EGI-Engage

Resource template changes:

OCCI extension, final specification

D4.3

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Abstract

This Report deals with the effort to standardize the changing of resource templates in existing virtual machine instances. The main motivation is achieving the ability to resize an existing virtual machine instance. The standardization of resource template replacement with OCCI, originally envisioned as a separate extension to the standard, was finally achieved by augmenting the existing standard during preparation of the OCCI 1.2 release. This paves the way to future implementation of this new functionality on EGI infrastructure via EGI-Engage.

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	Name	Partner/Activity	Date
From:	Zdeněk Šustr, Boris Parák	CESNET	25.11.2015
Moderated by:	Kostas Koumantaros	GRNET/PMB	25.11.2015
Reviewed by	Diego Scardaci Enol Frenandez	INFN/WP3 IFCA/WP6.2Task Leader	25.11.2015
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TERMINOLOGY

A complete project glossary is provided at the following page: http://www.egi.eu/about/glossary/

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.

Contents

1 Introduction

The OCCI (Open Cloud Computing Interface)[1] standard is a set of community drive specifications delivered by the Open Grid Forum (OGF)[2], allowing for the development and deployment of interoperable clouds. The OCCI specification[3] consists of several complimentary documents defining the core abstract model, its renderings and extensions to the core model. Currently, the Infrastructure extension contains the required resource types, attributes and actions needed to manage Infrastructure as a Service (IaaS) resources.

The current version of the standard at the time of this deliverable is OCCI v. 1.1. The new version 1.2 has been developed in the last months, passing through the public comment phase that ended in July 2015. Currently the v. 1.2 version of the standard is going through the OGF processes to be officially released to the public.

IaaS cloud consumers normally specify their needs by selecting a set of hardware resources (e.g. CPU, memory, disk, etc.), so that are provisioned to the requested virtual machine or instance. The OCCI specification defines a consistent way of requesting these resources by means of the resource templates.

Some characteristics of an OCCI Resource (a virtual machine in this particular case) can be modified by associating one or more Mixins to the Resource instance. The OCCI infrastructure extension defines the Resource Template Mixins as a "*provider-defined Mixin instance that refers to a preset Resource configuration*". Therefore, Resource templates consist of a set of predefined resources set by the resource provider that will determine the final size of the virtual machine instance in terms of hardware capabilities (i.e. number of CPUs, memory, etc.).

During the lifetime of a virtual machine, IaaS customers may find that their initial estimation of the resources was not accurate enough or they want to dynamically adjust the VM size; hence a way of readjusting the resources attached to a running instance is needed. This feature is already available in many of the cloud backends, however, the current OCCI 1.1 standard did not envision changing a resource template associated with a virtual machine instance during its lifetime.

This feature has been requested by multiple user groups within the EGI Federated Cloud activity that find as a limitation the inability for changing the resources allocated to the running virtual machines. The lack of proper support for resizing them was hindering their usage of the infrastructure; therefore it became necessary to augment the OCCI standard so as to achieve the desired and needed functionality.

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1 http://occi-wg.org/
2 https://www.ogf.org/
3 http://occi-wg.org/about/specification/

1.1 Use cases

In Infrastructure as a Service providers users are accounted by the resources requested and allocated, not by their actual usage. This fact makes that users are more aware of the resources they are requesting for their virtual machines. In some cases users tend to be conservative so as not to be accounted for resources not needed. This may lead to an under-estimation of the requested resources, causing problems in the execution of their applications.

Several of the existing cloud resource providers and management frameworks provide the ability of changing some or all the resources (in terms of CPU, memory, disk, network bandwidth, etc.) attached to a running virtual machine. This functionality is exploited by the users that are able to dynamically adjust their virtual machines sizes if needed.

However, as already explained, OCCI 1.1 lacked this functionality. Whenever an EGI Federated Cloud user requested a virtual machine, it was not possible to resize it via the OCCI interface, even if the underlying cloud management framework offered this functionality. Therefore, users had to face this issue by contacting the particular resource provider that would resize their virtual machine on their behalf if their cloud backend allowed it. In some other cases, users directly created a new virtual machine with the desired size and they workloads were migrated to that new virtual machine. These two circumventions made possible for the users to resize their instances, but introduced an overhead that would not exist if they were able to self-service the resizing of the running virtual machines by themselves.

2 Virtual Machine (Compute) Instance Resizing

As explained in the Introduction, the size of an instance is determined by an associated Resource Template, applied as a Mixin to a Compute instance. Therefore, an virtual machine resize should be done by applying a new Resource Template Mixin to the existing Compute instance, as shown in Figure 1. However, up until, and including, OCCI v. 1.1, Mixins may only have been associated or disassociated, not exchanged in place, as the standard did not specify unambiguously what the behaviour would be when applying a new Mixin.
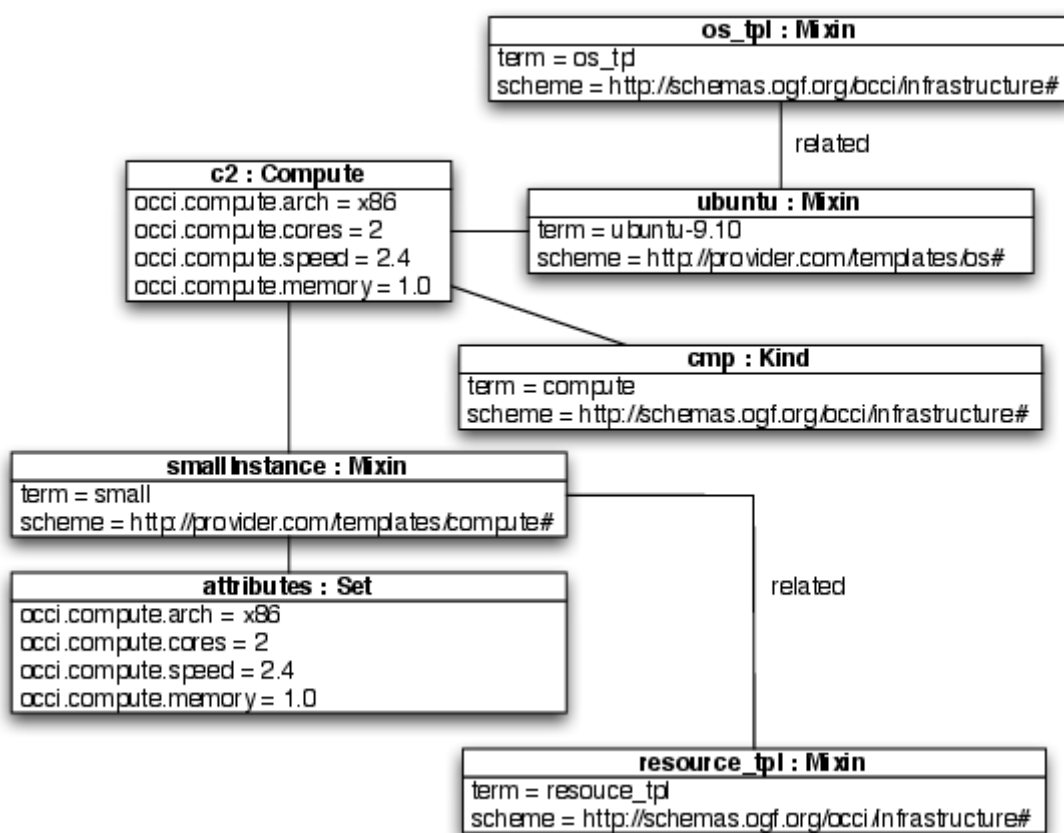

Fig.1 - Object Diagram of a Compute Instance and its Associated OS Template Mixin and Resource Template Mixin.

Therefore the OCCI Core definition for OCCI v. 1.2 has been updated based on EGI-Engage comments and discussions carried out during the public comment phase to also allow replacing Mixins, wherefore Mixins related to the same parent, applied sequentially, can replace each other. Nevertheless, the desired behaviour – whether Mixins should replace each other or stay in place side-by-side – is further specified by the standard depending on the given Mixin.

The OCCI Infrastructure extension specification has similarly been updated to specify that by replacing a Resource Template Mixin, the size of the compute instance is changed, and related Mixins replace each other. The resize action itself is to be implemented in a provider-specific way, i.e., in a way the given cloud management framework supports. If the requested resize is no available or supported in the underlying, the OCCI implementation MUST return any of the HTTP error codes, according to the OCCI HTTP rendering.

As a reference, we attach the OCCI 1.2 Core and OCCI 1.2 Infrastructure Extension drafts, valid as of the date of this deliverable. However, it is worth noticing that these are not the final documents, as they are subject to the OGF processes that are still ongoing.

2.1 Changes introduced into the standard

The Section 3.5.2 "Resource Template" from the OCCI Infrastructure Extension has been augmented as follows. An ellipsis *(…)* means that unmodified parts of the standard have been omitted.

> 3.5.2 Resource Template
>
> *(...)*
>
> If a Resource Template is already associated with the given Resource instance, associating a new Resource Template (using mechanisms defined by the chosen rendering and transport protocol) MUST result in an immediate removal of the old Resource Template and association of the new Resource Template. The change must affect the given Resource instance, in a provider-specific way (e.g., resizing the instance).

3 Roadmap and future plans

The EGI-Engage proposed changes for standardizing the changing of resource templates in existing virtual machine instances have been accepted in the public comment phase for the elaboration of the next OCCI 1.2 standard by the OGF. The preparation and release of the new version of the standard is currently undergoing the internal OGF processes, but no substantial changes are expected to the proposed extensions.

Although outside of the scope of this deliverable, the implementation of this functionality on EGI infrastructure within the scope of EGI-Engage depends on OCCI 1.2 support being introduced for each of the OCCI interfaces for the available cloud management frameworks supported in the EGI Federated Cloud. The first OCCI 1.2 preview release is planned for March 2016. The final OCCI 1.2 release will depend on the delivery by the OGF of the final OCCI 1.2 specifications, but it is expected for the 2nd quarter of 2016.

Regarding the adoption and deployment of OCCI 1.2 by the EGI Federated Cloud sites, it is expected that resource providers deploy the new interface as soon as it is available. OCCI 1.2 solves several usability shortcomings (such as the lack of a JSON rendering) that are present in the OCCI 1.1 implementation.

Appendix I. Specifications

As a reference, we attach the OCCI 1.2 Core and the OCCI 1.2 Infrastructure Extension drafts as it stands as of the date of this deliverable. The latest version of the drafts are provided in the following link https://documents.egi.eu/document/2644