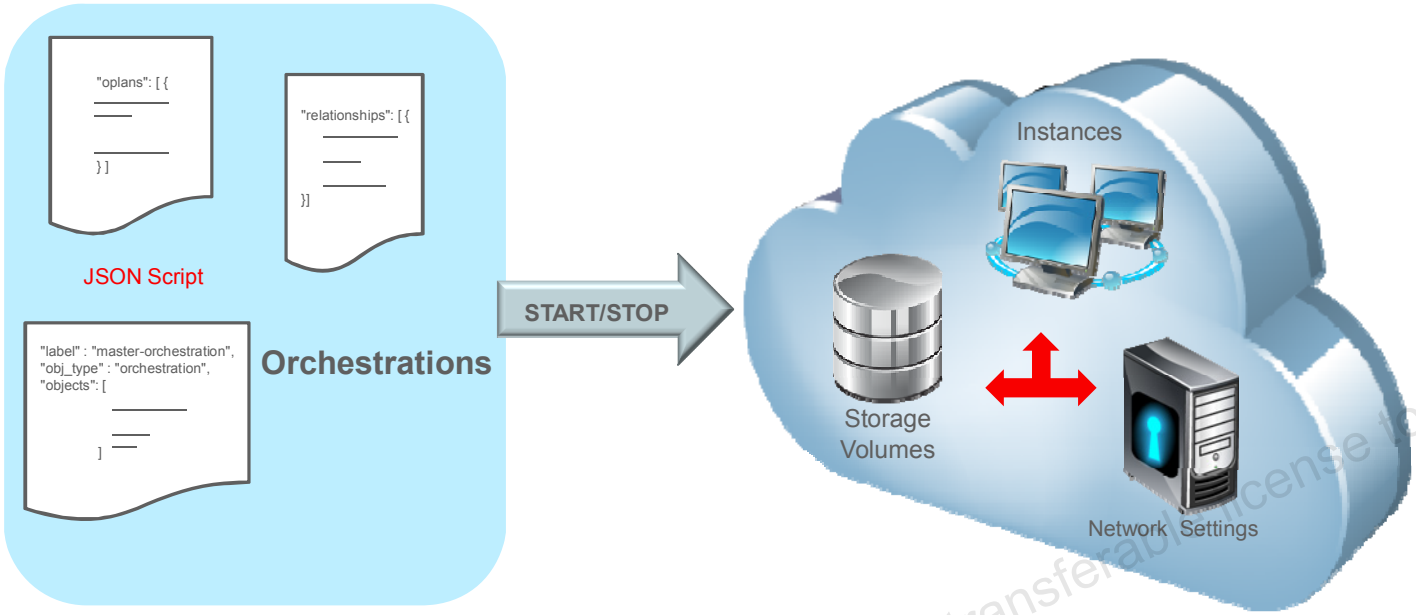
What Is an Orchestration?



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An orchestration is a script that defines the attributes and interdependencies of a collection of compute, networking, and storage resources in Oracle Compute Cloud Service. You can use orchestrations to automate the provisioning and lifecycle operations of an entire virtual compute topology.

For example, you can use orchestrations to create and manage a collection of instances hosting a multi-tiered application stack with all the necessary networking, storage, and security settings.

At any time, you can delete all the instances in an orchestration just by stopping the orchestration. Later on, if required, you can re-create all the objects in that orchestration by starting the orchestration again. Storage attachments, security lists, and any other objects that are created or referenced in the orchestration are then re-created and referenced again, automatically.

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Why Should I Use Orchestrations?

- Simplify the process of provisioning and removing objects
- Assign specified objects to specified instances – always
- Define dependencies between objects
- Specify a High Availability policy for instances

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Here's how orchestrations are useful.

When you create an orchestration file, you can use it to create not just one instance, but many instances in one file and at the same time. Let's say you want to spin up five instances and you want each instance to use a different SSH key, bootable storage volume, and persistent public IP address. You know that you'll need these instances for – let's say – a few days, and after that you won't want to use them again for several days. If you create these instances one at a time, you'll have to make a note of which resources you used with each instance. If you have another, say, 15 instances in the same environment, then you'll have to make a careful note of which instances you want to delete and start up again later on. It's tedious, right?

Now, if you use an orchestration to do this, it's much simpler. You define all five instances in a single orchestration file. Ensure that the storage volumes, security lists, SSH keys, and IP reservations that you want to use already exist – you can even use separate orchestration files to create those objects. Then just start the orchestration to create all five instances.

When you're done with the instances, stop the orchestration to delete all five instances.

If you created the associated objects, such as IP reservations and storage volumes, in separate orchestrations, then you can stop those orchestrations as well. Later on, when you want to use those instances again, start the orchestrations that create the referenced objects first, then start the orchestration that creates your instances. All your instances will start up using exactly the same resources as they had the first time around.

When you create an instance using the web console, you must ensure that you have created the prerequisite objects, such as SSH public keys or bootable storage volumes, before you start the create instance wizard.

When you use an orchestration to create an instance, it is possible to reference an object such as a security list or a public IP address reservation, that is not currently available. You might not have created the referenced object yet, you might have created it and then removed it, or as for an IP reservation, you might have used it with another instance. If this happens, you will not be able to start your orchestration.

To avoid this situation, you can create many of the referenced or prerequisite objects in the same orchestration that you use to create your instance. You can then define dependencies to ensure that the prerequisite objects are always created before the object that refers to them.

Another benefit of using an orchestration to create an instance is that the orchestration can monitor the status of the instances it creates. If you set the High Availability (HA) policy in an orchestration to active, the orchestration continuously monitors the status of its instances. If an instance in such an orchestration goes down, the instance is re-created automatically.

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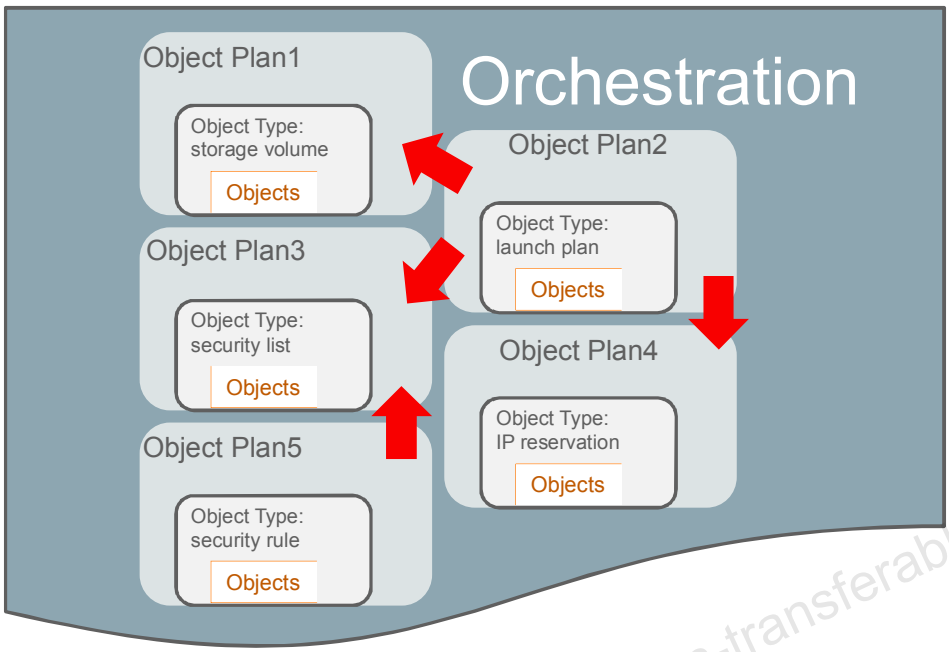
What Does an Orchestration Look Like?



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An orchestration is designed with primary building blocks called object plans, or "oplan"s.

Each oplan contains all the attributes for the “object type” defined in that oplan.

An “object type” refers to the Oracle Compute Cloud Service resource that you want to create. For example, if you want to create a storage volume, the “object type” would be storage/volume. If you want to create an instance, the “object type” would be launchplan.

The “objects” attribute defines the properties or characteristics of the Oracle Compute Cloud Service specific object that you want to create. The attributes of the “objects” vary depending on the object type.

For example, if you want to create a storage volume, the “object type” would be storage/volume, and the attributes under “objects” would include size and bootable. If you want to create an instance, the object type would be launch plan, and the objects would include instances, along with instance-specific attributes, such as image list and shape.

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Which Objects Can I Create Using an Orchestration?

Object Type	Description
ip/reservation	Reserves an IP address.
launchplan	Creates an instance.
orchestration	Starts a set of orchestrations.
storage/volume	Creates a storage volume.
secapplication	Creates a security application.
seciplist	Creates a security IP list.
seclist	Creates a security list.
secrule	Creates a security rule.

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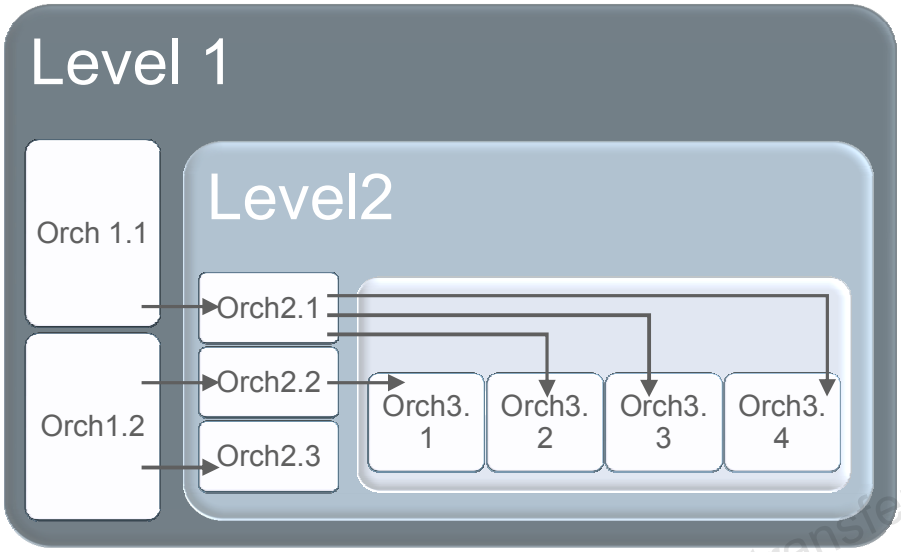
You can define the following object types in an orchestration:

- **ip/reservation:** Reserves an IP address. To associate an IP reservation with an instance that is defined in the same orchestration, you must specify a relationship between the ip/reservation and the launchplan object plans.
- **launchplan:** Creates an instance. To add an instance to a security list that is defined in the same orchestration, you must specify a relationship between the launchplan and the seclist object plans.
- **orchestration:** Starts a set of orchestrations.
- **storage/volume:** Creates a storage volume. To attach this storage volume to an instance that is defined in the same orchestration, you must specify a relationship between the storage/volume and the launchplan object plans.
- **secapplication:** Creates a security application. To use this security application in a security rule that is defined in the same orchestration, you must specify a relationship between these objects.
- **seciplist:** Creates a security IP list. To use this security IP list in a security rule that is defined in the same orchestration, you must specify a relationship between these objects.
- **seclist:** Creates a security list. To use this security list in a security rule that is defined in the same orchestration, you must specify a relationship between these objects.
- **secrule:** Creates a security rule. If this security rule uses security applications, security lists, or security IP lists that are defined in the same orchestration, then you must specify a relationship between these objects.

What If I Don't Want All My Objects in One Orchestration?



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You can use separate orchestrations to define different sets of objects. For example, you could create separate orchestrations for networking objects, for storage volumes, and for instances.

If you want to orchestrate different sets of interrelated objects together, you can create a master orchestration that references multiple nested orchestrations.

Suppose you want to start two orchestrations that create two different sets of instances. The instances in Orchestration 1.1 will be added to three security lists that are defined in a separate orchestration, say Orch2.1. These security lists are used by security rules defined separately in orchestrations Orch3.2, Orch3.3, and Orch3.4. Also, assume that the instances in Orch1.2 use similar networking objects defined in Orch2.2 and Orch3.1 and that they additionally require storage volumes, which are defined in Orch2.3.

Now you can create a master orchestration that references Orch1.1 and Orch1.2, where Orch1.1 and Orch1.2 in turn reference each of their respective nested orchestrations. You can start or stop an individual orchestration at any level of nesting, or you can start or stop the master orchestration, which causes all the nested orchestrations to start or stop.

Depending on the nature of the objects defined in the orchestrations, you might also need to specify dependencies between the different orchestrations, to ensure that all objects defined in the various orchestrations are created in the appropriate sequence.

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How Do I Define Dependencies in an Orchestration?

- Use the `relationships` attribute to specify the sequence in which the objects must be created in the orchestration
- Specify the two objects that have a relationship, identified by their oplan labels
- Specify the relationship type as `depends`

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The “relationships” attribute of an orchestration allows you to specify dependencies between oplans.

For example, if you define a storage volume in an orchestration and you also define an instance that the storage volume is attached to, then in the relationships section of the orchestration, you can specify that the launchplan object plan depends on the storage/volume object plan. This ensures that the storage volume is created before the instance is created.

So if you define a storage volume in an orchestration with the oplan label storagevolume1, and a launch plan with the oplan label boot-from-storagevolume1, then the relationship between these objects is as follows:

```
"relationships": [
    {
      "oplan": "boot-from-storagevolume1",
      "to_oplan": "storagevolume1",
      "type": "depends"
    }
]
```

For more complex scenarios, you can define multiple relationships.

For example, to create a security list (seclist1), a security application (secapplication1), and a security rule (secrule1) in a single orchestration, define the following relationships to ensure that both the security application and the security list are created before the security rule:

```
"relationships": [
    {
      "oplan": "secrule1",
      "to_oplan": "seclist1",
      "type": "depends"
    },
    {
      "oplan": "secrule1",
      "to_oplan": "secapplication1",
      "type": "depends"
    }
  ]
```

What about specifying dependencies between nested orchestrations in a master orchestration? Consider a master orchestration that references three nested orchestrations with the following labels:

- **instances-orchestration:** Defines instances.
- **network-orchestration:** Defines networking objects, such as security lists and IP addresses that instances must be associated with during instance creation.
- **storage-orchestration:** Defines storage volumes that must be associated with instances during instance creation.

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In order for instances-orchestration to be able to create its instances, all objects in network-orchestration and storage-orchestration must exist when the instances-orchestration starts. In this case, you define the following relationships:

```
"relationships": [
    {
        "oplan": "instances-orchestration",
        "to_oplan": "network-orchestration",
        "type": "depends"
    },
    {
        "oplan": "instances-orchestration",
        "to_oplan": "storage-orchestration",
        "type": "depends"
    }
]
```

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How Do I Create an Instance Using an Orchestration?

1. Build your orchestration using JSON.
2. Upload the orchestration to Oracle Compute Cloud Service.
3. Check that the prerequisite objects are available.
4. Start the orchestration.

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To create instances using orchestrations, you build an orchestration in a JSON-formatted file, upload it to Oracle Compute Cloud Service, and then start the orchestration. Before you start your orchestration, however, ensure that you have created all your prerequisite objects.

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Steps to Create an Instance Using an Orchestration

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What Is JSON? Why Should I Use It?

- JSON is JavaScript Object Notation (JSON)
- A lightweight format used for data interchange
- Based on a subset of the JavaScript Programming Language
- Easier to use than XML
- Universal data structures

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JavaScript Object Notation (JSON), is a syntax for storing and exchanging data. It is a lightweight format, based on a subset of the JavaScript Programming Language.

JSON utilizes two data structures:

- A collection of name/value pairs. In various languages, this is realized as an object, record, struct, dictionary, hash table, keyed list, or associative array.
- An ordered list of values. In most languages, this is realized as an array, vector, list, or sequence.

These are universal data structures. Virtually all modern programming languages support them in one form or another.

JSON has very simple syntax and is very easy to learn and use. It is generally considered to be an easier-to-use option to XML.

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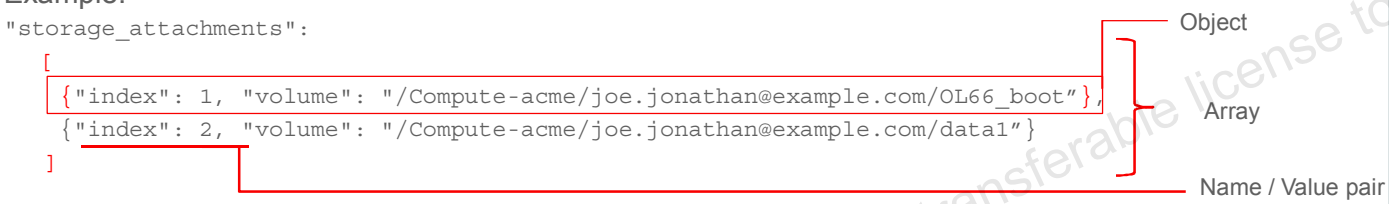
JSON Syntax

- Data is in name/value pairs
- Data is separated by commas
- Curly braces hold objects
- Square brackets hold arrays

Example:



ORACLE

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JSON data consists of a name and a value written as name/value pairs. JSON values can be:

- A number – either integer or floating point
- A string – enclosed in quotation marks " “
- A Boolean value – 1 / 0
- An array – enclosed in square brackets [ ]
- An object – enclosed in curly braces { }
- Null

Example

"storage_attachments":

[

{"index": 1, "volume": "/Compute-acme/joe.jonathan@example.com/OL66_boot”},

{"index": 2, "volume": "/Compute-acme/joe.jonathan@example.com/data1”}

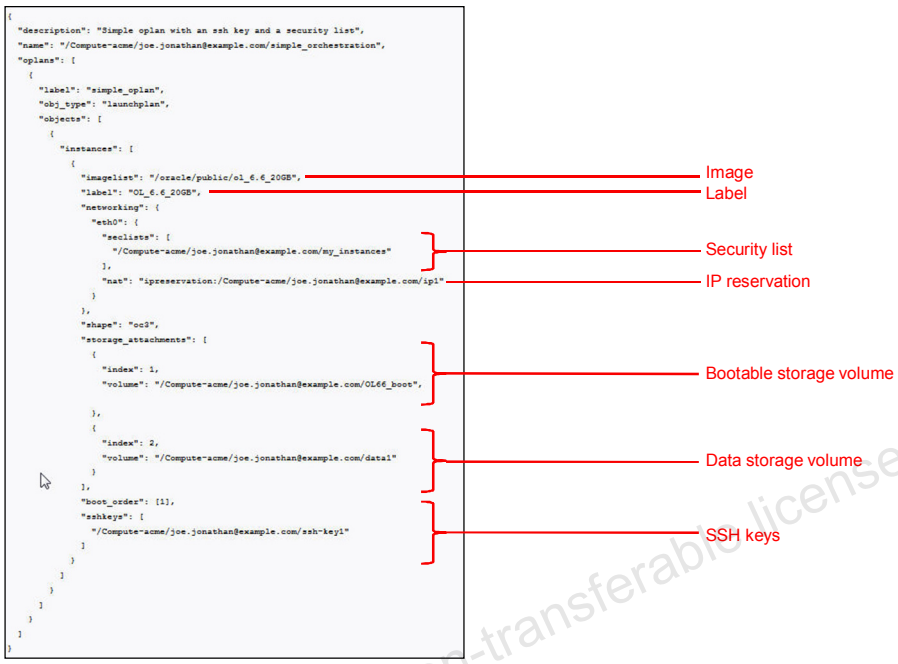
]

In this example, the object “storage_attachments" is an array containing two objects. Each object is a record of a storage volume. Each object has two name/value pairs to indicate the name of the storage volume and its index number.

You can use a JSON editor to create your orchestration file, and a JSON syntax checker of your choice to validate your JSON syntax.

Sample JSON to Build Your First Orchestration – Single Instance

Now modify this sample script and build your own Orchestration



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This sample orchestration does the following:

- Defines an instance with the label OL_6.6_20GB, the oc3 shape, and using the /oracle/public/ol_6.6_20GB image
- Adds the instance to the security list/Compute-acme/joe.jonathan@example.com/my_instances
- Associates the IP reservation /Compute-acme/joe.jonathan@example.com/ip1 with the instance
- Attaches the bootable storage volume /Compute-acme/joe.jonathan@example.com/OL66_boot to the instance
- Attaches the data storage volume /Compute-acme/joe.jonathan@example.com/data1 to the instance
- Associates the SSH public key /Compute-acme/joe.jonathan@example.com/ssh-key1 with the instance

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Steps for Building Your First Orchestration

- Copy the sample orchestration to a plain text file, and open the file in any text editor.
- Replace the name of the orchestration with an appropriate three-part name (/Compute-identity_domain/user/object).
- Change the value of the imagelist attribute to the image that you want to use. Select oel_6.4_5GB_RD_10oct2014.
- Under instances, change the value of the label attribute to any label that you want.
- Replace the security list /Compute-acme/joe.jonathan@example.com/my_instances with a security list that you have already created.
- Replace the IP reservation /Compute-acme/joe.jonathan@example.com/ip1 with an IP reservation that you have already created.
- Replace the oc3 shape with the shape that you want to use. For now, use oc3.
- Replace the storage volume /Compute-acme/joe.jonathan@example.com/OL66_boot with the bootable storage volume that your instance should boot from.
- Replace the storage volume /Compute-acme/joe.jonathan@example.com/data1 with a storage volume that you want to attach to the instance. If you want to attach more storage volumes, then specify the index for the storage attachment and the name of the storage volume.
- Replace the SSH key /Compute-acme/joe.jonathan@example.com/ssh-key1 with a key that you have created and added to Oracle Compute Cloud Service.
- Save the orchestration file. You should also validate your JSON file. You can do this by using a third-party tool. If your JSON format is not valid, then an error message is displayed when you upload the orchestration.

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Steps to Create an Instance Using an Orchestration

1. Build your orchestration using JSON.
2. Upload the orchestration to Oracle Compute Cloud Service.
3. Check that the prerequisite objects are available.
4. Start the orchestration.

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How Do I Upload My Orchestration to Oracle Compute Cloud Service?

1. Go to the Oracle Compute Cloud Service console.
2. Click the Orchestrations tab.
3. Click Upload Orchestration and select the orchestration file that you want to upload.

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Before you upload your orchestration JSON, check that your file is complete and use a syntax checker to validate your JSON. To upload the file:

1. Go to the Oracle Compute Cloud Service web console.
2. Click the Orchestrations tab.
3. Click Upload Orchestration and select the orchestration file that you want to upload.

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What Are the Prerequisite Objects for Creating an Instance?

Any object referenced in your orchestration file, such as:

- SSH public key(s)
- Bootable storage volume (optional)
- Storage volumes (optional)
- IP reservation (optional)
- Security lists

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When you define your instance in an orchestration, you can reference any of the following objects:

- SSH public key(s) – Use the one you created earlier.
- A bootable storage volume – You have created this earlier.
- One or more storage volumes for the data and applications that you plan to deploy on your instance – You have created this earlier. Make sure that the instance to which this was earlier attached is deleted, to be able to reuse this storage volume.
- An IP reservation, if you want your instance to have a persistent public IP address. So far, you have used an autogenerated IP address to associate with the instance. The procedure to create an IP reservation is discussed in Lesson 10, Configuring Network Settings. Refer to the steps there to create a persistent IP address for your instance at this point.
- One or more security lists, if you want to use security rules to control access to your instance. You have already created a security list. You can reference that security list in your orchestration.

If any object referenced in an orchestration is not available when you start the orchestration, the orchestration will go in to an error state. So ensure that you have created all the objects associated with the instance, and that the objects are available to the instance. For example, if you have specified a storage volume, “Vol1”, to be attached to your instance, you should have created Vol1 and it should not be attached to any other instance.

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Everything's Fine. Can I Start My Orchestration?

1. Go to the web console.
2. Click the Orchestrations tab.
3. Go to the orchestration that you want to start. From the menu, select Start.

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To start the orchestration:

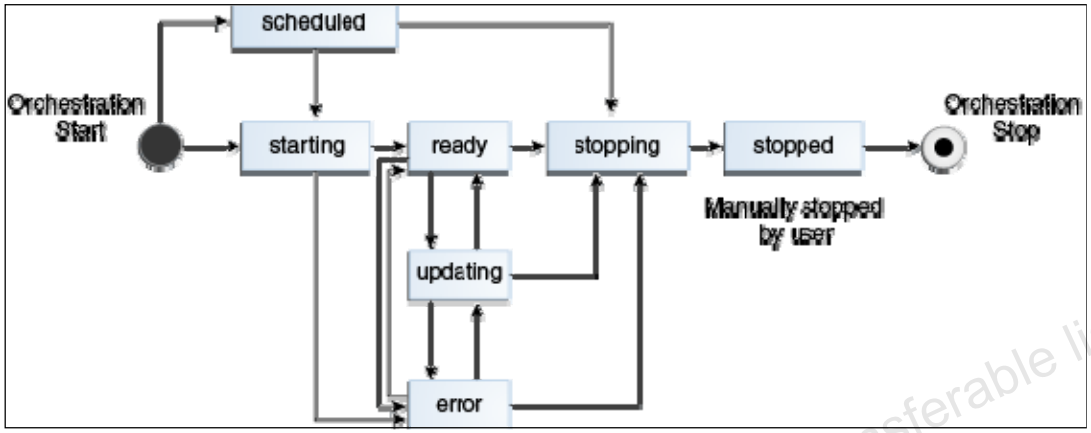
1. Go to the web console.
2. Click the Orchestrations tab.
3. Go to the orchestration that you want to start. From the menu, select Start.

When you start an orchestration, its status changes to Starting and the objects defined in the orchestration are provisioned. When all the objects have been created, the status of the orchestration changes to Ready.

If the orchestration cannot create an object, its status changes to Error. An orchestration might transition from the Error to the Ready state when it completes creating all the specified objects. However, if the status of your orchestration continues to show Error for a long time, then stop the orchestration, identify and fix the issue in an offline copy of the orchestration JSON file, upload the modified orchestration file, and try to start the orchestration again.

How Do I Know What My Orchestration Is Doing?

Orchestration Life Cycle



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To check the status of your orchestration:

1. Go to the Oracle Compute Cloud Service web console.
2. Click the Orchestrations tab. All orchestrations are displayed, with information about their description and status.

You can filter the list of orchestrations according to their category or status. To view orchestrations with a specific status (such as ready, error, or stopped), click the Show menu and select the appropriate filter. To view orchestrations of a specific category (such as all or personal), click the Category menu and select the appropriate filter.

An orchestration can be in any of the following states:

Starting

The orchestration is starting.

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scheduled

A future start_time has been specified for the orchestration.

- When the current time is equal to or past the start_time value, then the state of the orchestration changes to starting.
- To cancel a current schedule, stop the orchestration. The state of the orchestration then changes to stopping.

ready

The orchestration is running.

- Note that, for any object where the HA policy is not specified or is set to none, you can still update or delete the object using the web console or the API. In this case, the orchestration continues to be in the ready state, even though some or all of the objects created using that orchestration may have been deleted.
- For instances where the HA policy is set to active, if the orchestration is in the ready state, you can update the instance using the web console or the API, but you cannot delete the instance, because it is re-created automatically. To delete such instances, you must stop the orchestration.

updating

The orchestration is being updated.

- When an orchestration is in the ready or error state, you can update it by using the PUT /orchestration/name API call. This causes the state of the orchestration to change to updating.
- When an orchestration is in the updating state, no further updates can be made. Attempts to update such an orchestration are rejected with a validation error.
- If an orchestration in the updating state encounters an error, its state changes error. If no errors are encountered, then the orchestration completes the updates and returns to the ready state.
- When you stop an orchestration that is in the updating state, it transitions to the stopping state.

error

One or more instances in the orchestration have encountered an error.

- The orchestration remains in the error state until all the instances defined in it are running.
- Wait to see if all the instances start running and the state of the orchestration changes automatically to ready. If that does not happen, then stop the orchestration, identify and fix the error, and start the orchestration again.

stopping

The orchestration is stopping.

stopped

The orchestration has stopped. All the objects defined in the orchestration have been deleted.

You can also view details of an orchestration, including return parameters and information about errors, if any. Go to the orchestration that you want to view and, from the menu, select View. The orchestration details page shows you the details of the current state of the orchestration in JSON format.

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How Do I Know If My Instance Is Running?

1. Go to the web console.
2. The Instances page shows a list of instances, along with information about each instance.
3. Go to the instance that you want to view. From the menu, select View.

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When your orchestration has transitioned to the Ready state, your instance should be running. To verify this:

1. Go to the web console
2. The Instances page shows a list of instances, along with information about each instance. Verify that the instance defined in your orchestration is listed with the status Running.
3. To view the details of this instance, go to the instance and from the menu, select View.

The instance details page shows all the details of the selected instance, such as the public and private IP addresses, and the storage volumes, security lists, and SSH keys associated with it. Verify that your instance was created by the orchestration that you just started, that it uses the appropriate machine image and shape, and that it has the expected resources associated with it, such as the SSH public key, IP address, security lists, storage volumes, and so on.

If there are many instances in your environment, you can filter the list of instances according to their category or status. To list instances with a specific status (such as running, error, or stopped), click the Show menu and select the appropriate filter. To view instances of a specific category (such as PaaS, IaaS, or personal), click the Category menu and select the appropriate filter.

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My Orchestration Status Says Ready. Can I Stop It?

1. Go to the Oracle Compute Cloud Service console.
2. Click the Orchestrations tab.
3. Identify the orchestration that you want to stop. From the menu, select Stop.

Remember:

When you stop an orchestration, all the instances and other resources that were provisioned by that orchestration are deleted.

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When you stop an orchestration, all the instances and other resources that were provisioned by that orchestration are deleted. So stop an orchestration only if you are sure you do not need any of the objects defined in that orchestration.

To stop an orchestration:

1. Go to the web console.
2. Click the Orchestrations tab.
3. Identify the orchestration that you want to stop. From the menu, select Stop.

When you stop an orchestration, only the resources that are created by the orchestration are deleted. For example, if you use an orchestration to create storage volumes and attach them to your instances, then such storage volumes are deleted when you stop the orchestration, and you lose the data stored on those storage volumes. However, if an orchestration specifies only *attachments* to storage volumes, where the storage volumes themselves are created outside the orchestration, then when you stop the orchestration, the storage volumes are not deleted.

After an orchestration is stopped, its status on the Orchestrations page changes to Stopped. You can still view the orchestration, download it, or start it again later.

Quiz

Which of the following can you do with orchestrations?

a. Create, delete, and re-create multiple instances and other objects with varied attributes
b. Enable high-availability for instances
c. Specify dependencies between objects
d. Schedule the creation or deletion of a set of objects
e. All of the above

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Quiz

Which of the following objects can you create or start using orchestrations?

a. Instances
b. Storage volumes
c. SSH keys
d. Security lists and security rules
e. Security applications
f. Other orchestrations
g. All of the above

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Quiz

Identify the correct sequence for creating an instance using an orchestration.

a. Generate JSON script > Upload the file using the web console > Create instance > Create other objects such as storage volumes and security lists > Start the orchestration.
b. Generate JSON script > Add orchestration > Start orchestration > Create other objects such as storage volumes and network settings > Create instance.
c. Generate JSON script > Upload the file using the web console > Verify prerequisites > Start the orchestration.

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Quiz

What happens when you stop an orchestration?

a. All the objects defined in the orchestration are deleted.
b. All the objects defined in the orchestration are stopped but not deleted.
c. The instances defined in the orchestration are stopped, and other objects are deleted.

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Summary

In this lesson, you should have learned how to:

- Use orchestrations
- Explain the structure of an orchestration
- List the objects that you can create using an orchestration
- Create an orchestration file using JSON
- Create an instance using an orchestration
- Delete an instance by stopping an orchestration

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Resource: Links

For more information regarding Oracle Compute Cloud Service, visit http://docs.oracle.com/cloud/latest/stcomputecs/index.html

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