FUJITSU Cloud Service K5 IaaS

Heat Template Specifications

V1.0

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Preface

Purpose of this document

This document describes the specifications of and how to use the Heat template supplied with FUJITSU Cloud Service K5 IaaS. Refer to this document when building a system on FUJITSU Cloud Service K5 IaaS.

Intended readers

This document is intended for users who plan or develop applications and services for use on FUJITSU Cloud Service K5 IaaS. Readers of this document are assumed to have:

- Basic knowledge of virtualization technology (hypervisor, virtual server, virtual storage, virtual network)
- Basic knowledge of OpenStack
- Basic knowledge of the operating system that will be used
- Basic knowledge of the Internet and Intranet
- Basic knowledge of security
- Basic knowledge of system operations, such as backups, monitoring, and redundancy

Structure of the manuals

Refer to the following related manuals according to your purpose and usage.

Manual	Purpose and usage
FUJITSU Cloud Service K5 IaaS Features Handbook	Explains details on the features provided by this service.
FUJITSU Cloud Service K5 IaaS API User Guide	Explains how to use the REST API, how to build the API runtime environment, and sample scripts, etc., according to usage sequences.
FUJITSU Cloud Service K5 IaaS API Reference	Refer to this document as a detailed reference when using the REST API.
FUJITSU Cloud Service K5 IaaS Service Portal User Guide	Explains how to use the features provided by this service when using the service portal (Web GUI).

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Contents

1 Introduction

1.1 Purpose and scope of this document

This document describes the Heat template of FUJITSU CLOUD K5.

It should be noted that the content of this document is subject to change without prior notice.

2 Supported resource types

Refer to "Appendix A Resource type properties" for a list of properties.

Services	Resource Types
Auto Scaling	FCX::AutoScaling::AutoScalingGroup
	FCX::AutoScaling::LaunchConfiguration
	FCX::AutoScaling::ScalingPolicy
Telemetry	OS::Ceilometer::Alarm
	OS::Ceilometer::CombinationAlarm
Block Storage	OS::Cinder::Volume
	OS::Cinder::VolumeAttachment
Compute	OS::Nova::Server
Network	OS::Neutron::Firewall
	OS::Neutron::FirewallPolicy
	OS::Neutron::FirewallRule
	OS::Neutron::FloatingIP
	OS::Neutron::FloatingIPAssociation
	OS::Neutron::Net
	OS::Neutron::Port
	OS::Neutron::ProviderNet
	OS::Neutron::Router
	OS::Neutron::RouterInterface
	OS::Neutron::SecurityGroup
	OS::Neutron::Subnet
	FCX::Neutron::NetworkConnector
	FCX::Neutron::NetworkConnectorEndpoint
	FCX::Neutron::NetworkConnectorEndpointConnection
Expandable Load Balancing	FCX::ExpandableLoadBalancer::LoadBalancer
Database	FCX::Database::DBInstance
Object Storage	OS::Swift::Container

3 Heat Orchestration Template (HOT) format

3.1 Template structure

The HOT template is defined in YAML format. Below is an outline of the template structure.

```
heat_template_version: 2013-05-23

description: <description>

parameters:
  <parameters>

resources:
  <resources>

outputs:
  <outputs>
```

Section:

Section	Required	Description
heat_template_version	Yes	The HOT version. Specified as *2013-05-23*.
description	No	Defines a description of the template.
parameters	No	Defines the input parameters. This is used when instantiating the template.
resources	No	Defines the resources.
outputs	No	Defines the output parameters. This can be used by users after instantiation of the template has been completed.

3.2 `parameters` section

The `parameters` section defines the input parameters used when the template is instantiated. For example, parameters specified by the user, such as name, password, and image ID.

The type or default value is defined for each parameter, with the parameter name as the key.

```
parameters:
  <param name>:
    type: <string | number | json | comma_delimited_list>
    label: <human-readable name of the parameter>
    description: <description of the parameter>
    default: <default value for parameter>
    hidden: <true | false>
    constraints:
      <parameter constraints>
```

parameters:

Element	Required	Description
<param name>	Yes	Defines the name of an input parameter.
type	Yes	Defines the data type of an input parameter. - *string* - *number* - *json* - *comma_delimited_list*
label	No	Defines the human-readable label.
description	No	Defines the human-readable description.
default	No	Defines the default value used when input of the parameter is omitted.
hidden	No	Defines whether to hide the parameter when a user requests information about a stack created from the template. This attribute can be used for passwords. If omitted, *false* will be used. - *true* - *false*
constraints	No	Defines the constraints of the parameter. Constraints are specified in the format described in the section below.

3.2.1 Parameter constraints

This section describes the format of constraints used in the `parameters` section.

```
constraints:
  - <constraint type>: <constraint definition>
    description: <constraint description>
```

constraints:

Element	Required	Description
<constraint type>	Yes	Specifies the type of constraint. - *length* - *range* - *allowed_values* - *allowed_pattern* - *custom_constraint*
<constraint definition>	Yes	Specifies the definition of a constraint in the format corresponding to its type.
description	No	Defines the message that is displayed for the user when a constraint is violated. If omitted, the default message will be used.

`<constraint type>` and `<constraint definition>` are described in the section below.

3.2.1.1 length

Specifies constraints for a `string` parameter. The minimum and maximum number of characters can be defined.

```
length: { min: <lower limit>, max: <upper limit> }
```

length:

Element	Required	Description
min	No	Specifies the minimum number of characters. Specify `min`, `max`, or both.
max	No	Specifies the maximum number of characters. Specify `min`, `max`, or both.

3.2.1.2 range

Specifies constraints for a `number` parameter. The minimum and maximum value can be defined.

```
range: { min: <lower limit>, max: <upper limit> }
```

range:

Element	Required	Description
`min`	No	Specifies the minimum value. Specify `min`, `max`, or both.
`max`	No	Specifies the maximum value. Specify `min`, `max`, or both.

3.2.1.3 allowed_values

Specifies constraints for a `string` or `number` parameter. It specifies a set of possible values for a parameter.

```
allowed_values: [ <value>, <value>, ... ]
```

```
allowed_values:
  - <value>
  - <value>
  - ...
```

3.2.1.4 allowed_pattern

Specifies constraints for a `string` parameter. It specifies a regular expression that specified values must match.

```
allowed_pattern: <regular expression>
```

3.2.1.5 custom_constraint

Specifies a custom constraint. It specifies a constraint for which the Heat plug-in is implemented.

```
custom_constraint: <name>
```

3.2.1.6 Example of specified constraints

```
parameters:
  user_name:
    type: string
    label: User Name
    description: User name to be configured for the application
    constraints:
      - length: { min: 6, max: 8 }
        description: User name must be between 6 and 8 characters
      - allowed_pattern: "[A-Z]+[a-zA-Z0-9]*"
        description: User name must start with an uppercase character
  instance_type:
    type: string
    label: Instance Type
    description: Instance type for compute instances
    constraints:
      - allowed_values:
        - m1.small
        - m1.medium
        - m1.large
  key_name
    type: string
    description: SSH key pair
    constraints:
      - custom_constraint: nova.keypair
```

3.2.2 Pseudo parameters

There are parameters provided by Heat separately to the input parameters. These parameters can be referenced using the embedded function get_param, in the same manner as for the parameters defined using the template.

Pseudo Parameters:

Parameter name	Description
OS::stack_name	The name of the stack.
OS::stack_id	The ID used to identify stacks.

3.3 `resources` section

The `resources` section defines the resources that make up a stack deployed from the template (for example, compute instances, networks, storage volumes).

```
resources:
  <resource ID>:
    type: <resource type>
    properties:
      <property name>: <property value>
    metadata:
      <resource specific metadata>
    depends_on: <resource ID or list of ID>
    deletion_policy: <deletion policy>
```

resources:

Element	Required	Description
<resource ID>	Yes	Defines a unique resource ID in the template.
type	Yes	Specifies the resource type. For example, OS::Nova::Server, etc.
properties	No	Specifies a list of resource properties.
<property name>	No	Specifies a property name. The name of the properties defined for the resource type can be used.
<property value>	No	Specifies a value using the data type corresponding to a property. This can be specified directly, or via *Intrinsic Functions*.
metadata	No	Specifies the metadata of a resource.
depends_on	No	Defines the dependency relationship with other resources. Refer to *Resource Dependencies* for details.
deletion_policy	No	Specifies the deletion policy of resources. When *Delete* is specified, the resource entity will be removed on deletion. When *Retain* is specified, the resource entity will not be removed on deletion. If omitted, *Delete* will be used. - *Delete* - *Retain*

3.3.1 Example definition of resources

```
resources:
  my_instance:
    type: OS::Nova::Server
    properties:
      flavor: m1.small
      image: F18-x86_64-cfntools
```

3.3.2 Resource dependencies

`depends_on` can be used to define resources with one or more dependencies.

Example definition of a single dependency:

```
resources:
  server1:
    type: OS::Nova::Server
    depends_on: server2

  server2:
    type: OS::Nova::Server
```

Example definition of multiple dependencies:

```
resources:
  server1:
    type: OS::Nova::Server
    depends_on: [ server2, server3 ]

  server2:
    type: OS::Nova::Server

  server3:
    type: OS::Nova::Server
```

3.4 outputs section

The outputs section defines output parameters that should be available to users. The parameters defined here can be referenced by users as stack information. For example, output parameters are used for the IP address of deployed instances, or, the URL of a web application deployed to a stack.

```
outputs:
  <parameter name>:
    description: <description>
    value: <parameter value>
```

outputs:

Element	Required	Description
<parameter name>	Yes	Defines the name of a unique output parameter in the outputs section.
description	No	Defines the description of an output parameter.
value	No	Defines the value of an output parameter. *get_attr* can be used to obtain resource information. If omitted, a null character is used as the default value of an output parameter.

The example below defines the output parameter instance_ip used to obtain the IP address of a compute resource.

```
resources:
  my_instance:
    type: OS::Nova::Server
outputs:
  instance_ip:
    description: IP address of the deployed compute instance
    value: { get_attr: [my_instance, first_address] }
```

3.5 Intrinsic functions

The embedded functions described below can be used in the HOT template.

3.5.1 get_param

The get_param function obtains the value of input parameters defined in the parameters section.

```
get_param: <parameter name>

or

get_param:
  - <parameter name>
  - <key/index 1>
  - <key/index 2>
  - ...
```

get_param:

Element	Required	Description
<parameter name>	Yes	Specifies the name of an input parameter defined in the parameters section.
<key/index 1,2,..>	No	Specifies the key or index for obtaining data, when the input parameter defined in the parameters section is a list or hash.

Example specification of the get_param function:

```
parameters:
  instance_type:
    type: string
    label: Instance Type
    description: Instance type to be used.
  server_data:
    type: json

resources:
  my_instance:
    type: OS::Nova::Server
    properties:
      flavor: { get_param: instance_type }
      metadata: { get_param: [ server_data, metadata ] }
      key_name: { get_param: [ server_data, keys, 0 ] }
```

Example input parameter values:

```
{"instance_type": "m1.tiny",
{"server_data": {"metadata": {"foo": "bar"},
                 "keys": ["a_key","other_key"]}}}
```

Properties and values of "my_instance" in the above example:

properties	Value obtained using get_param
flavor	"m1.tiny"
metadata	{"foo": "bar"}
key_name	"a_key"

3.5.2 get_attr

The get_attr function references the attribute value of an instantiated resource. The name of an attribute defined for the resource type must be specified.

```
get_attr:
  - <resource ID>
  - <attribute name>
  - <key/index 1>
  - <key/index 2>
  - ...
```

get_attr:

Element	Required	Description
<resource ID>	Yes	Specifies a resource ID defined in the *Resources Section*.
<attribute name>	Yes	Specifies the name of an attribute for which you want to reference the value. The name of the attribute defined for the resource type can be used.
<key/index 1,2,..>	No	Specifies the key or index for obtaining data, when the attribute is a list or hash.

Example specification of the get_attr function:

```
resources:
  my_instance:
    type: OS::Nova::Server

outputs:
  instance_ip:
    description: IP address of the deployed compute instance
    value: { get_attr: [my_instance, first_address] }
  instance_private_ip:
    description: Private IP address of the deployed compute instance
    value: { get_attr: [my_instance, networks, private, 0] }
```

In this example, the `networks` attribute holds data such as the following.

```
{"public": ["2001:0db8:0000:0000:0000:ff00:0042:8329", "1.2.3.4"],
 "private": ["10.0.0.1"]}
```

In the above example, the "instance_private_ip" value in the `outputs` section is "10.0.0.1".

3.5.3 get_resource

The get_resource function references another resource defined in the same template. The return value is the resource ID defined for each resource type. For example, an IP address is returned for floating IP resources.

```
get_resource: <resource ID>
```

get_resource:

Element	Required	Description
<resource ID>	Yes	Specifies a resource ID defined in the *Resources Section*.

3.5.4 str_replace

The str_replace function replaces strings.

```
str_replace:
  template: <template string>
  params: <parameter mappings>
```

str_replace:

Element	Required	Description
template	Yes	Specifies the string that is the replacement source.
params	Yes	Specifies the mapping of the string for replacement. Other functions such as *get_attr* can be used.

Example specification of the str_replace function (1):

```
resources:
  my_instance:
    type: OS::Nova::Server

outputs:
  Login_URL:
    description: The URL to log into the deployed application
    value:
      str_replace:
        template: http://host/MyApplication
        params:
          host: { get_attr: [ my_instance, first_address ] }
```

In the above example, assuming the value returned by get_attr: [my_instance, first_address] is "10.0.0.1", the value of the output parameter "Login_URL" will be "http://10.0.0.1/MyApplication".

Example specification of the str_replace function (2):

```
parameters:
  DBRootPassword:
    type: string
    label: Database Password
    description: Root password for MySQL
    hidden: true

resources:
  my_instance:
    type: OS::Nova::Server
    properties:
      # general properties ...
      user_data:
        str_replace:
          template: |
            #!/bin/bash
            echo "Hello world"
            echo "Setting MySQL root password"
            mysqladmin -u root password $db_rootpassword
            # do more things ...
          params:
            $db_rootpassword: { get_param: DBRootPassword }
```

In the above example, in relation to user_data input for the compute resource, the str_replace function is used to replace the string "$db_rootpassword" with the value of the input parameter "DBRootPassword" of the template.

3.5.5 get_file

The get_file function references string data. For example, use this function when referencing content of scripts or configuration files in a non-Heat format.

```
get_file: <content key>
```

get_file:

Element	Required	Description
<content key>	Yes	Specifies a key for referencing string data. When executing from the REST API of Heat, the string data mapped in `files` of the request parameters is referenced. When executing from the CLI of Heat, external files are referenced by specifying the file URL or a relative path.

```
resources:
  my_instance:
    type: OS::Nova::Server
    properties:
      # general properties ...
      user_data:
        get_file: my_instance_user_data.sh
  my_other_instance:
    type: OS::Nova::Server
    properties:
      # general properties ...
      user_data:
        get_file: http://example.com/my_other_instance_user_data.sh
```

In the above example, when executing from the REST API, the string data mapped in `files` of the request parameters is referenced.

```
"files" : {
  "my_instance_user_data.sh" : "<file content>",   (*1)
  "http://example.com/my_other_instance_user_data.sh" : "<file content>"  (*1)
}
```

(1*)　To specify the escaped characters, use ‘\’ .　For example:　return →\n、 ” →\”

When executing from CLI, the following files are referenced:

- file://<current dir>/my_instance_user_data.sh
- http://example.com/my_other_instance_user_data.sh

3.5.6 resource_facade

The resource_facade function is used by the resource template. In the resource template, properties values can be retrieved. Use this function to retrieve other values.

```
resource_facade: <data type>
```

resource_facade:

Element	Required	Description
<data type>	Yes	Specifies the data type for retrieving values. - *metadata* - *deletion_policy*

Example definition of the parent template:

```
resources:
  my_server:
    type: my_actual_server.yaml
    metadata:
      key: value
      some: more stuff
```

Example definition of the resource template "my_actual_server.yaml":

```
resources:
  _actual_server_:
    type: OS::Nova::Server
    metadata: { resource_facade : metadata }
```

4 Resource type details

4.1 OpenStack resource types

4.1.1 Auto scaling

4.1.1.1 FCX::AutoScaling::AutoScalingGroup

4.1.1.1.1 Notes

- When an abnormal instance detected using the health check of Load Balancer is automatically recovered, and scaling by CPU load, etc., is used at the same time, the event for which the abnormal instance was detected may be recorded in the stack event during the scale-in operation. It is not necessary to address this as it is an event for an instance that is deleted by scaling in.
- Instances that have already been created cannot be incorporated into the AutoScalingGroup.

4.1.1.1.2 Properties

- **AvailabilityZones**

  Not Implemented.

  Specify an appropriate value to support future feature enhancements.

  Required property.

  Type: List

- **Cooldown**

  Cooldown period, in seconds.

  Set sufficient time (in seconds) for execution of scaling to be completed.

  The time of stack creation will be recorded as the initial scaling execution time.

  Alarms that occur during the standby time leading up to the next scale are discarded.

  When using scaling with multiple alarms, of the values obtained using the estimation formula described later in this document, set the largest value for this item.

  When abnormal instances detected using the health check of Load Balancer are automatically recovered, and scaling by CPU load, etc., is used at the same time, set this item only, and do not set Cooldown of FCX::AutoScaling::ScalingPolicy.

  The estimation formula is as follows, with the largest value obtained using this formula to be set.

  - When using scale-out:

    (Time required to create one instance x ScalingAdjustment value)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + OS::Ceilometer::Alarm period x OS::Ceilometer::Alarm evaluation_periods

    + Number of Grade(ELB VM) subnets x Number of Grades (ELB VM) x 10 (*1)

    + 60

  - When using scale-in:

    Time required to delete one instance x (ScalingAdjustment value x -1)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + OS::Ceilometer::Alarm period x OS::Ceilometer::Alarm evaluation_periods

    + Number of Grade(ELB VM) subnets x Number of Grades (ELB VM) x 10 (*1)

    + 60

  - When an abnormal instance detected using the health check of Load Balancer is automatically recovered

    (Time required to create one instance x ScalingAdjustment value)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + (Time required to delete one instance x 5)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + (Time required to create one instance x FCX::AutoScaling::MinSize value of AutoScalingGroup)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + OS::Ceilometer::Alarm period x OS::Ceilometer::Alarm evaluation_periods

    + Number of Grade(ELB VM) subnets x Number of Grades (ELB VM) x 10 (*1) x 3

    + 60

  "Number of Grade(ELB VM) subnets" is the number of subnets specified in Subnets in the properties of FCX::ExpandableLoadBalancer::LoadBalancer in the template.

  "Number of Grades (ELB VM)" is the number of instances registered under the name specified in LoadBalancerName of FCX::ExpandableLoadBalancer::LoadBalancer in the template when a stack is created.

  *1: This is rough estimate for times of low loads, so this will vary depending on communication performance.

  Optional property, defaults to 0.

  Type: Number

- **HealthCheckGracePeriod**

  The amount of time until LoadBalancer starts the health check, after an instance is created.

  Optional property, defaults to 0.

  Type: Integer

- **HealthCheckType**

  The type of health check.

  Only "ELB" is supported.

  Only Load Balancer "ELB" is supported.

  When LoadBalancerNames and this parameter are specified, abnormal instances detected using the health check of Load Balancer are automatically recovered.

  Optional property.

  Type: String

- **LaunchConfigurationName**

  The reference to a LaunchConfiguration resource.

  Required property.

  Type: String

- **LoadBalancerNames**

  List of LoadBalancer resources.

  Optional property.

  Type: List

- **MaxSize**

  Maximum number of instances in the group.

  When an abnormal instance detected using the health check of Load Balancer is automatically recovered, set a value of MinSize + 1 or higher.

  Required property.

  Type: Integer

- **MinSize**

  Minimum number of instances in the group.

  Required property.

  Type: Integer

- **Tags**

  Tags to attach to this group.

  Optional property.
  Type: List

  List contents:

    Optional property.
    Type: Map

    Map properties:

    - Key

      Required property.
      Type: String

    - Value

      Required property.
      Type: String

  Below is an example of specifying a password when the operating system is Windows.

  ```
  Tags: [ { Value: 'password', Key: 'admin_pass' } ]
  ```

- **VPCZoneIdentifier**

  To list the internal subnet to which the instance will be attached.
  When specified, set one or more subnets.
  When LoadBalancerNames and multiple subnets are specified for this parameter, the first subnet is targeted for distribution by Load Balancer.

  Optional property.
  Type: List

  List contents:

    UUID of the internal subnet to which the instance will be attached.

    Optional property.
    Type: String

4.1.1.1.3 Attributes

- **InstanceList**

  A comma-delimited list of server ip addresses. (Heat extension).

4.1.1.1.4 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: FCX::AutoScaling::AutoScalingGroup
    properties:
      AvailabilityZones: [Value, Value, ...]
      Cooldown: Number
      HealthCheckGracePeriod: Integer
      HealthCheckType: String
      LaunchConfigurationName: String
      LoadBalancerNames: [Value, Value, ...]
      MaxSize: Integer
      MinSize: Integer
      Tags: [{"Value": String, "Key": String}, {"Value": String, "Key": String}, ...]
      VPCZoneIdentifier: [String, String, ...]
```

4.1.1.2 FCX::AutoScaling::LaunchConfiguration

- Instance that will be created
- Notes
- Properties
- HOT Syntax

4.1.1.2.1 Instance that will be created

The format of the instance name to be created is as follows:

> "First 2 characters of the stack name" + "-" + "Last 11 characters of the resource name of the AutoScalingGroup" + "-" + "Random ID (12 characters)" + "-" + "Random ID (12 characters)" + "-" + "Random ID (12 characters)"
>
> Example: au-aling_group-knu4eeueo2c5-cyrtttd6lwbu-xsge7xcbkxum

The instance name is set as the host name with the hyphen (-) converted into an underscore (_).

4.1.1.2.2 Notes

- To enable access to a created instance from an external network, it is necessary to separately assign an IP address (floating IP address) for external connections to an instance after it is created using a stack.
- After an instance is created, loads will not be distributed to the new IP address even if the IP address of a distribution destination instance registered in Load Balancer is changed.
- When the properties are changed on updating a stack, the properties after the change are reflected to newly added instances or redeployed instances.

4.1.1.2.3 Properties

- **BlockDeviceMappingsV2**

  Block device mappings to attach to instance.

  Required property.

  Type: List

  List contents:

  Optional property.

  Type: Map

  Map properties:

  - source_type

    Describes the volume source type for the volume.

    Required property.

    Allowed values: image, volume, snapshot

    Type: String

  - destination_type

    Describes where the volume comes from.

    Required property.

    Allowed values: volume

    Type: String

  - boot_index

    Indicates a number designating the boot order of the device.

    Specifies continuous values from 0. For the boot disk, "0" is specified.

    Required property.

    Type: String

  - volume_size

    Size of the volume (GB).

    This item must be specified when "image" is specified for source_type. Specify a value equal to or higher than the min_disk parameter of the image to be used. If the min_disk parameter of the image to be used has not been specified or is "0", check the minimum size with the image provider and specify the value accordingly.

    If "volume" was specified for source_type, this item will not be enabled even if a value is specified, and the volume size will not change.

    If "snapshot" was specified for source_type, and this item is omitted, the volume size of the snapshot collection source will be used.

    Optional property.

    Type: String

  - uuid

    uuid of the resource specified for source_type.

    Required property.

    Type: String

  - delete_on_termination

    Indicate whether the volume should be deleted when the instance is terminated.

    When "True" is specified, the volume that was created during scale-out and stack creation will be deleted during scale-in and during stack deletion.

    When "False" is specified, the volume that was created during scale-out and stack creation will not be deleted during scale-in and during stack deletion. If you want to retain the volume content even after an instance is deleted, specify "False".

    The volume where snapshots are collected will not be deleted even if "True" is specified.

    Optional property, defaults to "True".

    Type: Boolean

  - device_name

    A device name where the volume will be attached in the system at /dev/device_name.e.g. vdb

    Specify this item in /dev/vdx format. /dev/vd is fixed, and for x, specify characters that are valid as a device name.

    When creating an instance that is allocated multiple volumes, for the boot volume, specify the character with highest priority among the device names of all volumes.

    The order of priority is a > b > c > ...

    Required property.

    Type: String

- **ImageId**

  Glance image ID or name.

  Optional property.

  Type: String

  Value must be of type glance.image

- **InstanceType**

  Nova instance type (flavor).

  Optional property.

  Type: String

  Value must be of type nova.flavor

- **KeyName**

  Optional Nova keypair name.

  Optional property.

  Type: String

  Value must be of type nova.keypair

- **NovaSchedulerHints**

  Scheduler hints to pass to Nova (Heat extension).

  When creating an instance with the server group uuid of "anti-affinity" specified, if there is no VM host where an instance can be created (the number of VM hosts that can be used is smaller than the number of instances belonging to the same server group), the instance status becomes ERROR after the instance creation request is received.

  Optional property.

  Type: List

  List contents:

    Optional property.

    Type: Map

    Map properties:

    - Key

      Required property.

      Type: String

    - Value

      Required property.

      Type: String

- **SecurityGroups**

  Security group names to assign.

  Optional property.

  Type: List

- **UserData**

  User data to pass to instance. Specifies the script. The supported format is mainly as shown below.

  - Linux:

    - Shell script (begins with #!)

  - Windows:

    - PowerShell (begins with #ps1_sysnative or #ps1_x86)

    - Windows batch (begins with rem cmd)

  Optional property.

  Type: String

  Below is an example in which the c:temp directory is created using PowerShell.

```
user_data: |
  #!ps1_sysnative
  New-Item "c:\\temp" -Type Directory
```

  Note: In case operating system is Linux, specified value with cloud-config format invalid.

4.1.1.2.4 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: FCX::AutoScaling::LaunchConfiguration
    properties:
      BlockDeviceMappingsV2: [{"source_type": String, "destination_type": String, "boot_index": String,
"device_name": String, "volume_size": String, "uuid": String, "delete_on_termination": Boolean}, ...]
      ImageId: String
      InstanceType: String
      KeyName: String
      NovaSchedulerHints: [{"Value": String, "Key": String}, {"Value": String, "Key": String}, ...]
      SecurityGroups: [Value, Value, ...]
      UserData: String
```

4.1.1.3 FCX::AutoScaling::ScalingPolicy

- Notes
- Properties
- Attributes
- HOT Syntax

4.1.1.3.1 Notes

Nothing in particular

4.1.1.3.2 Properties

- **AdjustmentType**

  Type of adjustment (absolute or percentage).

  Required property.

  Allowed values: ChangeInCapacity, ExactCapacity, PercentChangeInCapacity

- **AutoScalingGroupName**

  AutoScaling group name to apply policy to.

  Required property.

  Type: String

- **Cooldown**

  Cooldown period, in seconds.

  Set sufficient time (in seconds) for execution of scaling to be completed.

  Alarms that occur during the standby time leading up to the next scale are discarded.

  When abnormal instances detected using the health check of Load Balancer are automatically recovered, and scaling by CPU load, etc., is used at the same time, only set Cooldown of FCX::AutoScaling::AutoScalingGroup, and do not specify this item.

  The estimation formula is shown below.

  - When using scale-out:

    (Time required to create one instance x ScalingAdjustment value)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + OS::Ceilometer::Alarm period x OS::Ceilometer::Alarm evaluation_periods

    + Number of Grade(ELB VM) subnets x Number of Grades (ELB VM) x 10 (*1)

    + 60

  - When using scale-in:

    Time required to delete one instance x (ScalingAdjustment value x -1)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + OS::Ceilometer::Alarm period x OS::Ceilometer::Alarm evaluation_periods

    + Number of Grade(ELB VM) subnets x Number of Grades (ELB VM) x 10 (*1)

    + 60

  - When an abnormal instance is automatically recovered using the health check of the Load Balancer

    (Time required to create one instance x ScalingAdjustment value)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + (Time required to delete one instance x 5)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + (Time required to create one instance x FCX::AutoScaling::MinSize value of AutoScalingGroup)

    + FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup

    + OS::Ceilometer::Alarm period x OS::Ceilometer::Alarm evaluation_periods

    + Number of Grade(ELB VM) subnets x Number of Grades (ELB VM) x 10 (*1) x 3

    + 60

  "Number of Grade(ELB VM) subnets" is the number of subnets specified in Subnets in the properties of FCX::ExpandableLoadBalancer::LoadBalancer in the template.

  "Number of Grades (ELB VM)" is the number of instances registered under the name specified in LoadBalancerName of FCX::ExpandableLoadBalancer::LoadBalancer in the template when a stack is created.

  *1: This is rough estimate for times of low loads, so this will vary depending on communication performance.

  Optional property, defaults to 0.

  Type: Number

- **ScalingAdjustment**

  Size of adjustment.

  Notes when automatic recovery of abnormal instances detected by the health check of Load Balancer is used:

  - If 0 is specified, nothing will happen.

  - Specify a value smaller than MaxSize of FCX::AutoScaling::AutoScalingGroup, and in the range of 1 to 5.

  Required property.

  Type: Number

4.1.1.3.3 Attributes

- **AlarmUrl**

  A signed url to handle the alarm. (Heat extension).

4.1.1.3.4 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: FCX::AutoScaling::ScalingPolicy
    properties:
      AdjustmentType: String
      AutoScalingGroupName: String
      Cooldown: Number
      ScalingAdjustment: Number
```

4.1.2 Block storage

4.1.2.1 OS::Cinder::Volume

4.1.2.1.1 Notes

Nothing in particular

4.1.2.1.2 Properties

- **availability_zone**

  The availability zone in which the volume will be created.

  Optional property.

  Type: String

- **backup_id**

  If specified, the backup to create the volume from.

  Optional property.

  Type: String

- **description**

  A description of the volume.

  This value will not be set when backup_id is specified.

  Optional property.

  Type: String

- **image**

  If specified, the name or ID of the image to create the volume from.

  Optional property.

  Value must be of type glance.image

- **metadata**

  Key/value pairs to associate with the volume.

  This value will not be set when backup_id is specified.

  Optional property.

  Type: Map

- **name**

  A name used to distinguish the volume.

  When backup_id is specified, the value that is set will differ depending on the setting value of the volume from which the backup was collected.

  - The volume from which the backup was collected does not have a setting value

    This setting value will be set.

  - The volume from which the backup was collected has a setting value

    The value of the volume from which the backup was collected will be set.

  Optional property

  Type: String

- **size**

  The size of the volume in GB. On update only increase in size is supported.

  Optional property.

  Type: Integer

  The value must be at least 1.

- **snapshot_id**

  If specified, the snapshot to create the volume from.

  Optional property.

  Type: String

  Value must be of type cinder.snapshot

- **source_volid**

  If specified, the volume to use as source.

  Optional property.
  Type: String
  Value must be of type cinder.volume

- **imageRef**

  Note: DEPRECATED! - Use property image.

  The ID of the image to create the volume from.

  Optional property.
  Type: String

- **volume_type**

  If specified, the type of volume to use, mapping to a specific backend.
  This value will not be set when backup_id is specified.

  Optional property.
  Type: String

4.1.2.1.3 Attributes

- **availability_zone**

  The availability zone in which the volume is located.

- **bootable**

  Boolean indicating if the volume can be booted or not.

- **created_at**

  The timestamp indicating volume creation.

- **display_description**

  Description of the volume.

- **display_name**

  Name of the volume.

- **metadata**

  Key/value pairs associated with the volume.

- **size**

  The size of the volume in GB.

- **snapshot_id**

  The snapshot the volume was created from, if any.

- **source_volid**

  The volume used as source, if any.

- **status**

  The current status of the volume.

- **volume_type**

  The type of the volume mapping to a backend, if any.

4.1.2.1.4 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: OS::Cinder::Volume
    properties:
      availability_zone: String
      backup_id: String
      description: String
      image: String
      metadata: {...}
      name: String
      size: Integer
      snapshot_id: String
      source_volid: String
      volume_type: String
```

4.1.2.2 OS::Cinder::VolumeAttachment

- Notes
- Properties
- HOT Syntax

4.1.2.2.1 Notes

Nothing in particular

4.1.2.2.2 Properties

- **instance_uuid**

  The ID of the server to which the volume attaches.

  Required property.

  Type: String

- **mountpoint**

  The location where the volume is exposed on the instance. This assignment may not be honored and it is advised that the path /dev/disk/by-id/virtio-<VolumeId> be used instead.

  Optional property.

  Type: String

- **volume_id**

  The ID of the volume to be attached.

  Required property.
  Type: String
  Value must be of type cinder.volume

4.1.2.2.3 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: OS::Cinder::VolumeAttachment
    properties:
      instance_uuid: String
      mountpoint: String
      volume_id: String
```

4.1.3 Compute

4.1.3.1 OS::Nova::Server

4.1.3.1.1 Notes

Nothing in particular

4.1.3.1.2 Properties

- **availability_zone**

  Name of the availability zone for server placement.

  Optional property.
  Type: String

- **block_device_mapping**

  Block device mappings for this server.

  Required property.
  Type: List

  List contents:

    Optional property.
    Type: Map

    Map properties:

- **delete_on_termination**

  Indicate whether the volume should be deleted when the server is terminated.

  Specifies whether the volume that was created during scale-out and stack creation will be deleted during scale-in and during stack deletion.

  When "True" is specified, the volume that was created during scale-out and stack creation will be deleted during scale-in and during stack deletion.

  When "False" is specified, the volume that was created during scale-out and stack creation will not be deleted during scale-in and during stack deletion.

  If not specified, "False (do not delete)" will be used.

  The volume where snapshots are collected will not be deleted even if "True" is specified.

  Optional property.

  Type: Boolean

- **device_name**

  A device name where the volume will be attached in the system at /dev/device_name. This value is typically vda.

  Specify this item in /dev/vdx format. /dev/vd is fixed, and for x, specify characters that are valid as a device name.

  When creating an instance that is allocated multiple volumes, for the boot volume, specify the character with highest priority among the device names of all volumes.

  The order of priority is a > b > c > ...

  If vda is specified without an image being specified, only vda will be specified and "/dev/" will not be appended.

  Required property.

  Type: String

- **snapshot_id**

  The ID of the snapshot to create a volume from.

  If volume_id is not specified, this item must be specified.

  Optional property.

  Type: String

  Value must be of type cinder.snapshot

- **volume_id**

  The ID of the volume to boot from. Only one of volume_id or snapshot_id should be provided.

  If snapshot_id is not specified, this item must be specified.

  Optional property.

  Type: String

  Value must be of type cinder.volume

- **volume_size**

  The size of the volume, in GB. It is safe to leave this blank and have the compute service infer the size.

  - If volume_id is specified and delete on termination is set to "True":

    This setting is mandatory. However, the specified volume size is ignored, and there is no change to the volume size specified for volume_id.

  - If volume_id is specified and delete on termination is not specified, or set to "False":

    This must not be specified. If specified, the specified volume size is ignored, and there is no change to the volume size specified for volume_id.

  - If snapshot_id is specified and delete on termination is set to "True":

    This setting is mandatory.

  - If snapshot_id is specified and delete on termination is not specified, or set to "False":

    This item is optional. If this item is omitted, the volume size of the snapshot collection source will be used.

  Optional property.

  Type: Integer

- **config_drive**

  If True, enable config drive on the server.

  Optional property.

  Type: String

- **diskConfig**

  Control how the disk is partitioned when the server is created.

  Optional property.

  Allowed values: AUTO, MANUAL

- **flavor**

  The ID or name of the flavor to boot onto.

  Required property.

  Type: String

  Value must be of type nova.flavor

- **image**

  The ID or name of the image to boot with.

  Optional property.

  Type: String

  Value must be of type glance.image

- **key_name**

  Name of keypair to inject into the server.

  Optional property.

  Type: String

  Value must be of type nova.keypair

- **metadata**

  Arbitrary key/value metadata to store for this server. Both keys and values must be 255 characters or less. Non-string values will be serialized to JSON (and the serialized string must be 255 characters or less).

  Optional property.

  Type: Map

  Below is an example of specifying a password when the operating system is Windows.

  The specified password is set for users specified in cloudbase-init.

  ```
  metadata: { "admin_pass": 'password' } }
  ```

- **name**

  Server name.

  Specify the value using up to 63 characters. Up to 255 characters can be specified, however, if the name is 64 characters or longer, the host name/computer name set for an instance will be as follows.

  - Linux:

    The host name will be "host-*fixedIpAddressOfEth0*".

  - Windows:

    The computer name is the default name set by Windows.

  The string set for the host name/computer name is changed as follows and set.

  - Spaces ( ) and underscores (_) are replaced with a hyphen (-).

  - Uppercase alphabets are replaced with lowercase alphabets.

  - Symbols other than periods (.) and hyphens (-) are removed.

  - Periods (.) are removed from the beginning and end of the string if any, and a string consisting of hyphens (-) is removed.

  Furthermore, if the operating system is Windows:

  - If the string contains a period (.) other than at the beginning or end, the characters preceding the period will be used for the name.

  Optional property.

  Type: String

- **networks**

  An ordered list of nics to be added to this server, with information about connected networks, fixed ips, port etc.

  Optional property.

  Type: List

  List contents:

  Optional property.

  Type: Map

  Map properties:

  - fixed_ip

    Fixed IP address to specify for the port created on the requested network.

    Optional property.

    Type: String

  - network

    Name or ID of network to create a port on.

    Optional property.

    Type: String

    Value must be of type neutron.network

  - port

    ID of an existing port to associate with this server.

    Optional property.

    Type: String

  - uuid

    Note: DEPRECATED! - Use property network.

    ID of network to create a port on.

    Optional property.

    Type: String

    Value must be of type neutron.network

- **scheduler_hints**

  Arbitrary key-value pairs specified by the client to help boot a server.

  When creating an instance with the server group uuid of "anti-affinity" specified, if there is no VM host where an instance can be created (the number of VM hosts that can be used is smaller than the number of instances belonging to the same server group), the instance status becomes ERROR after the instance creation request is received.

Optional property.

Type: Map

- **security_groups**

  List of security group names or IDs. Cannot be used if neutron ports are associated with this server; assign security groups to the ports instead.

  Optional property, defaults to "[]".

  Type: List

- **user_data**

  User data script to be executed by cloud-init.

  Specifies the script. The supported format is mainly as shown below.

  - Linux:

    - Shell script (begins with #!)

  - Windows:

    - PowerShell (begins with #ps1_sysnative or #ps1_x86)

    - Windows batch (begins with rem cmd)

  Optional property, defaults to "".

  Type: String

  > **Note:**
  >
  > If the operating system is Linux, the cloud-config format can be specified apart from scripts, however, it is recommended that scripts be specified.

- **user_data_format**

  Specify "RAW".

  Optional property, defaults to "HEAT_CFNTOOLS".

  Type: String

  > **Note:**
  >
  > Only "RAW" is supported.
  >
  > - RAW: The specified user_data is passed as is to Nova.

- **admin_user**

  > **Note:** DEPRECATED!

  Name of the administrative user to use on the server. This property will be removed from Juno in favor of the default cloud-init user set up for each image (e.g. "ubuntu" for Ubuntu 12.04+, "fedora" for Fedora 19+ and "cloud-user" for CentOS/RHEL 6.5).

  Optional property.

  Type: String

4.1.3.1.3 Attributes

- **accessIPv4**

  The manually assigned alternative public IPv4 address of the server.

- **accessIPv6**

  The manually assigned alternative public IPv6 address of the server.

- **addresses**

  A dict of all network addresses with corresponding port_id. The port ID may be obtained through the following expression: "{get_attr: [<server>, addresses, <network name>, 0, port]}".

  ```
  {get_attr: [<server>, addresses, <network name>, 0, port]}
  ```

- **first_address**

  Note: DEPRECATED! - Use the networks attribute instead of first_address. For example: "{get_attr: [<server name>, networks, <network name>, 0]}"

  Convenience attribute to fetch the first assigned network address, or an empty string if nothing has been assigned at this time. Result may not be predictable if the server has addresses from more than one network.

- **instance_name**

  AWS compatible instance name.

- **networks**

  A dict of assigned network addresses of the form: {"public": [ip1, ip2...], "private": [ip3, ip4]}.

- **show**

  A dict of all server details as returned by the API.

4.1.3.1.4 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: OS::Nova::Server
    properties:
      availability_zone: String
      block_device_mapping: [{"volume_size": Integer, "volume_id": String, "snapshot_id": String, "delete_on_termination": Boolean, "device_name": String}, {"volume_size": Integer, "volume_id": String, "snapshot_id": String, "delete_on_termination": Boolean, "device_name": String}, ...]
      config_drive: Boolean
      diskConfig: String
      flavor: String
      flavor_update_policy: String
      image: String
      image_update_policy: String
      key_name: String
      metadata: {...}
      name: String
      networks: [{"port": String, "fixed_ip": String, "uuid": String, "network": String}, {"port": String, "fixed_ip": String, "uuid": String, "network": String}, ...]
      personality: {...}
      reservation_id: String
      scheduler_hints: {...}
      security_groups: [Value, Value, ...]
      software_config_transport: String
      user_data: String
      user_data_format: String
```

4.1.3.2 OS::Nova::ServerGroup

- Notes
- Properties
- HOT Syntax

4.1.3.2.1 Notes

- When creating an instance with the server group uuid of "anti-affinity" specified, if there is no VM host where an instance can be created (the number of VM hosts that can be used is smaller than the number of instances belonging to the same server group), the instance status becomes ERROR after the instance creation request is received.

4.1.3.2.2 Properties

- **name**

  Server Group name.

  Optional property.

  Type: String

- **policies**

  A list of string policies to apply. Defaults to anti-affinity.

  Optional property, defaults to "['anti-affinity']".
  Allowed values: anti-affinity, affinity
  List contents:

  - *

    Type: String

- **availability_zone**

  Name of the availability zone for server group placement.

  Optional property.
  Type: String

4.1.3.2.3 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: OS::Nova::ServerGroup
    properties:
      name: String
      policies: [String, String, ...]
      availability_zone: String
```

4.1.4 Telemetry

4.1.4.1 OS::Ceilometer::Alarm

4.1.4.1.1 Notes

Nothing in particular

4.1.4.1.2 Properties

- **alarm_actions**

  A list of URLs (webhooks) to invoke when state transitions to alarm.

  Optional property.
  Type: List

- **comparison_operator**

  Operator used to compare specified statistic with threshold.

  Optional property.
  Allowed values: ge, gt, eq, ne, lt, le
  Type: String

- **description**

  Description for the alarm.

  Optional property.

  Type: String

- **enabled**

  True if alarm evaluation/actioning is enabled.

  Optional property, defaults to "true".

  Type: Boolean

- **evaluation_periods**

  Number of periods to evaluate over.

  Optional property, defaults to 1.

  Type: Integer

- **insufficient_data_actions**

  A list of URLs (webhooks) to invoke when state transitions to insufficient-data.

  Optional property.

  Type: List

- **matching_metadata**

  Meter should match this resource metadata (key=value) additionally to the meter_name.

  When monitoring the CPU usage rate of instances in the AutoScalingGroup, metadata.user_metadata.groupname is specified as the key, and the AutoScalingGroup resource is specified for the value.

  When this item is used for automatic recovery of an abnormal instance detected using the health check of Load Balancer, resource_id is specified as the key, and the name of Load Balancer is specified for the value.

  Optional property, defaults to "{}".

  Type: Map

- **meter_name**

  Meter name watched by the alarm.

  When monitoring the CPU usage rate of an instance, fcx.compute.cpu_util is specified.

  When this item is used for automatic recovery of an abnormal instance detected using the health check of Load Balancer, fcx.loadbalancing.instance.unhealthy is specified.

  Required property.

  Type: String

- **ok_actions**

  A list of URLs (webhooks) to invoke when state transitions to ok.

  Optional property

  Type: List

- **period**

  Period (seconds) to evaluate over.

  Optional property, defaults to 60.

  Type: Integer

- **repeat_actions**

  False to trigger actions when the threshold is reached AND the alarm's state has changed. By default, actions are called each time the threshold is reached.

  Alarms that occur during the cooldown period leading up to the next scale are discarded, so it may not be possible to recover from events that have occurred.

  Specify "true" to periodically issue an alarm until recovery of the event(s) in question.

  When this item is used for automatic recovery of an abnormal instance detected using the health check of Load Balancer, "true" is specified.

  Optional property, defaults to "false".

  Type: Boolean

- **statistic**

  Meter statistic to evaluate.

  When this item is used for automatic recovery of an abnormal instance detected using the health check of Load Balancer, "min" is specified.

  Optional property.

  Allowed values: count, avg, sum, min, max

  Type: String

- **threshold**

  Threshold to evaluate against.

  Notes when automatic recovery of abnormal instances detected by the health check of Load Balancer is used:

  - Specify the same value as the ScalingAdjustment value specified in the policy settings.

  - When a value of 2 or higher has been set, automatic recovery will not take place until at least that number of instances are in an error state.

  Required property.

  Type: Number

4.1.4.1.3 HOT syntax

```
heat_template_version: 2013-05-23
...
resources:
  ...
  the_resource:
    type: OS::Ceilometer::Alarm
    properties:
      alarm_actions: [Value, Value, ...]
      comparison_operator: String
      description: String
      enabled: Boolean
      evaluation_periods: Integer
      insufficient_data_actions: [Value, Value, ...]
      matching_metadata: {...}
      meter_name: String
      ok_actions: [Value, Value, ...]
      period: Integer
      repeat_actions: Boolean
      statistic: String
      threshold: Number
```

4.1.5 DBaaS

4.1.5.1 Template format

The format of the Database template is as follows.

```
heat_template_version: 2013-05-23
description: dbaas plugin test

resources:
  Test_db_instance:
    type: FCX::Database::DBInstance
    properties:
      name: String
      flavor: String
      size: Integer,
      disk_type: String
      id: String
      availability_zone: String
      subnet_group_id: String
      multi_az: Boolean
      port: Integer
      preferred_backup_window: String
      preferred_maintenance_window: String
      publicly_accessible: Boolean
      security_group_ids: [ Value, Value...]
      parameter_group_id: String
      backup_retention_period: Integer
      auto_minor_version_upgrade: Boolean
      engine: String
      engine_version: String
      masteruser_password: String
      character_set: String
      collate: String
      databases: [{"name": String},...]
      users: [{"name": String, "password": String, databases: [Value,
Value,...]},...]

  Test_db_subnetgroup:
    type: FCX::Database::DBSubnetGroup
    properties:
      id: String
      name: String
      subnet_ids: [{"subnet_id":String}, {"subnet_id": String},...]
      description: String

  Test_db_parametergroup:
    type: FCX::Database::DBParameterGroup
    properties:
      id: String
      name: String
      parameter_group_family: String
      description: String
```

4.1.5.2 FCX::Database::DBInstance

This section describes the parameters that can be specified for creating DB instances.

4.1.5.2.1 Description of properties parameters

4.1.5.2.1.1 Basic parameters

- Parameter list

Parameter	*Description*	*Type*	*Mandatory*	*Constraints/default value*	*Remarks*
flavor	*List ID of the predefined hardware resource*	String	Y		Specifies the flavor ID. The flavor ID can be retrieved by using the get flavor list (GET /v1.0/{tenantId}/flavors) and get flavor information (GET /v1.0/{tenantId}/flavors/{flavorId}) APIs
size	*Size of the data volume*	Integer	Y	10-10240	
disk_type		String		L1 | M1 | F1	
availability_zone	*Availability zone where the instance is created*	String	Y		
subnet_group_id	*Subnet group where the DB instance will be deployed to*	String	Y	*Only subnets with DHCP ON can be specified	It is necessary to have a set of subnets that include at least two availability zones The specifiable values can be retrieved using the get DB subnet group list API (GET /v1.0/{tenantId}/subnetgroups)
publicly_accessible	*Whether an Internet connection is possible during deployment of the DB instance*	Boolean		true | false Default value: true	*true: External Internet connections are permitted If True is specified, the subnet specified in subnet_group_id must be connected to ext-net false: Access from within VPC only
security_group_ids.	*ID list of the VPC security group*	List (String list)		List of the VPC security group default security group	*Specify the VPC security group. The specifiable values can be retrieved by executing the Networking service API
multi_az	*Multi availability zone option*	Boolean		true | false Default value: true	
id	*ID of the DB instance*	String		Default : random value	
name	*Name of the DB instance*	String		Default : Random value	

Parameter	*Description*	*Type*	*Mandatory*	*Constraints/default value*	*Remarks*
backup_retention_period	*Backup retention period (in days)*	Integer		0 to 10 Default: 0	*Automatic backup will not be performed when the value is 0.
preferred_backup_window	*Backup time slot*	String		Format: hh24:mi-hh24:mi Default: A random thirty-minute-period within the ten-hour-period prescribed for each region	*If automatic backups are enabled, specify the timeslot when the daily backups are to be performed *It is necessary to specify a time slot of thirty minutes or more o Eastern Japan Region 1 (jp-east-1): 17:00-03:00 UTC o Western Japan Region 1 (jp-west-1): 17:00-03:00 UTC o UK Region 1 (uk-1): 17:00-03:00 UTC *Specify times in UTC format *You cannot specify a timeslot that overlaps the preferred maintenance window *Backups may take longer than thirty minutes, depending on the backup conditions
preferred_maintenance_window	*Maintenance time slot*	String		Format: ddd:hh24:mi-ddd:hh24:mi Default: A random thirty-minute period within the ten-hour period prescribed for each region (the day of the week is also determined randomly)	*Specify the timeslot when weekly maintenance is to be performed. *It is necessary to specify a timeslot from thirty minutes to twenty-three hours and 30 minutes A thirty-minute period within the ten-hour period prescribed for each region will be randomly determined (the day of the week is also determined randomly) Example: Sun:0500 - Sun:06:00 Day value: Mon, Tue, Wed, Thu, Fri, Sat, Sun
auto_minor_version_upgrade	*Automatic minor version upgrade*	Boolean		Default: true	True: Perform automatic minor version upgrade
port	*Port number*	Integer		1024 to 32767 Default value: 26500	

Parameter	***Description***	***Type***	***Mandatory***	***Constraints/default value***	***Remarks***
masteruser_name	*Administrator user name*	String		Default : postgres - Up to 63 alphanumeric characters can be used - The first character must be an alphabetic character or an underscore	
masteruser_password	*Administrator password*	String	Y	Up to 1024 characters	
character_set	*Character encoding*	String		Default: UTF8	The specifiable values can be retrieved using get DB engine information (GET /v1.0/{tenantId}/engineversion)
collate	*Collating sequence*	String		Default: C	The specifiable values can be retrieved using get DB engine information (GET /v1.0/{tenantId}/engineversion)
parameter_group_id	*Name of the DB parameter group*	String		DB parameter group ID Default: default parameter group	The specifiable values can be retrieved using get DB parameter group list (GET /v1.0/{tenantId}/parametergroups)
engine	*Name of the DB engine*	String		symfoware Default: symfoware	In the future, this will depend on whether DB types are increased
engine_version	*DB version*	String		Default: Latest version	The specifiable values can be retrieved using get DB engine information (GET /v1.0/{tenantId}/engineversion)
databases	*List of the DB structure*	Map (Database structure)			
users	*List of the user structure*	Map (User structure)			

4.1.5.2.1.2 Database parameters

Parameter	**Description**	**Type**	**Mandatory**	**Value**	**Remarks**
name	DB name	String	Y	*DB identifier* *- Up to 63 alphanumeric characters can be used* *- The first character must be an alphabetic character or an underscore*	

User structures

Parameter	Description	Type	Mandatory	Value	Remarks
name	DB user name	String	Y	- Up to 63 alphanumeric characters can be used - The first character must be an alphabetic character or an underscore	
password	Password	String	Y	Up to 1024 characters	
databases	Databases that this user can log in to	List (String list)	Y		

4.1.5.2.2 Description of the attributes parameter

Attributes is data as of the execution time that can be disclosed to other resources in a stack.

The attributes that can be retrieved using the DBaaS plug-in are as follows.

Name	Description
PUBLICADDRESS	External address of a Database instance (FQDN)
PRIVATEADDRESS	Internal address of a Database instance (FQDN)
PRIVATEIP	Internal IP address of a Database instance
PUBLICIP	External IP address of a Database instance
SUBPRIVATEIP	Internal IP address of a Standby Database instance
SUBPUBLICIP	External IP address of a Standby Database instance

4.1.5.3 FCX::Database::DBSubnetGroup

4.1.5.3.1 Description of properties parameters

4.1.5.3.1.1 Basic parameters

- Parameter list

Parameter	Description	Type	Mandatory	Constraints/default value	Remarks
id	ID of DB subnet group	String			
name	Name of DB subnet group	String	Y	Default: random value	
subnetIds	List of subnets	String	Y		
description	Description of DB subnet group	String		Default: None	

SubnetId

Parameter	Description	Type	Mandatory	Value	Remarks
subnetId	ID of subnet	String	Y		

4.1.5.4 FCX::Database::DBParameterGroup

4.1.5.4.1 Description of properties parameters

4.1.5.4.1.1 Basic parameters

- Parameter list

Parameter	Description	Type	Mandatory	Constraints/default value	Remarks
parameterGroupFamily	Type of parameter group, determined by the DB engine and version	String	Y	symfoware_v12.1	
id	ID of the DB parameter group	String		Default: random value	
parameterGroupName	Name of the DB parameter group	String	Y		
description	Description of the DB parameter group	String		Default: None	

5 Example templates

5.1 VM creation Heat template example

- hello_world.yaml

The following is an example template that defines a single volume and a single server.

```
#
# This is a hello world HOT template just defining a single compute
# server.
#
heat_template_version: 2013-05-23

description: >
  Hello world HOT template that just defines a single server.
  Contains just base features to verify base HOT support.

parameters:
  key_name:
    type: string
    description: Name of an existing key pair to use for the server
    default: (Any key pair name)
  flavor:
    type: string
    description: Flavor for the server to be created
    default: (Select from the following flavors: "S-1", "S-2", "S-4",
"S-8", "S-16".)
  image:
    type: string
    description: Image ID or image name to use for the server
    default: 839c1db6-738c-4e2b-9a1d-c14977564203
  db_port:
    type: number
    description: Database port number
    default: 5432
    constraints:
      - range: { min: 5000, max: 60000 }
        description: Port number must be between 5000 and 60000
  az:
    type: string
    description: availability zone
    default: jp-east-1b
  network:
    type: string
    description: network uuid
    default: (Any network ID)
  vm_name:
    type: string
    description: name of vm
    default: (Any virtual machine name)
  sg_name:
    type: string
    description: security group
    default: (Any security group ID)


resources:
  sys-vol:
    type: OS::Cinder::Volume
    properties:
      name: "sys-vol"
      size: 30
      volume_type: "M1"
      availability_zone: { get_param: az }
      image : { get_param: image }

  server:
    type: OS::Nova::Server
    properties:
      key_name: { get_param: key_name }
      image: { get_param: image }
      flavor: { get_param: flavor }
      networks: ["uuid": {get_param: network} ]
      user_data_format: RAW
      user_data:
        str_replace:
          template: |
            #!/bin/bash
            adduser sample-user
            echo db_port
          params:
            db_port: {get_param: db_port }
      name: { get_param: vm_name }
      security_groups: [{get_param: sg_name }]

outputs:
  server_networks:
    description: The networks of the deployed server
    value: { get_attr: [server, networks] }
```

5.2 Example Heat template created in VM (Windows)

- hello_world_windows.yaml

The following is an example template that defines a single volume and a single server (Windows).

```
#
# This is a hello world HOT template just defining a single compute
# server.
#
heat_template_version: 2013-05-23

description: >
  Hello world HOT template that just defines a single server.
  Changing hostname by ps1 script.

parameters:
  az:
    type: string
    description: availability zone
    default: jp-east-1b
  param_image_id:
    type: string
    default: 5ab16551-c229-4611-834b-a16e074c187e
  param_flavor:
    type: string
    default: (Select from the following flavors: "S-1", "S-2", "S-4",
"S-8", "S-16".)
  network:
    type: string
    description: network uuid
    default: (Any network ID)
  vm_name:
    type: string
    default: (Any virtual machine name)
  security_group_name:
    type: comma_delimited_list
    default: (Any security group name)
  admin_password:
    type: string
    default: (Any password (*1)
                *1: Specify a password that satisfies the complexity
requirements of Windows.


resources:
  sys-vol:
    type: OS::Cinder::Volume
    properties:
      name: "sys-vol"
      size: 80
      volume_type: "M1"
      availability_zone: { get_param: az }
      image : { get_param: param_image_id }

  server:
    type: OS::Nova::Server
    properties:
      image: { get_param: param_image_id }
      flavor: { get_param: param_flavor }
      security_groups: {get_param: security_group_name}
      block_device_mapping: [{"volume_size": "80", "volume_id":
{get_resource: sys-vol}, "delete_on_termination": True, "device_name":
"/dev/vda"}]
      networks: ["uuid": {get_param: network} ]
      name: { get_param: vm_name }
      metadata: { "admin_pass": { get_param: admin_password }}
      user_data: |
        #ps1
        New-Item "c:\\test" -itemType Directory
        Rename-Computer -Force -NewName win2012r2v02 -Restart

outputs:
  server_networks:
    description: The networks of the deployed server
    value: { get_attr: [server, networks] }
```

5.3 Example AutoScale Heat template

- autoscaling.yaml

The following is an example template for AutoScale.

```
heat_template_version: 2013-05-23

description:
  Autoscaling test HOT.

parameters:

  az:
    type: string
    default: jp-east-1b

  param-image-id:
    type: string
    default: 839c1db6-738c-4e2b-9a1d-c14977564203

  param-flavor:
    type: string
    default: (Select from the following flavors: "S-1", "S-2", "S-4",
"S-8", "S-16".)

  key-name:
    type: string
    description: SSH key to connect to the servers
    default: (Any key pair name)

  autoscale-security-group:
    type: comma_delimited_list
    default: (Any security group name)

  subnet-id:
    type: string
    description: subnet id
    default: (Any subnet ID)

resources:

  web-server-group:
    type: FCX::AutoScaling::AutoScalingGroup
    properties:
      AvailabilityZones: [{get_param: az}]
      LaunchConfigurationName: {get_resource: launch_config}
      MinSize: '2'
      MaxSize: '3'
      VPCZoneIdentifier: [{get_param: subnet-id}]
      LoadBalancerNames:
      - {get_resource: fj-elb}

  launch_config:
    type: FCX::AutoScaling::LaunchConfiguration
    properties:
      ImageId: { get_param: param-image-id }
      InstanceType: { get_param: param-flavor }
      KeyName: {get_param: key-name}
      SecurityGroups: {get_param: autoscale-security-group}
      BlockDeviceMappingsV2: [{source_type: 'image', destination_type: 
'volume', boot_index: '0', device_name: '/dev/vda', volume_size: '30', 
uuid: {get_param: param-image-id}, delete_on_termination: true}]

  fj-elb:
    type: FCX::ExpandableLoadBalancer::LoadBalancer
    properties:
      Subnets: [{get_param: subnet-id}]
      Listeners:
      - {LoadBalancerPort: '80', InstancePort: '80',
        Protocol: 'HTTP', InstanceProtocol: 'HTTP' }
      HealthCheck: {Target: 'HTTP:80/healthcheck', HealthyThreshold: 
'3',
                UnhealthyThreshold: '5', Interval: '30', Timeout: '5'}
      Version: 2014-09-30
      Scheme: internal
      LoadBalancerName: (Any Load Balancer name)

  web_server_scaleup_policy:
    type: FCX::AutoScaling::ScalingPolicy
    properties:
      AdjustmentType: ChangeInCapacity
      AutoScalingGroupName: {get_resource: web-server-group}
      Cooldown: '60'
      ScalingAdjustment: '1'

  web_server_scaledown_policy:
    type: FCX::AutoScaling::ScalingPolicy
    properties:
      AdjustmentType: ChangeInCapacity
      AutoScalingGroupName: {get_resource: web-server-group}
      Cooldown: '60'
      ScalingAdjustment: '-1'

  cpu_alarm_high:
    type: OS::Ceilometer::Alarm
    properties:
      description: Scale-up if the average CPU > 50% for 1 minute
      meter_name: fcx.compute.cpu_util
      statistic: avg
      period: '60'
      evaluation_periods: '1'
      threshold: '50'
      alarm_actions:
      - {get_attr: [web_server_scaleup_policy, AlarmUrl]}
      matching_metadata: {'metadata.user_metadata.groupname': 
{get_resource: 'web-server-group'}}
      comparison_operator: gt

  cpu_alarm_low:
    type: OS::Ceilometer::Alarm
    properties:
      description: Scale-down if the average CPU < 15% for 1 minute
      meter_name: fcx.compute.cpu_util
      statistic: avg
      period: '60'
      evaluation_periods: '1'
      threshold: '15'
      alarm_actions:
      - {get_attr: [web_server_scaledown_policy, AlarmUrl]}
      matching_metadata: {'metadata.user_metadata.groupname':
{get_resource: 'web-server-group'}}
      comparison_operator: lt
```

5.4 Example AutoScale Heat template (Windows)

- autoscaling_windows.yaml

The following is an example template for AutoScale (Windows).

```
heat_template_version: 2013-05-23

description:
  Autoscaling Windows

parameters:

  az:
    type: string
    default: jp-east-1a
  param_image_id:
    type: string
    default: 5ab16551-c229-4611-834b-a16e074c187e
  param_flavor:
    type: string
    default: (Select from the following flavors: "S-1", "S-2", "S-4",
"S-8", "S-16".)
  autoscale_security_group_name:
    type: comma_delimited_list
    default: (Any security group name)
  autoscale_security_group_id:
    type: comma_delimited_list
    default: (Any security group ID)
  autoscale_subnet_id:
    type: comma_delimited_list
    default: (Any subnet ID)
  autoscale_elb_name:
    type: string
    default: m0918WinELB1

resources:

  AutoScaleWindows:
    type: FCX::AutoScaling::AutoScalingGroup
    properties:
      AvailabilityZones: [{get_param: az}]
      LaunchConfigurationName: {get_resource: launch_config}
      MinSize: '1'
      MaxSize: '3'
      VPCZoneIdentifier: {get_param: autoscale_subnet_id}
      HealthCheckGracePeriod: '110'
      HealthCheckType: 'ELB'
      Cooldown: 750
      LoadBalancerNames: [{get_resource: fj_elb}]
      Tags: [{"Key": "admin_pass", "Value": "(any password (*1))"}]
                *1: Specify a password that satisfies the complexity
requirements of Windows.

  launch_config:
    type: FCX::AutoScaling::LaunchConfiguration
    properties:
      ImageId: { get_param: param_image_id }
      InstanceType: { get_param: param_flavor }
      SecurityGroups: {get_param: autoscale_security_group_name}
      BlockDeviceMappingsV2: [{source_type: 'image', destination_type:
'volume', boot_index: '0', device_name: '/dev/vda', volume_size: '80',
uuid: {get_param: param_image_id}, delete_on_termination: true}]
      UserData: |
        #ps1
        New-Item "c:\\test" -itemType Directory

  fj_elb:
    type: FCX::ExpandableLoadBalancer::LoadBalancer
    properties:
      Subnets: {get_param: autoscale_subnet_id}
      SecurityGroups: {get_param: autoscale_security_group_id}
      Listeners:
      - {LoadBalancerPort: '80', InstancePort: '80',
        Protocol: 'HTTP', InstanceProtocol: 'HTTP' }
      HealthCheck: {Target: 'HTTP:80/iisstart.htm', HealthyThreshold:
'3',
                   UnhealthyThreshold: '5', Interval: '30', Timeout: '5'}
      Version: 2014-09-30
      Scheme: internal
      LoadBalancerName: {get_param: autoscale_elb_name}

  web_server_scaleup_policy:
    type: FCX::AutoScaling::ScalingPolicy
    properties:
      AdjustmentType: ChangeInCapacity
      AutoScalingGroupName: {get_resource: AutoScaleWindows}
      ScalingAdjustment: '1'

  web_server_scaledown_policy:
    type: FCX::AutoScaling::ScalingPolicy
    properties:
      AdjustmentType: ChangeInCapacity
      AutoScalingGroupName: {get_resource: AutoScaleWindows}
      ScalingAdjustment: '-1'

  cpu_alarm_high:
    type: OS::Ceilometer::Alarm
    properties:
      description: Scale-up if the average CPU > 80% for 1 minute
      meter_name: fcx.compute.cpu_util
      statistic: avg
      period: '180'
      evaluation_periods: '1'
      threshold: '80'
      alarm_actions:
      - {get_attr: [web_server_scaleup_policy, AlarmUrl]}
      matching_metadata: {'metadata.user_metadata.groupname':
{get_resource: 'AutoScaleWindows'}}
      comparison_operator: gt

  cpu_alarm_low:
    type: OS::Ceilometer::Alarm
    properties:
      description: Scale-down if the average CPU < 20% for 1 minute
      meter_name: fcx.compute.cpu_util
      statistic: avg
      period: '180'
      evaluation_periods: '1'
      threshold: '20'
      alarm_actions:
```

```
      - {get_attr: [web_server_scaledown_policy, AlarmUrl]}
      matching_metadata: {'metadata.user_metadata.groupname':
{get_resource: 'AutoScaleWindows'}}
      comparison_operator: lt
```

5.5 Example health check Heat template (Windows)

- autoscaling_healthcheck.yaml

The following is an example template for automatically recovering abnormal instances included in AutoScale (Windows) that are detected using the health check of Load Balancer.

```
heat_template_version: 2013-05-23

description:
  Autoscaling Windows Health HTTP80

parameters:

  az:
    type: string
    default: jp-east-1a
  param_image_id:
    type: string
    default: 5ab16551-c229-4611-834b-a16e074c187e
  param_flavor:
    type: string
    default: (Select from the following flavors: "S-1", "S-2", "S-4",
"S-8", "S-16".)
  autoscale_security_group_name:
    type: comma_delimited_list
    default: (Any security group name)
  autoscale_security_group_id:
    type: comma_delimited_list
    default: (Any security group ID)
  autoscale_subnet_id:
    type: comma_delimited_list
    default: (Any subnet ID)
  autoscale_elb_name:
    type: string
    default: m0918WinELB2


resources:

  autoscalewindows:
    type: FCX::AutoScaling::AutoScalingGroup
    properties:
      AvailabilityZones: [{get_param: az}]
      LaunchConfigurationName: {get_resource: launch_config}
      MinSize: '1'
      MaxSize: '2'
      VPCZoneIdentifier: {get_param: autoscale_subnet_id}
      HealthCheckGracePeriod: '110'
      HealthCheckType: 'ELB'
      Cooldown: 750
      LoadBalancerNames: [{get_resource: fj_elb}]
      Tags: [{"Key": "admin_pass", "Value": "(any password (*1))"}]
              *1: Specify a password that satisfies the complexity
requirements of Windows.

  launch_config:
    type: FCX::AutoScaling::LaunchConfiguration
    properties:
      ImageId: { get_param: param_image_id }
      InstanceType: { get_param: param_flavor }
      SecurityGroups: {get_param: autoscale_security_group_name}
      BlockDeviceMappingsV2: [{source_type: 'image', destination_type:
'volume', boot_index: '0', device_name: '/dev/vda', volume_size: '80',
uuid: {get_param: param_image_id}, delete_on_termination: true}]
      UserData: |
        #ps1
        New-Item "c:\\test" -itemType Directory

  fj_elb:
    type: FCX::ExpandableLoadBalancer::LoadBalancer
    properties:
      Subnets: {get_param: autoscale_subnet_id}
      SecurityGroups: {get_param: autoscale_security_group_id}
      Listeners:
      - {LoadBalancerPort: '80', InstancePort: '80',
        Protocol: 'HTTP', InstanceProtocol: 'HTTP' }
      HealthCheck: {Target: 'HTTP:80/iisstart.htm', HealthyThreshold:
'3',
                   UnhealthyThreshold: '5', Interval: '30', Timeout: '5'}
      Version: 2014-09-30
      Scheme: internal
      LoadBalancerName: {get_param: autoscale_elb_name}

  vm_recover_policy:
    type: FCX::AutoScaling::ScalingPolicy
    properties:
      AdjustmentType: ChangeInCapacity
      AutoScalingGroupName: {get_resource: autoscalewindows}
      ScalingAdjustment: '1'

  elb_status_abnormal:
    type: OS::Ceilometer::Alarm
    properties:
      description: elb_unhealty_recovery
      meter_name: fcx.loadbalancing.instance.unhealthy
      statistic: min
      period: '180'
      evaluation_periods: '1'
      repeat_actions: true
      threshold: '1'
      alarm_actions:
      - {get_attr: [vm_recover_policy, AlarmUrl]}
      matching_metadata: { 'resource_id': {get_param:
autoscale_elb_name}}
      comparison_operator: ge
```

Appendix A Resource type properties

Refer to "4 Resource type details" for details on the resource types.

About the "Updateable" column:

- Y: Can be updated using Update stack
- (blank): Resources are created/deleted when you attempt to change a resource type using Update stack

A.1 Auto scaling

Resource Types	Properties	Mandatory	Updateable
FCX::AutoScaling::AutoScalingGroup	AvailabilityZones	Y	
	Cooldown		Y
	HealthCheckGracePeriod		
	HealthCheckType		
	LaunchConfigurationName	Y	Y
	LoadBalancerNames		
	MaxSize	Y	Y
	MinSize	Y	Y
	Tags		
	VPCZoneIdentifier	Y	
FCX::AutoScaling::LaunchConfiguration	BlockDeviceMappingsV2		
	ImageId	Y	
	InstanceType	Y	
	KeyName		
	NovaSchedulerHints		
	SecurityGroups		
	UserData		
FCX::AutoScaling::ScalingPolicy	AdjustmentType	Y	Y
	AutoScalingGroupName	Y	
	Cooldown		Y
	ScalingAdjustment	Y	Y

A.2 Telemetry

Resource Types	Properties	Mandatory	Updateable
OS::Ceilometer::Alarm	meter_name	Y	
	alarm_actions		Y
	ok_actions		Y
	description		Y
	matching_metadata		
	evaluation_periods		Y
	statistic		Y
	enabled		Y
	period		Y
	insufficient_data_actions		Y
	repeat_actions		Y
	threshold	Y	Y
	comparison_operator		Y
OS::Ceilometer::CombinationAlarm	alarm_actions		Y
	ok_actions		Y
	description		Y
	enabled		Y
	alarm_ids	Y	Y
	insufficient_data_actions		Y
	repeat_actions		Y
	operator		Y

A.3 Block storage

Resource Types	Properties	Mandatory	Updateable
OS::Cinder::Volume	availability_zone		

Resource Types	Properties	Mandatory	Updateable
	backup_id		
	description		
	image		
	metadata		
	name		
	size		
	snapshot_id		
	source_volid		
	imageRef		
	volume_type		
OS::Cinder::VolumeAttachment	instance_uuid	Y	Y
	mountpoint		Y
	volume_id	Y	Y

A.4 Compute

Resource Types	Properties	Mandatory	Updateable
OS::Nova::Server	availability_zone		
	block_device_mapping		
	config_drive		
	diskConfig		
	flavor	Y	Y
	image		
	key_name		
	metadata		Y
	name		Y
	networks		Y
	scheduler_hints		
	security_groups		
	user_data		
	user_data_format		
	admin_user		

A.5 Network

Resource Types	Properties	Mandatory	Updateable
OS::Neutron::Firewall	router_id		
	description		Y
	admin_state_up		Y
	availability_zone		
	firewall_policy_id	Y	Y
	name		Y
OS::Neutron::FirewallPolicy	description		Y
	firewall_rules	Y	Y
	availability_zone		
	shared		Y
	audited		Y
	name		Y
OS::Neutron::FirewallRule	protocol		Y
	description		Y
	availability_zone		
	enabled		Y
	source_ip_address		Y
	destination_ip_address		Y
	source_port		Y
	action		Y
	shared		Y
	destination_port		Y
	ip_version		Y
	name		Y
OS::Neutron::FloatingIP	floating_network_id	Y	
	fixed_ip_address		
	port_id		

Resource Types	Properties	Mandatory	Updateable
	value_specs		
	availability_zone		
OS::Neutron::FloatingIPAssociation	floatingip_id	Y	
	fixed_ip_address		
	port_id	Y	
OS::Neutron::Net	dhcp_agent_ids		Y
	name		Y
	availability_zone		
	tenant_id		
	admin_state_up		Y
	value_specs		Y
	shared		Y
OS::Neutron::Port	name		Y
	allowed_address_pairs		
	availability_zone		
	network_id	Y	
	admin_state_up		Y
	device_owner		Y
	value_specs		
	mac_address		
	fixed_ips		Y
	security_groups		Y
	device_id		Y
OS::Neutron::ProviderNet	name		Y
	availability_zone		
	segmentation_id		Y
	admin_state_up		Y
	physical_network	Y	Y
	shared		Y
	network_type	Y	Y
OS::Neutron::Router	external_gateway_info		Y
	l3_agent_id		Y
	name		Y
	admin_state_up		Y
	availability_zone		
	value_specs		Y
OS::Neutron::RouterInterface	router_id	Y	
	subnet_id		
	port_id		
OS::Neutron::SecurityGroup	rules		Y
	description		Y
	name		Y
	availability_zone		
OS::Neutron::Subnet	name		Y
	enable_dhcp		Y
	availability_zone		
	network_id	Y	
	tenant_id		
	dns_nameservers		Y
	allocation_pools		
	host_routes		
	value_specs		Y
	ip_version		
	gateway_ip		Y
	cidr	Y	
FCX::Neutron::NetworkConnector	tenant_id		
	network_connector_pool_id		
	name	Y	Y
FCX::Neutron::NetworkConnectorEndpoint	tenant_id		
	endpoint_type	Y	
	name	Y	Y
	network_connector_id	Y	
	location	Y	
FCX::Neutron::NetworkConnectorEndpointConnection	port_id	Y	
	network_connector_endpoint_id	Y	

A.6 Expandable load balancing

Resource Types	Properties	Mandatory	Updateable
FCX::ExpandableLoadBalancer::LoadBalancer	LBCookieStickinessPolicies		Y
	Subnets	Y	Y
	LoadBalancerAttributes		Y
	Grade		
	HealthCheck		Y
	SorryServerRedirectionPolicies		Y
	Instances		Y
	Listeners	Y	Y
	Version	Y	
	SecurityGroups		Y
	LoadBalancerName	Y	
	Scheme		
	InstancesPorts		Y
	ListenersPolicies		Y

A.7 Database

Resource Types	Properties	Mandatory	Updateable
FCX::Database::DBInstance	backup_retention_period		Y
	availability_zone	Y	
	publicly_accessible		
	auto_minor_version_upgrade		Y
	flavor	Y	Y
	id		
	users		
	disk_type		Y
	port		Y
	collate		
	masteruser_password	Y	Y
	preferred_backup_window		Y
	size	Y	Y
	engine		
	description		Y
	multi		Y
	security_group_ids		Y
	masteruser_name		
	parameter_group_id		Y
	subnet_group_id	Y	
	name		Y
	engine_version		Y
	multi_az		Y
	databases		
	character_set		
	preferred_maintenance_window		Y

A.8 Object storage

Resource Types	Properties	Mandatory	Updateable
OS::Swift::Container	X-Container-Meta		
	X-Container-Read		
	name		
	X-Account-Meta		
	X-Container-Write		