FUJITSU Cloud Service K5 IaaS

Heat Template Specifications

V1.0

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Fujitsu Limited

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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.

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

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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.

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

<table>
<thead>
<tr>
<th>Section</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>No</td>
<td>Defines a description of the template.</td>
</tr>
<tr>
<td>parameters</td>
<td>No</td>
<td>Defines the input parameters. This is used when instantiating the template.</td>
</tr>
<tr>
<td>resources</td>
<td>No</td>
<td>Defines the resources.</td>
</tr>
<tr>
<td>outputs</td>
<td>No</td>
<td>Defines the output parameters. This can be used by users after instantiation of the template has been completed.</td>
</tr>
</tbody>
</table>

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>
```

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;param name&gt;</td>
<td>Yes</td>
<td>Defines the name of an input parameter.</td>
</tr>
<tr>
<td>type</td>
<td>Yes</td>
<td>Defines the data type of an input parameter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- string</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- number</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- json</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- comma_delimited_list</td>
</tr>
<tr>
<td>label</td>
<td>No</td>
<td>Defines the human-readable label.</td>
</tr>
<tr>
<td>description</td>
<td>No</td>
<td>Defines the human-readable description.</td>
</tr>
<tr>
<td>default</td>
<td>No</td>
<td>Defines the default value used when input of the parameter is omitted.</td>
</tr>
<tr>
<td>hidden</td>
<td>No</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- false</td>
</tr>
<tr>
<td>constraints</td>
<td>No</td>
<td>Defines the constraints of the parameter. Constraints are specified in the format described in the section below.</td>
</tr>
</tbody>
</table>
### 3.2.1 Parameter constraints

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

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;constraint type&gt;</td>
<td>Yes</td>
<td>Specifies the type of constraint.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- allowed_values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- allowed_pattern</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- custom_constraint</td>
</tr>
<tr>
<td>&lt;constraint definition&gt;</td>
<td>Yes</td>
<td>Specifies the definition of a constraint in the format corresponding to its type.</td>
</tr>
<tr>
<td>description</td>
<td>No</td>
<td>Defines the message that is displayed for the user when a constraint is violated. If omitted, the default message will be used.</td>
</tr>
</tbody>
</table>

<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.

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>min</td>
<td>No</td>
<td>Specifies the minimum number of characters. Specify min, max, or both.</td>
</tr>
<tr>
<td>max</td>
<td>No</td>
<td>Specifies the maximum number of characters. Specify min, max, or both.</td>
</tr>
</tbody>
</table>

#### 3.2.1.2 range

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

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>min</td>
<td>No</td>
<td>Specifies the minimum value. Specify min, max, or both.</td>
</tr>
<tr>
<td>max</td>
<td>No</td>
<td>Specifies the maximum value. Specify min, max, or both.</td>
</tr>
</tbody>
</table>

#### 3.2.1.3 allowed_values

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

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

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

---

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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 }
      - 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.

<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS::stack_name</td>
<td>The name of the stack.</td>
</tr>
<tr>
<td>OS::stack_id</td>
<td>The ID used to identify stacks.</td>
</tr>
</tbody>
</table>

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

### 3.3.1 Example definition of resources

```yaml
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:

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

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

Example definition of multiple dependencies:

```yaml
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.

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;parameter name&gt;</td>
<td>Yes</td>
<td>Defines the name of a unique output parameter in the outputs section.</td>
</tr>
<tr>
<td>description</td>
<td>No</td>
<td>Defines the description of an output parameter.</td>
</tr>
<tr>
<td>value</td>
<td>No</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

```yaml
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.

```yaml
get_param: <parameter name>
```

or

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;parameter name&gt;</td>
<td>Yes</td>
<td>Specifies the name of an input parameter defined in the parameters section.</td>
</tr>
<tr>
<td>&lt;key/index 1,2,..&gt;</td>
<td>No</td>
<td>Specifies the key or index for obtaining data, when the input parameter defined in the parameters section is a list or hash.</td>
</tr>
</tbody>
</table>
Example specification of the `get_param` function:

```yaml
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:

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

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

<table>
<thead>
<tr>
<th>properties</th>
<th>Value obtained using get_param</th>
</tr>
</thead>
<tbody>
<tr>
<td>flavor</td>
<td>&quot;m1.tiny&quot;</td>
</tr>
<tr>
<td>metadata</td>
<td>{&quot;foo&quot;: &quot;bar&quot;}</td>
</tr>
<tr>
<td>key_name</td>
<td>&quot;a_key&quot;</td>
</tr>
</tbody>
</table>

### 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.

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;resource ID&gt;</td>
<td>Yes</td>
<td>Specifies a resource ID defined in the Resources Section.</td>
</tr>
<tr>
<td>&lt;attribute name&gt;</td>
<td>Yes</td>
<td>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.</td>
</tr>
<tr>
<td>&lt;key/index 1,2,..&gt;</td>
<td>No</td>
<td>Specifies the key or index for obtaining data, when the attribute is a list or hash.</td>
</tr>
</tbody>
</table>

Example specification of the `get_attr` function:

```yaml
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>
```

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;resource ID&gt;</td>
<td>Yes</td>
<td>Specifies a resource ID defined in the <code>Resources Section</code></td>
</tr>
</tbody>
</table>

### 3.5.4 str_replace

The `str_replace` function replaces strings.

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>template</td>
<td>Yes</td>
<td>Specifies the string that is the replacement source.</td>
</tr>
<tr>
<td>params</td>
<td>Yes</td>
<td>Specifies the mapping of the string for replacement. Other functions such as <code>get_attr</code> can be used.</td>
</tr>
</tbody>
</table>

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):

```yaml
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.

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

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;content key&gt;</td>
<td>Yes</td>
<td>Specifies a key for referencing string data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When executing from the REST API of Heat, the string data mapped in files of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the request parameters is referenced. When executing from the CLI of Heat,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>external files are referenced by specifying the file URL or a relative path.</td>
</tr>
</tbody>
</table>

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

```yaml
"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:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;data type&gt;</td>
<td>Yes</td>
<td>Specifies the data type for retrieving values.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- metadata</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- deletion_policy</td>
</tr>
</tbody>
</table>

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 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.

4.1.1.2 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:**

    \[
    \text{(Time required to create one instance} \times \text{Scaling Adjustment value)} \\
    + \text{FCX::AutoScaling::Time specified for Health Check Grace Period of AutoScalingGroup} \\
    + \text{OS::Ceilometer::Alarm period} \times \text{OS::Ceilometer::Alarm evaluation periods} \\
    + \text{Number of Grade(ELB VM) subnets} \times \text{Number of Grades (ELB VM)} \times 10 (*1) \\
    + 60
    \]

  - **When using scale-in:**

    \[
    \text{Time required to delete one instance} \times \text{(Scaling Adjustment value} \times -1) \\
    + \text{FCX::AutoScaling::Time specified for Health Check Grace Period of AutoScalingGroup} \\
    + \text{OS::Ceilometer::Alarm period} \times \text{OS::Ceilometer::Alarm evaluation periods} \\
    + \text{Number of Grade(ELB VM) subnets} \times \text{Number of Grades (ELB VM)} \times 10 (*1) \\
    + 60
    \]

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

    \[
    \text{(Time required to create one instance} \times \text{Scaling Adjustment value)} \\
    + \text{FCX::AutoScaling::Time specified for Health Check Grace Period of AutoScalingGroup} \\
    + \text{(Time required to delete one instance} \times 5) \\
    + \text{FCX::AutoScaling::Time specified for Health Check Grace Period of AutoScalingGroup} \\
    + \text{(Time required to create one instance} \times \text{FCX::AutoScaling::Min Size value of AutoScalingGroup)} \\
    + \text{FCX::AutoScaling::Time specified for Health Check Grace Period of AutoScalingGroup} \\
    + \text{OS::Ceilometer::Alarm period} \times \text{OS::Ceilometer::Alarm evaluation periods} \\
    + \text{Number of Grade(ELB VM) subnets} \times \text{Number of Grades (ELB VM)} \times 10 (*1) \times 3 \\
    + 60
    \]

  "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

4.1.1.3 **Attributes**

• **InstanceList**
  A comma-delimited list of server ip addresses. (Heat extension).
4.1.1.4 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)"

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:**
    
    
    \[(\text{Time required to create one instance} \times \text{ScalingAdjustment value})
    
    + \text{FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup}
    
    + \text{OS::Ceilometer::Alarm period} \times \text{OS::Ceilometer::Alarm evaluation periods}
    
    + \text{Number of Grade(ELB VM) subnets} \times \text{Number of Grades (ELB VM)} \times 10 \text{ (*1)}
    
    + 60\]

  • **When using scale-in:**
    
    \[
    \text{Time required to delete one instance} \times (\text{ScalingAdjustment value} \times -1)
    
    + \text{FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup}
    
    + \text{OS::Ceilometer::Alarm period} \times \text{OS::Ceilometer::Alarm evaluation periods}
    
    + \text{Number of Grade(ELB VM) subnets} \times \text{Number of Grades (ELB VM)} \times 10 \text{ (*1)}
    
    + 60\]

  • **When an abnormal instance is automatically recovered using the health check of the Load Balancer**
    
    \[
    \text{(Time required to create one instance} \times \text{ScalingAdjustment value})
    
    + \text{FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup}
    
    + (\text{Time required to delete one instance} \times 5)
    
    + \text{FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup}
    
    + (\text{Time required to create one instance} \times \text{FCX::AutoScaling::MinSize value of AutoScalingGroup})
    
    + \text{FCX::AutoScaling::Time specified for HealthCheckGracePeriod of AutoScalingGroup}
    
    + \text{OS::Ceilometer::Alarm period} \times \text{OS::Ceilometer::Alarm evaluation periods}
    
    + \text{Number of Grade(ELB VM) subnets} \times \text{Number of Grades (ELB VM)} \times 10 \text{ (*1)} \times 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**

```yaml
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

```yaml
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-<Volumeld> 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.

  ```json
  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
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

```yaml
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.

```yaml
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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Mandatory</th>
<th>Constraints/default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>flavor</td>
<td>List ID of the predefined hardware resource</td>
<td>String</td>
<td>Y</td>
<td></td>
<td>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</td>
</tr>
<tr>
<td>size</td>
<td>Size of the data volume</td>
<td>Integer</td>
<td>Y</td>
<td>10-10240</td>
<td></td>
</tr>
<tr>
<td>disk_type</td>
<td>Disk type</td>
<td>String</td>
<td>L1</td>
<td>M1</td>
<td>F1</td>
</tr>
<tr>
<td>availability_zone</td>
<td>Availability zone where the instance is created</td>
<td>String</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>subnet_group_id</td>
<td>Subnet group where the DB instance will be deployed to</td>
<td>String</td>
<td>Y</td>
<td>*Only subnets with DHCP ON can be specified</td>
<td>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)</td>
</tr>
<tr>
<td>publicly_accessible</td>
<td>Whether an Internet connection is possible during deployment of the DB instance</td>
<td>Boolean</td>
<td>true</td>
<td>false</td>
<td>Default value: true</td>
</tr>
<tr>
<td>security_group_ids</td>
<td>ID list of the VPC security group</td>
<td>List (String list)</td>
<td>List of the VPC security group default security group</td>
<td>*Specify the VPC security group. The specifiable values can be retrieved by executing the Networking service API</td>
<td></td>
</tr>
<tr>
<td>multi_az</td>
<td>Multi availability zone option</td>
<td>Boolean</td>
<td>true</td>
<td>false</td>
<td>Default value: true</td>
</tr>
<tr>
<td>id</td>
<td>ID of the DB instance</td>
<td>String</td>
<td>Default : random value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>name</td>
<td>Name of the DB instance</td>
<td>String</td>
<td>Default : Random value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Type</td>
<td>Mandatory</td>
<td>Constraints/default value</td>
<td>Remarks</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------</td>
<td>---------</td>
<td>-----------</td>
<td>---------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>backup_retention_period</strong></td>
<td>Backup retention period (in days)</td>
<td>Integer</td>
<td></td>
<td>0 to 10</td>
<td>Default: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*Automatic backup will not be performed when the value is 0.</td>
</tr>
<tr>
<td><strong>preferred_backup_window</strong></td>
<td>Backup time slot</td>
<td>String</td>
<td></td>
<td>Format: hh24:mi-hh24:mi</td>
<td>Default: A random thirty-minute-period within the ten-hour-period prescribed for each region</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*If automatic backups are enabled, specify the timeslot when the daily backups are to be performed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*It is necessary to specify a timeslot of thirty minutes or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>o Eastern Japan Region 1 (jp-east-1): 17:00-03:00 UTC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>o Western Japan Region 1 (jp-west-1): 17:00-03:00 UTC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>o UK Region 1 (uk-1): 17:00-03:00 UTC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*Specify times in UTC format</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*You cannot specify a timeslot that overlaps the preferred maintenance window</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*Backups may take longer than thirty minutes, depending on the backup conditions</td>
</tr>
<tr>
<td><strong>preferred_maintenance_window</strong></td>
<td>Maintenance time slot</td>
<td>String</td>
<td></td>
<td>Format: ddd:hh24:mi-ddd:hh24:mi</td>
<td>Default: A random thirty-minute period within the ten-hour period prescribed for each region (the day of the week is also determined randomly)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*Specify the timeslot when weekly maintenance is to be performed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*It is necessary to specify a timeslot from thirty minutes to twenty-three hours and 30 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>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)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Example: Sun:0500 - Sun:06:00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Day value: Mon, Tue, Wed, Thu, Fri, Sat, Sun</td>
</tr>
<tr>
<td><strong>auto_minor_version_upgrade</strong></td>
<td>Automatic minor version upgrade</td>
<td>Boolean</td>
<td></td>
<td>Default: true</td>
<td>True: Perform automatic minor version upgrade</td>
</tr>
<tr>
<td><strong>port</strong></td>
<td>Port number</td>
<td>Integer</td>
<td></td>
<td>1024 to 32767</td>
<td>Default value: 26500</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Type</td>
<td>Mandatory</td>
<td>Constraints/default value</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>masteruser_name</td>
<td>Administrator user name</td>
<td>String</td>
<td></td>
<td>Default: postgres - Up to 63 alphanumeric characters can be used - The first character must be an alphabetic character or an underscore</td>
<td></td>
</tr>
<tr>
<td>masteruser_password</td>
<td>Administrator password</td>
<td>String</td>
<td>Y</td>
<td>Up to 1024 characters</td>
<td></td>
</tr>
<tr>
<td>character_set</td>
<td>Character encoding</td>
<td>String</td>
<td></td>
<td>Default: UTF8</td>
<td>The specifiable values can be retrieved using get DB engine information (GET/v1.0/{tenantId}/engineversion)</td>
</tr>
<tr>
<td>collate</td>
<td>Collating sequence</td>
<td>String</td>
<td></td>
<td>Default: C</td>
<td>The specifiable values can be retrieved using get DB engine information (GET/v1.0/{tenantId}/engineversion)</td>
</tr>
<tr>
<td>parameter_group_id</td>
<td>Name of the DB parameter group</td>
<td>String</td>
<td></td>
<td>DB parameter group ID Default: default parameter group</td>
<td>The specifiable values can be retrieved using get DB parameter group list (GET/v1.0/{tenantId}/parametergroups)</td>
</tr>
<tr>
<td>engine</td>
<td>Name of the DB engine</td>
<td>String</td>
<td></td>
<td>symfoware</td>
<td>In the future, this will depend on whether DB types are increased</td>
</tr>
<tr>
<td>engine_version</td>
<td>DB version</td>
<td>String</td>
<td></td>
<td>Default: Latest version</td>
<td>The specifiable values can be retrieved using get DB engine information (GET/v1.0/{tenantId}/engineversion)</td>
</tr>
<tr>
<td>databases</td>
<td>List of the DB structure</td>
<td>Map</td>
<td></td>
<td>(Database structure)</td>
<td></td>
</tr>
<tr>
<td>users</td>
<td>List of the user structure</td>
<td>Map</td>
<td></td>
<td>(User structure)</td>
<td></td>
</tr>
</tbody>
</table>

4.1.5.2.1.2 Database parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Mandatory</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>DB name</td>
<td>String</td>
<td>Y</td>
<td>DB identifier</td>
<td>- Up to 63 alphanumeric characters can be used - The first character must be an alphabetic character or an underscore</td>
</tr>
</tbody>
</table>

User structures
### 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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLICADDRESS</td>
<td>External address of a Database instance (FQDN)</td>
</tr>
<tr>
<td>PRIVATEADDRESS</td>
<td>Internal address of a Database instance (FQDN)</td>
</tr>
<tr>
<td>PRIVATEIP</td>
<td>Internal IP address of a Database instance</td>
</tr>
<tr>
<td>PUBLICIP</td>
<td>External IP address of a Database instance</td>
</tr>
<tr>
<td>SUBPRIVATEIP</td>
<td>Internal IP address of a Standby Database instance</td>
</tr>
<tr>
<td>SUBPUBLICIP</td>
<td>External IP address of a Standby Database instance</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Mandatory</th>
<th>Constraints/default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>ID of DB subnet group</td>
<td>String</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>name</td>
<td>Name of DB subnet group</td>
<td>String</td>
<td>Y</td>
<td>Default: random value</td>
<td></td>
</tr>
<tr>
<td>subnetIds</td>
<td>List of subnets</td>
<td>String</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>Description of DB subnet group</td>
<td>String</td>
<td></td>
<td>Default: None</td>
<td></td>
</tr>
</tbody>
</table>

### SubnetId

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Mandatory</th>
<th>Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>subnetId</td>
<td>ID of subnet</td>
<td>String</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Mandatory</th>
<th>Constraints/default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>parameterGroupFamily</td>
<td>Type of parameter group, determined by the DB engine and version</td>
<td>String</td>
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<td>symfoware_v12.1</td>
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<tr>
<td>id</td>
<td>ID of the DB parameter group</td>
<td>String</td>
<td></td>
<td>Default: random value</td>
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<tr>
<td>parameterGroupName</td>
<td>Name of the DB parameter group</td>
<td>String</td>
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<td></td>
</tr>
<tr>
<td>description</td>
<td>Description of the DB parameter group</td>
<td>String</td>
<td></td>
<td>Default: None</td>
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</tbody>
</table>
## 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.

```yaml
# 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}

fj-elb:
  type: FCX::ExpandableLoadBalancer::LoadBalancer
  properties:
    Subnets: [{get_param: subnet-id}]
    Listeners:
  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'
5.4 Example AutoScale Heat template (Windows)

- autoscaling_windows.yaml

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

```yaml
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 }
  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:
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.

```yaml
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}
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_unhealthy_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

<table>
<thead>
<tr>
<th>Resource Types</th>
<th>Properties</th>
<th>Mandatory</th>
<th>Updateable</th>
</tr>
</thead>
<tbody>
<tr>
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<td>AvailabilityZones</td>
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<td>Cooldown</td>
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<td>FCX::AutoScaling::LaunchConfiguration</td>
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A.2 Telemetry

<table>
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<th>Properties</th>
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<td>comparison_operator</td>
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A.3 Block storage

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<th>Properties</th>
<th>Mandatory</th>
<th>Updateable</th>
</tr>
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<tbody>
<tr>
<td>OS::Cinder::Volume</td>
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<tr>
<td>Resource Types</td>
<td>Properties</td>
<td>Mandatory</td>
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### A.4 Compute

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### A.5 Network

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A.6 Expandable load balancing

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A.7 Database

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A.8 Object storage

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