Aneka: Cloud Application Platform

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Platform Abstraction Layer

- The Platform Abstraction Layer (PAL) is responsible for detecting the supported hosting environment and providing the corresponding implementation to interact with it to support the activity of the container
- The PAL provides the following features:
  - Uniform and platform-independent implementation interface for accessing the hosting platform
  - Uniform access to extended and additional properties of the hosting platform
  - Uniform and platform-independent access to remote nodes
  - Uniform and platform-independent management interfaces
- The PAL is a small layer of software that comprises a detection engine, which automatically configures the container at boot time, with the platform-specific component to access the above information and an implementation of the abstraction layer for the Windows, Linux, and Mac OS X operating systems

Fabric Services

- Fabric Services define the lowest level of the software stack representing the Aneka Container
- They provide access to the resource-provisioning subsystem and to the monitoring facilities implemented in Aneka
- Resource-provisioning services are in charge of dynamically providing new nodes on demand by relying on virtualization technologies, while monitoring services allow for hardware profiling and implement a basic monitoring infrastructure that can be used by all the services installed in the container

Profiling and Monitoring

- Profiling and monitoring services are mostly exposed through the Heartbeat, Monitoring, and Reporting Services
- The first makes available the information that is collected through the PAL; the other two implement a generic infrastructure for monitoring the activity of any service in the Aneka Cloud
- Currently several built-in services provide information through this channel:
  - The Membership Catalogue tracks the performance information of nodes
  - The Execution Service monitors several time intervals for the execution of jobs
  - The Scheduling Service tracks the state transitions of jobs
  - The Storage Service monitors and makes available information about data transfer, such as upload and download times, filenames, and sizes
  - The Resource Provisioning Service tracks the provisioning and lifetime information of virtual nodes

Resource Management

- Resource management is another fundamental feature of Aneka Clouds
- It comprises several tasks: resource membership, resource reservation, and resource provisioning
- Aneka provides a collection of services that are in charge of managing resources
- These are the Index Service (or Membership Catalogue) Reservation Service, and Resource Provisioning Service
- The Membership Catalogue is Aneka's fundamental component for resource management; it keeps track of the basic node information for all the nodes that are connected or disconnected
- Dynamic resource provisioning allows the integration and management of virtual resources leased from IaaS providers into the Aneka Cloud
- Resource provisioning is a feature designed to support QoS requirements-driven execution of applications

Foundation Services

- Fabric Services are fundamental services of the Aneka Cloud and define the basic infrastructure management features of the system
- Foundation Services are related to the logical management of the distributed system built on top of the infrastructure and provide supporting services for the execution of distributed applications
- All the supported programming models can integrate with and leverage these services to provide advanced and comprehensive application management
- These services cover:
    - Storage management for applications
    - Accounting, billing, and resource pricing
    - Resource reservation

Storage Management

- Aneka offers two different facilities for storage management: a centralized file storage, which is mostly used for the execution of compute- intensive applications, and a distributed file system, which is more suitable for the execution of data-intensive applications
- The requirements for the two types of applications are rather different
- Compute-intensive applications mostly require powerful processors and do not have high demands in terms of storage, which in many cases is used to store small files that are easily transferred from one node to another
- In this scenario, a centralized storage node, or a pool of storage nodes, can constitute an appropriate solution. In contrast, data-intensive applications are characterized by large data files (gigabytes or terabytes), and the processing power required by tasks does not constitute a performance bottleneck
- In this scenario, a distributed file system harnessing the storage space of all the nodes belonging to the cloud might be a better and more scalable solution.

Accounting, Billing, and Resource Pricing

- Accounting Services keep track of the status of applications in the Aneka Cloud
- The collected information provides a detailed breakdown of the distributed infrastructure usage and is vital for the proper management of resources. The information collected for accounting is primarily related to infrastructure usage and application execution
- A complete history of application execution and storage as well as other resource utilization parameters is captured and minded by the Accounting Services. This information constitutes the foundation on which users are charged in Aneka
- Aneka Billing Service provides detailed information about each user's usage of resources, with the associated costs. Each resource can be priced differently according to the set of services that are available on the corresponding Aneka container or the installed software in the node

Resource Reservation

- Aneka's Resource Reservation supports the execution of distributed applications and allows for reserving resources for exclusive use by specific applications
- Resource reservation is built out of two different kinds of services: Resource Reservation and the Allocation Service
- Resource Reservation keeps track of all the reserved time slots in the Aneka Cloud and provides a unified view of the system
- The Allocation Service is installed on each node that features execution services and manages the database of information regarding the allocated slots on the local node
- Applications that need to complete within a given deadline can make a reservation request for a specific number of nodes in a given timeframe. If it is possible to satisfy the request, the Reservation Service will return a reservation identifier as proof of the resource booking