Analysis of Infrastructure Monitoring Requirements for OpenStack Nova

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Abstract

Nova, the compute component of open source cloud platform OpenStack, is responsible for provisioning and management of virtual machines. For the provision of services, compute requires large amount of physical and logical infrastructure. There is a need for monitoring the infrastructure in order to gauge resource utilization, proper functioning and performance of the system. Though several tools exist, a well-defined list of parameters and processes to be monitored within Nova is lacking. In this paper, we identify and present a list of attributes required for monitoring the infrastructure and processes associated with OpenStack Nova. Different categories within infrastructure monitoring are identified, and monitoring parameters associated with them are listed. The proposed list has been applied to three existing software commonly used for monitoring OpenStack Nova. The list facilitates system administrators during selection of existing monitoring software for Nova and will be of help to the developers in selecting monitoring functionality for new monitoring software.

1. Introduction

IaaS clouds provide infrastructure resources, namely, CPU, storage and network and associated services to the users. Some of the popular open source IaaS cloud providers are OpenStack, CloudStack and Eucalyptus. Amongst these OpenStack is a common cloud platform implemented by organizations like, HP, Bloomberg, PayPal etc. CPU resources in the form of compute services are provided by OpenStack software component named Nova[1]. Compute service includes virtual machine (VM) provisioning and overall management of VMs in cloud. VM provisioning involves providing virtual CPU and associated resources to the end users on request. VM management in Nova includes services such as creation, instantiation, migration, state management, snapshot creation and removal of virtual machines. When the user requests a VM, it is provisioned using VM provisioning and managed by the VM management part of Nova.

The growing demand for compute services has resulted in manifold increase in the demand for infrastructure, thus, increasing the complexity of cloud operations. In this scenario, accurate and fine-grained monitoring activities

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are required to efficiently operate the platform and manage their increasing complexity[2]. Efficient monitoring of the system helps in determining health of the system and is beneficial for both service provider and the consumer[3–5]. The monitoring of the infrastructure by keeping track of resources and associated services helps in management of infrastructure and also provides information about performance of the system. The major areas covered under infrastructure monitoring include:

- Physical resources – hosts, CPU, storage etc.,
- Virtual resources – resources used by user – virtual machines, volumes etc., and
- Performance of resources.

In OpenStack, third party tools are used for infrastructure monitoring. Some of the popularly available open source third party monitoring software tools are Zabbix[6], Zenoss Zenpack[7] and CollectD[8]. These tools can be integrated with the cloud for providing monitoring services. The tools gather data about the system, resources and associated processes via available OpenStack API[9] and integrated middleware[10, 11]. The information collected by tools is analyzed and presented to the consumer in an easy-to-understand format, like, graphically. Although several tools exist for monitoring, there is no mention of coverage of the infrastructure monitoring required for Nova.

Here, we focus on defining on what needs to be monitored for infrastructure monitoring of Nova. There is a need to define the set of attributes and parameters which are required to be monitored for determining the health of the system. In this paper, we aim to provide a comprehensive list of attributes, functionality and processes involved in the compute infrastructure that need to be monitored for smooth functioning and management of Nova. This list provides detailed information required to be monitored by the users of the system. The list will be of benefit to the system administrator, the system developers and the monitoring tool developers. As a result of our work, a checklist is developed that lists out all the resources, their attributes and processes that require monitoring in Nova. The list is categorized into four main headers based on the infrastructure monitoring functionality and parameters of compute services in OpenStack Nova. The four headers under which the list is provided are: Background processes, Compute infrastructure, Compute usage data, and OS processes utilization data.

The designers of the system and the administrators who manage the whole system can benefit from the list. Instead of identifying the parameters to be monitored, the designers can select from checklist the attributes that need to be incorporated in the monitoring component of the software. Similarly, for the administrators, the list is an indicator of all that can be monitored in the system and the need for monitoring those attributes. Also, the list can be used for verifying if any parameter to be monitored is missing from the current monitoring system. It can be helpful in identifying the functionality that could be included in the software for providing better monitoring services. The third party monitoring software that are integrated with OpenStack can refer to the list for providing a more exhaustive coverage of the system in their tool. The presented list is a consolidated list and attempts to cover all the major aspects of Nova monitoring and is extendable to be updated for any new services. Different users associated with Nova software need not generate their own individual functionality list and specification; rather they can select the required functionality from the presented list.

Further, as a case study, we have applied our functionality list to three popular infrastructure monitoring software that is used for monitoring Nova – Zabbix, Zenoss and CollectD software. Section 2 of the paper provides an overview of Nova. In section 3, we provide categories defined under infrastructure monitoring. Section 4 explains the lists and parameters associated with each category of infrastructure monitoring in detail. Section 5 describes the case study for identifying functionalities in existing infrastructure monitoring software. The related work is discussed in Section 6. Section 7 states the conclusion.

2. OpenStack Nova

Openstack Nova provides compute as a service to the consumers. Nova has a modular architecture comprising of six main components: nova-api, queue, nova-db, nova-conductor, nova-scheduler and nova-compute[12, 13]. The components of Nova interact with each other to facilitate the process of VM management.

Nova-api is the end point in nova for user interaction. It provides support for OpenStack Compute API, Amazon's EC2 API and a special Admin API. *Queue* is the central communication point for all the nova components. It facilitates