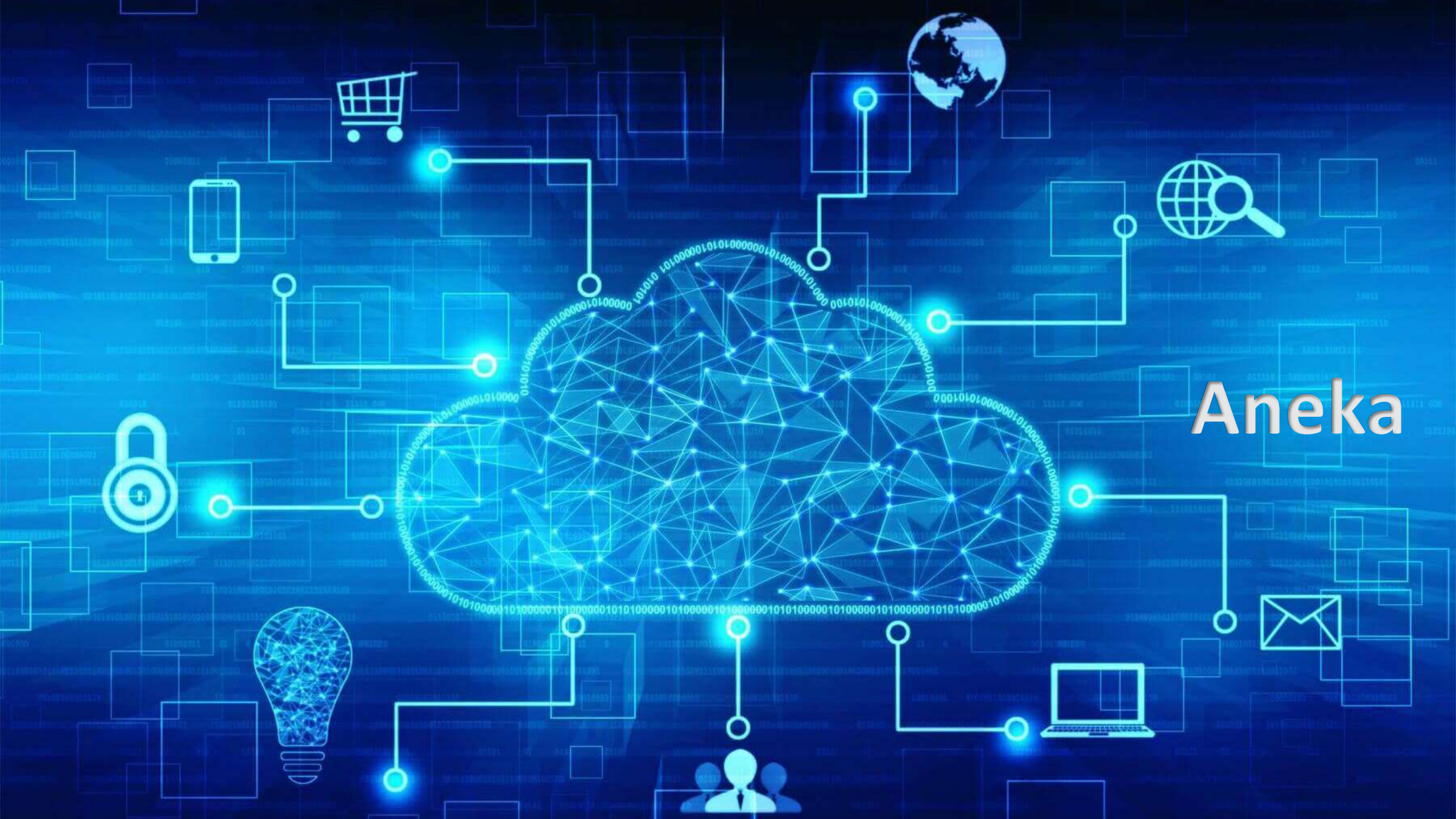

Aneka

UNIT 3

- **Aneka:** Cloud Application Platform Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode.

Aneka- Introduction and Frame work

Aneka is a pure PaaS solution for cloud computing.

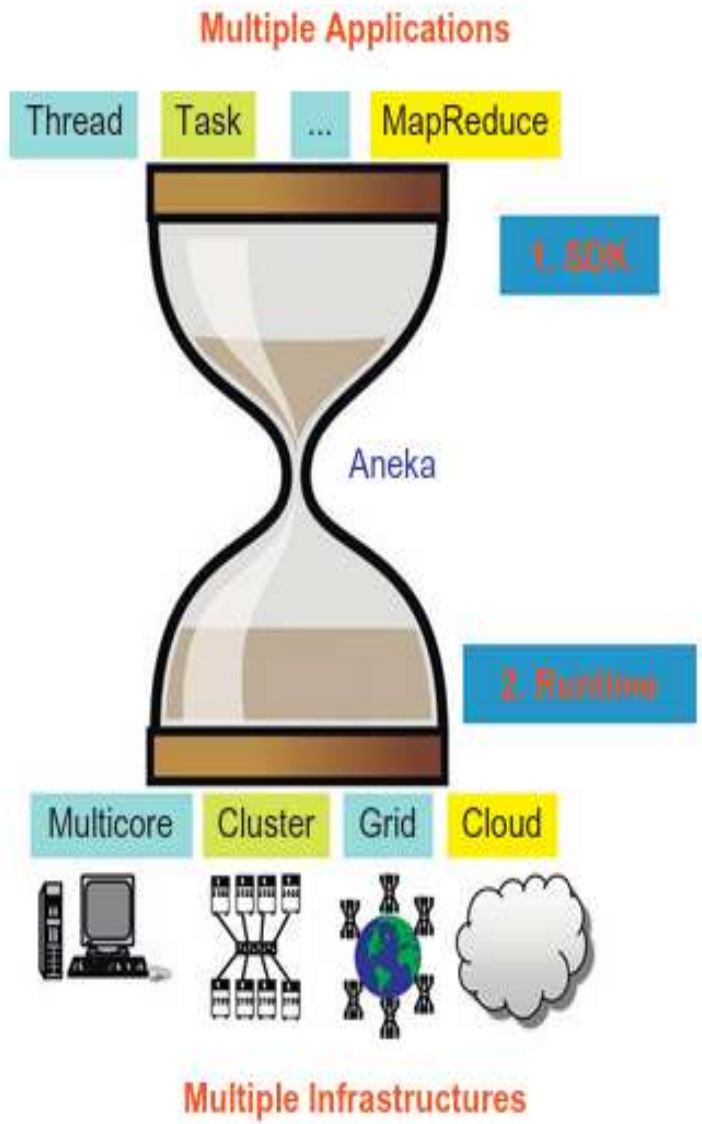
Aneka is Manjra soft solution's for developing, deploying, and managing cloud applications

Aneka consists of a scalable cloud middleware that can be deployed on top of heterogeneous computing resources.

Aneka Capabilities

Aneka supports various programming models involving Task Programming, Thread Programming and Map Reduce Programming and tools for rapid creation of applications and their seamless deployment on private or public Clouds to distribute applications.





Aneka

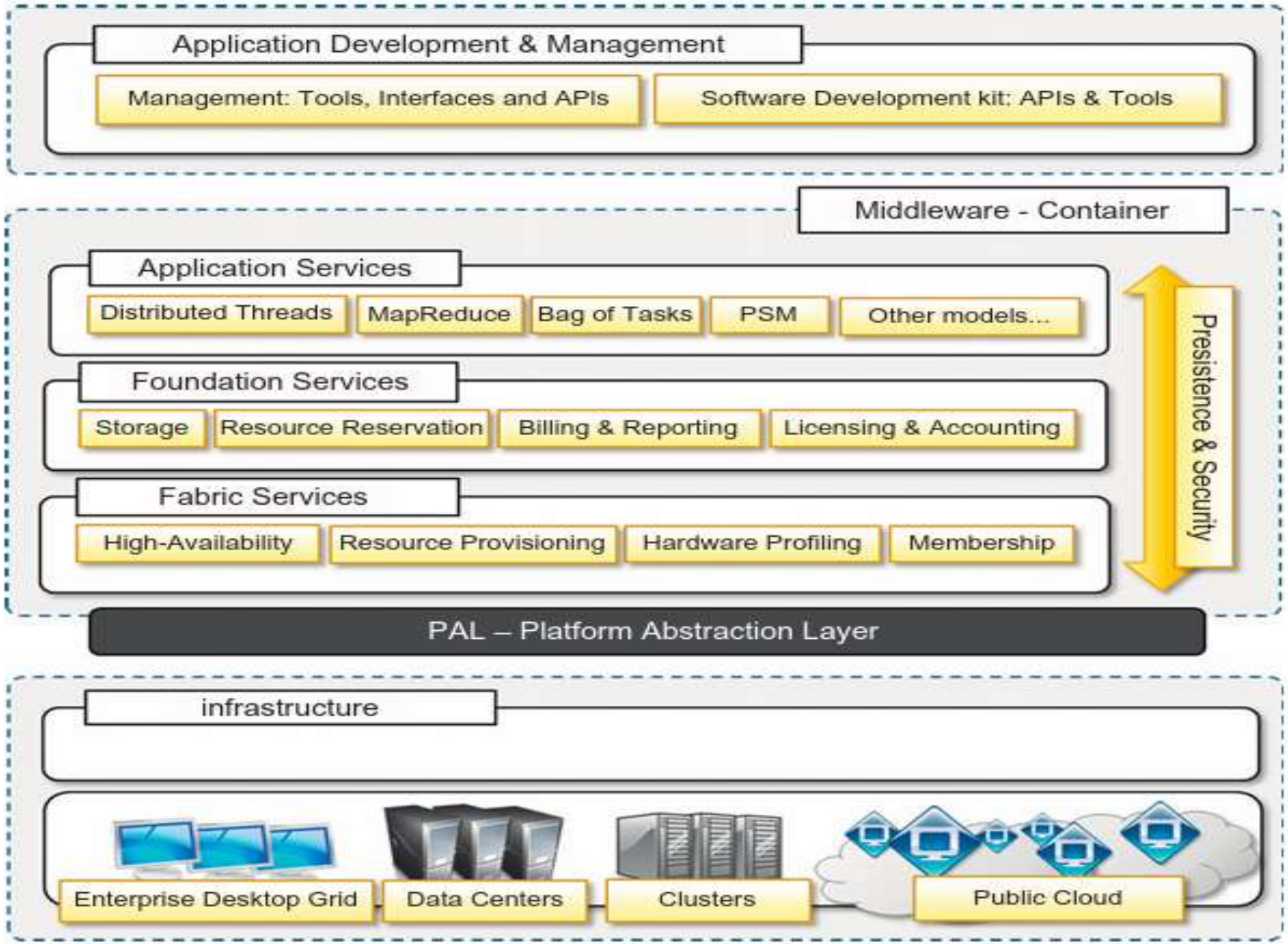
Aneka technology primarily consists of two key components:

- **SDK (Software Development Kit)** containing application programming interfaces (APIs) and tools essential for the rapid development of applications. Aneka APIs supports three popular Cloud programming models: Task, Thread, and MapReduce.
- **A Runtime Engine and Platform** for managing ,deployment and execution of applications on private or public Clouds.

One of the notable characteristics of Aneka PaaS is to support the provisioning of **private cloud resources** ranging from desktops, clusters to virtual data centers using VMWare, Citrix Zen server and **public cloud resources** such as Windows Azure, Amazon EC2, and GoGrid Cloud Service.

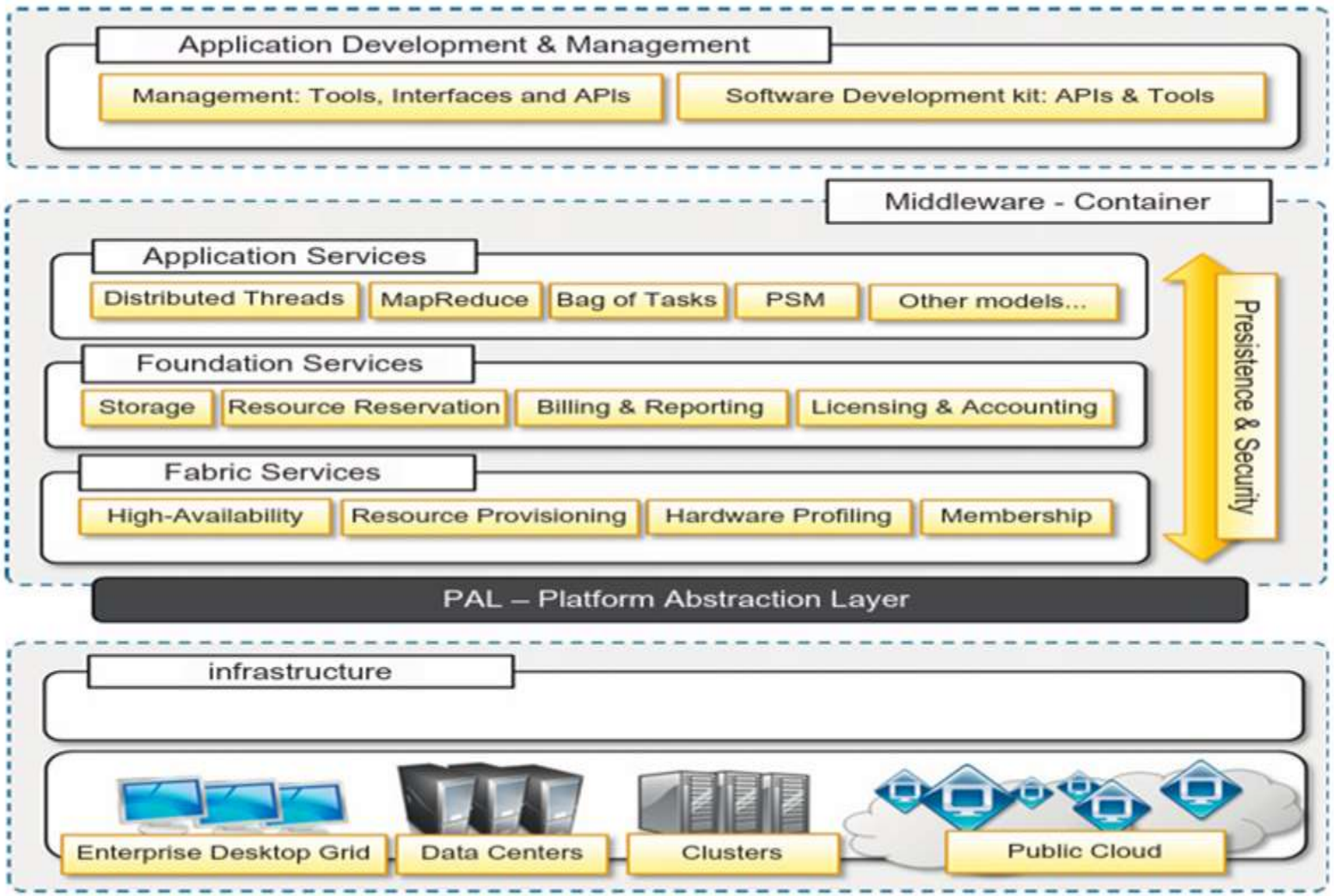
Aneka Features to Applications

- **Elasticity and scaling:** Aneka supports dynamic upsizing and downsizing of the infrastructure available for applications.
- **Runtime management:** The runtime machinery is responsible for keeping the infrastructure up and running the serves as a hosting environment for services.
- **Resource management:** Aneka is an elastic infrastructure in which resources are added and removed dynamically according to application needs and user requirements.
- **Application management:** A specific subset of services is devoted to managing applications.
- **User management:** Aneka is a multitenant distributed environment in which multiple applications, potentially belonging to different users, are executed.
- **QoS/SLA management and billing:** Application execution is metered and billed.



Frame work of the Aneka

Anatomy of the Aneka container



Execution

Application Management

Infrastructure management, supporting services for the Aneka Cloud

Anatomy of the Aneka container

- The Aneka container constitutes the building blocks of Aneka Clouds and represents the runtime machinery available to services and applications.
- The main role of the container is to provide a lightweight environment in which to deploy services and some basic capabilities such as communication channels through which it interacts with other nodes in the Aneka Cloud.
- **The services stack resides on top of the Platform Abstraction Layer (PAL), representing the interface to the underlying operating system and hardware.** It provides a uniform view of the software and hardware environment in which the container is running.
- **Persistence and security traverse** all the services stack to provide a secure and reliable infrastructure.

Components

- 1.Application Development & Management
- 2 Middleware Container
- a. Application Services
- b. Foundation Services
- c. Fabric Services
- 3. PAL- Plat Form Abstraction Layer
- 4.Infrastructure

Platform Abstraction Layer (PAL)

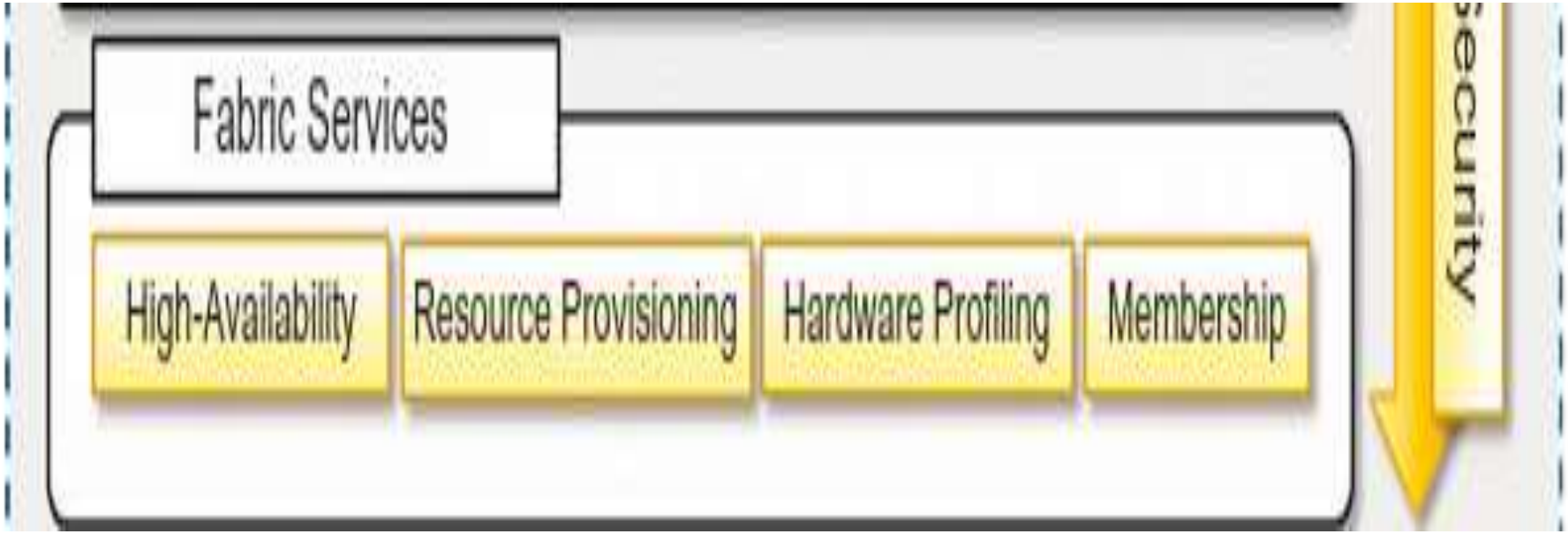
- **The core infrastructure of the system is based on the .NET technology and allows the Aneka container to be portable over different platforms and operating systems using the Common Language Infrastructure** (CLI), which is the specification introduced in the ECMA-334 standard.
- The PAL provides the 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.

Cntd.

- **The collectible data that are exposed by the PAL** are the following:
  - Number of cores, frequency, and CPU usage
  - Memory size and usage
  - Aggregate available disk space
  - Network addresses and devices attached to the node

1.Fabric Services

- Fabric Services defines 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.



Cntd..

- Fabric Services containing
- 1.Resource Management
- 2. Profiling and monitoring.



Cntd.

1.1. Resource management

- It comprises several tasks: resource membership, resource reservation, and resource provisioning.
- Aneka provides a collection of services that are in charge of managing resources.
  - The Index Service (or Membership Catalogue)
  - Reservation Service
  - Resource Provisioning Service.



Cntd.

1. **The Index Service (or Membership Catalogue)**
- The nodes that are connected or disconnected.
- Container publishes during startup
- Discover the available services and interact with them.
- Collects the dynamic performance data of each node.

2. **Resource Provisioning Service**
- **It allows the integration and management of virtual resources**
- Flexible/Dynamic Infrastructure for provisioning
- Resource Pool – Common Interface

3. **Reservation Service**
- **Scheduling the services**



Cntd.

1.2. Profiling and monitoring

- Profiling and monitoring services are mostly exposed through
  - The Heartbeat
  - Monitoring
  - 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.



2.Foundation services

- 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.
- Allow developers to concentrate only on the logic that distinguishes a specific programming model from the others.
- These services cover
  1. Storage management for applications
  2. Accounting, billing, and resource pricing
  3. Resource reservation



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2.1.Storage management

Two different facilities for storage management:

- Centralized file storage, which is mostly used for the execution of compute-intensive applications
- Distributed file system, which is more suitable for the execution of data-intensive applications

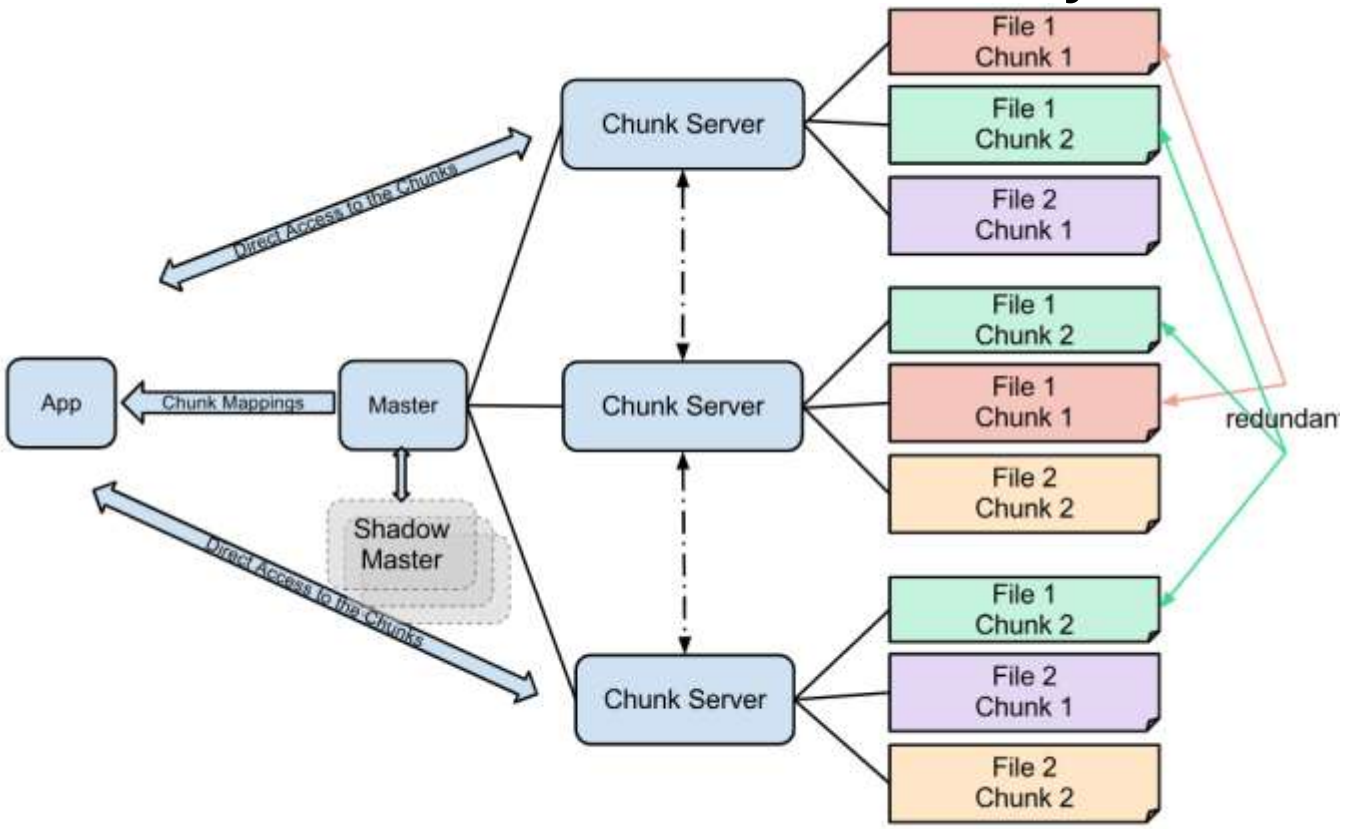
Centralized Storage

- Centralized storage is implemented through and managed by Aneka's Storage Service.
- **FTP - file channel**
  - **file channel controller** constitutes the server component
  - **file channel handler** represents the client component

Cntd,

Distributed File System:

- The reference model for the distributed file system is the Google File System





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2.2.Accounting, billing, and resource pricing

- **Accounting Services** keeps track of the status of applications in the Aneka Cloud. The information collected for accounting is primarily related to infrastructure usage and application execution.
- **Aneka Billing Service** provides detailed information about each user's usage of resources, with the associated costs.
- **Resource Pricing:** 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.



Cntd..

2.3.Resource reservation

Resource reservation is built out of two different kinds of services

- **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.

Three Reservations

- **Basic Reservation** with alternate offers protocol
- **Libra Reservation**: the ability to price nodes differently
- **Relay Reservation**: allows a resource broker to reserve nodes



3.Application services

Application Services manage the execution of applications and constitute a layer that differentiates according to the specific programming model used for developing distributed applications on top of Aneka.

3.1Scheduling

- Common tasks that are performed by the scheduling component are the following:
  - Job-to-node mapping
  - Rescheduling of failed jobs
  - Job-status monitoring
  - Application status monitoring



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3.2Execution

Execution services control the execution of single jobs that compose applications

some common operations that apply across the range of supported models:

- Unpacking the jobs received from the scheduler
- Retrieval of input files required for job execution
- Sandboxed execution of jobs
- Submission of output files at the end of execution
- Execution failure management
- Performance monitoring
- Packing jobs and sending them back to the scheduler

Building Aneka Clouds

Building Aneka Clouds

- Aneka is a platform designed for **developing applications** for the cloud environment
- Aneka is a software platform that requires an infrastructure on which to be deployed
- Tools are designed to manage the infrastructure

Building Aneka Clouds

- Infrastructure Organization
- Logical Organization
- Private Cloud Deployment Mode
- Public Cloud Deployment Mode
- Hybrid Cloud Deployment Mode

• Infrastructure Organization

- Infrastructure Organization provides an overview of Aneka Clouds from an infrastructure point of view
- This refers to the physical and virtual resources required for deploying Aneka
- **Key Components**
  - **Administrative Console:** Manages the entire Aneka Cloud.
  - **Repositories:** Store and distribute the libraries needed to run Aneka. The Management Console in Aneka is designed to handle multiple repositories
  - **Node Deployment:** Involves installing the Aneka daemon on nodes to create and manage containers. The process is supported by the Administrative Console, which provides tools for uniform management and configuration of nodes.
  - **Uniform Management:** Ensures consistent management of both physical and virtual nodes
  - **Dynamic Provisioning:** Allows for quick creation and configuration of virtual instances to join the Aneka Cloud.

Aneka Cloud Infrastructure Organization

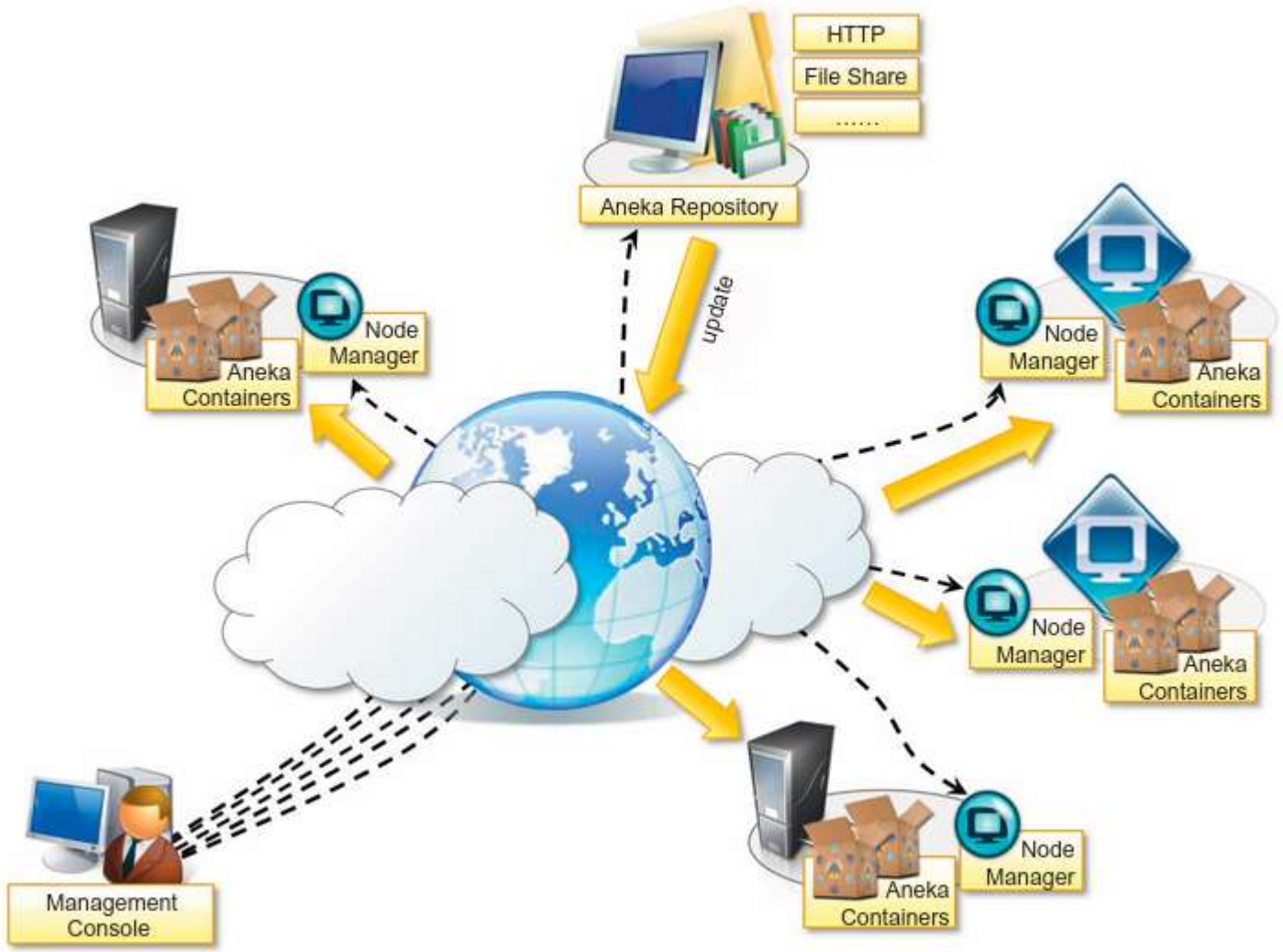


FIGURE 5.3

Aneka cloud infrastructure overview.

• Logical Organization

The logical organization of Aneka Clouds is highly adaptable and can vary greatly depending on the configuration chosen for the container instances within the cloud. The most common setup follows a master-worker configuration with separate nodes dedicated to storage.

- **Master Node:** Coordinates and manages the overall cloud environment.
- **Worker Nodes:** Execute tasks and run applications distributed by the master node.
- **Resource Allocation:** Logical segmentation of resources to optimize performance and scalability.

• Logical Organization

- **Master Node services:**

The master node is pivotal to the cloud's intelligence and control.

- **Index Service**: Acts as the master copy, functioning as the membership catalog for the cloud.
- **Heartbeat Service**: Monitors the health and status of nodes.
- **Logging Service**: Collects and manages logs from different nodes.
- **Reservation Service**: Manages resource reservations.
- **Resource Provisioning Service**: Handles the allocation and provisioning of resources.
- **Accounting Service**: Tracks resource usage for billing and monitoring.
- **Reporting and Monitoring Service**: Provides insights and reports on cloud operations.
- **Scheduling Services**: Manages job scheduling for supported programming models.

• Logical Organization

•**Worker Node services:**

Worker nodes perform the bulk of the **computational tasks** in the Aneka Cloud. They are configured to execute applications and include mandatory services as well as execution services for the supported programming models:

- **Index Service**: Registers with the master node.
- **Heartbeat Service**: Reports node status to the master.
- **Logging Service**: Collects logs specific to the worker node's operations.
- **Allocation Service**: Manages resource allocation for tasks.
- **Monitoring Service**: Tracks the performance and status of tasks.
- **Execution Services:** Specific to the supported programming models.

• Logical Organization

•Storage Node services:

Storage nodes are optimized to provide storage support to applications and typically include

- **Index Service:** Registers with the master node**.**
- **Heartbeat Service:** Ensures the node's health status is monitored.
- **Logging Service**: Manages logs related to storage operations.
- **Monitoring Service**: Tracks storage usage and performance.
- **Storage Service**: Manages the storage and retrieval of application data.

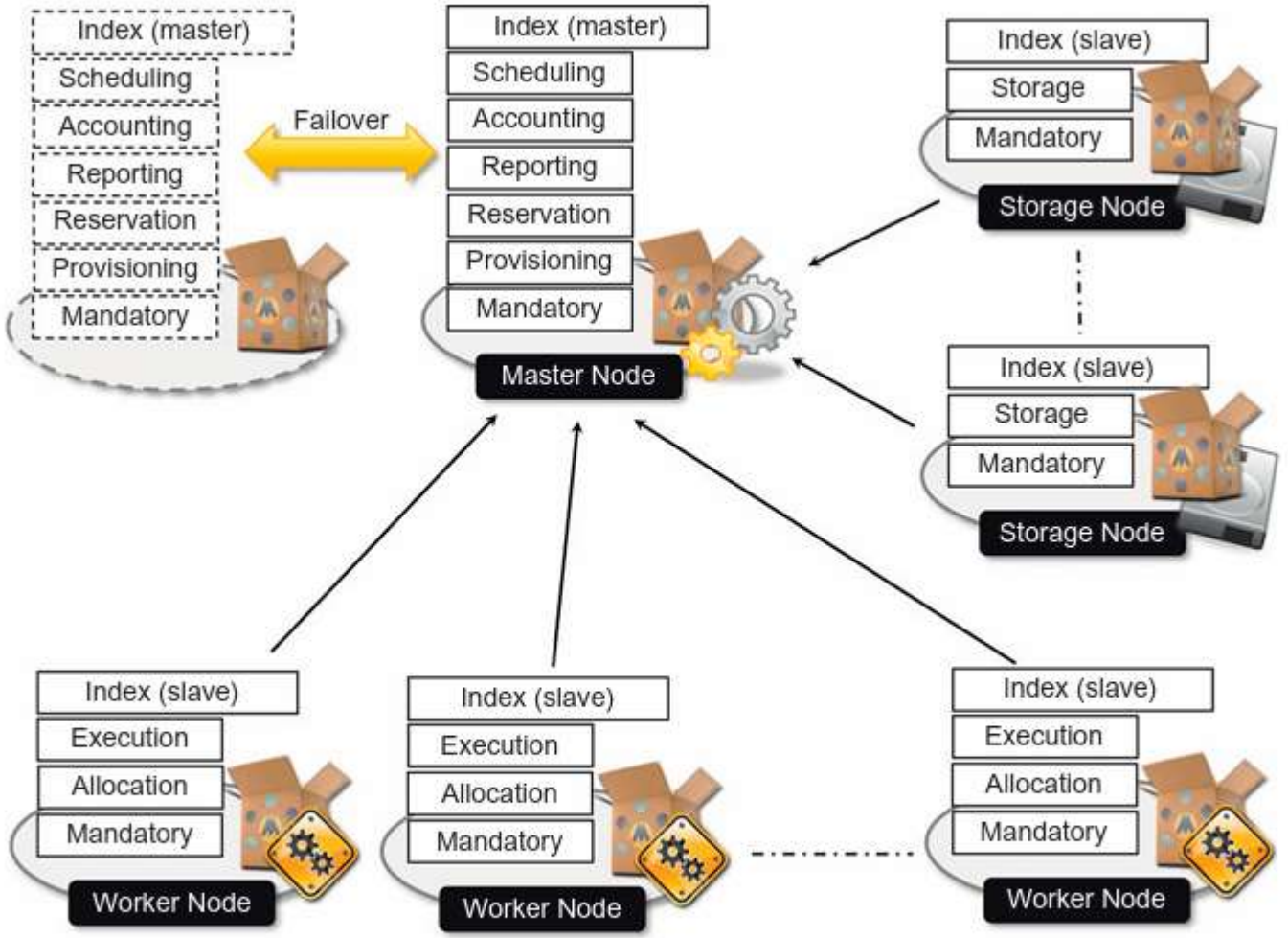


FIGURE 5.4

Logical organization of an Aneka cloud.

Aneka Cloud Logical Organization

• Private Cloud Deployment Mode

- Private cloud deployment mode in Aneka Clouds leverages local physical resources and infrastructure management software to create a secure and dedicated cloud environment
- the cloud is built using a diverse mix of local physical machines, such as desktop computers, clusters, and workstations.
- Infrastructure management software like XenServer, Eucalyptus, and OpenStack is used to manage the local pool of nodes.
- These systems facilitate the integration and management of both physical and virtual nodes within the private cloud
- The Resource Provisioning Service enables the addition of virtual nodes from the local resource pool.
- This dynamic provisioning allows the cloud to scale up or down based on workload demands, providing flexibility and efficiency
- The Reservation Service allows for the implementation of specific resource management policies.

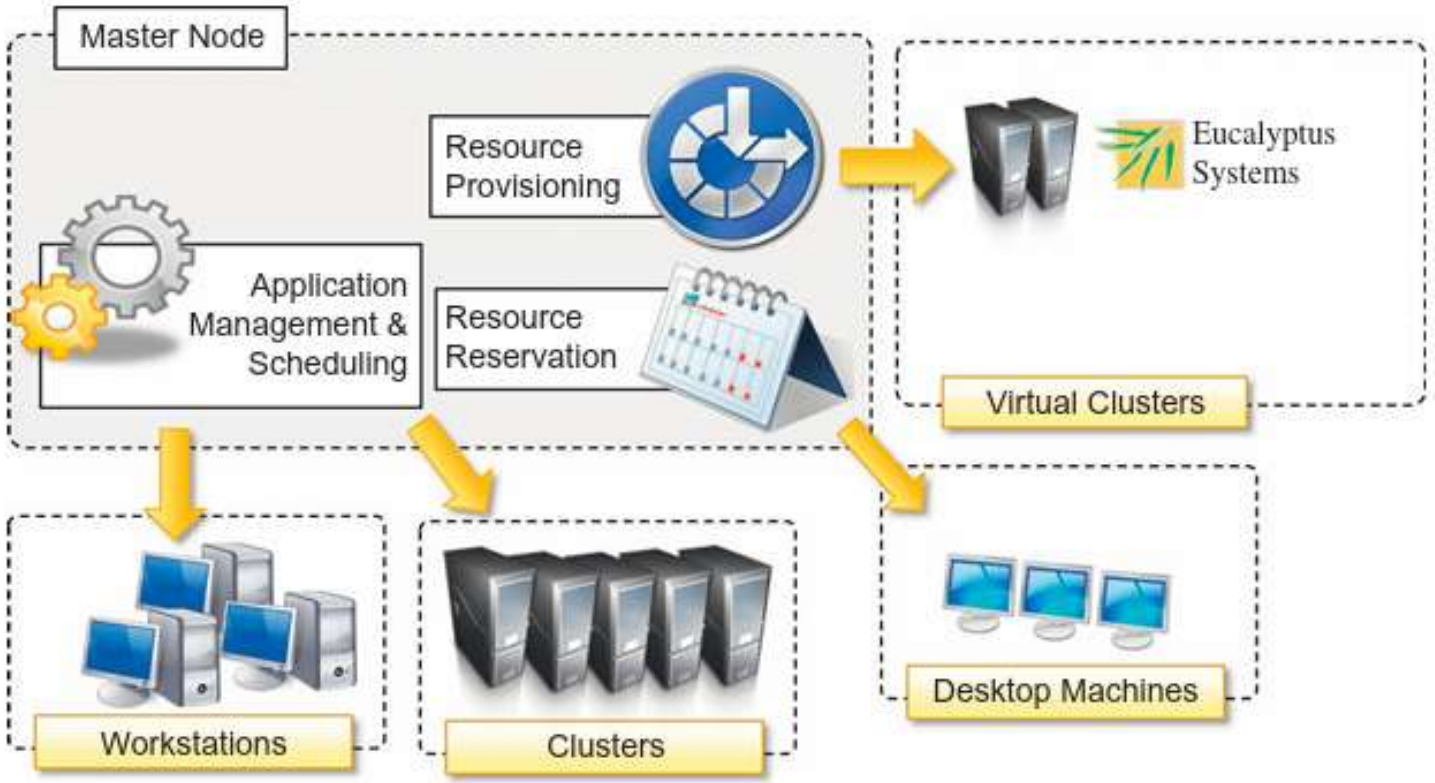


FIGURE 5.5

Private cloud deployment.

Aneka Private cloud Deployment Mode

• Public Cloud Deployment Mode

- Public cloud deployment mode involves setting up Aneka master and worker nodes on a completely virtualized infrastructure hosted by one or more resource providers, such as Amazon EC2 or GoGrid.
- This mode leverages the infrastructure as a service (IaaS) capabilities provided by these cloud providers to create a dynamic and scalable cloud environment
- In a public cloud deployment, there are two main scenarios:

➢ Static Deployment:

Nodes are provisioned beforehand and used as if they were physical machines. This setup replicates a classic Aneka installation on a virtual infrastructure without utilizing dynamic provisioning capabilities.

➢ Dynamic Deployment:

The elastic features of IaaS providers are used to create a completely dynamic cloud environment. Nodes are provisioned on-demand, allowing the infrastructure to scale up or down based on current needs.

• Public Cloud Deployment Mode

Infrastructure and Services

- The deployment is generally contained within the infrastructure boundaries of a single IaaS provider. This approach minimizes data transfer between different providers, reducing costs and improving network performance
- Key services included in the master node are the Accounting and Reporting services. These services provide detailed information about resource utilization by users and applications

Dynamic Provisioning

- Dynamic instances are mostly configured as worker nodes. For example, in Amazon EC2, different images with varying hardware setups can be made available to instantiate worker containers.

Considerations for Multi-provider Deployments

- Deployments using different providers are uncommon due to high data transfer costs. However, a possible scenario for federated clouds exists, where resources are shared or leased among providers under specific agreements and more favorable pricing.

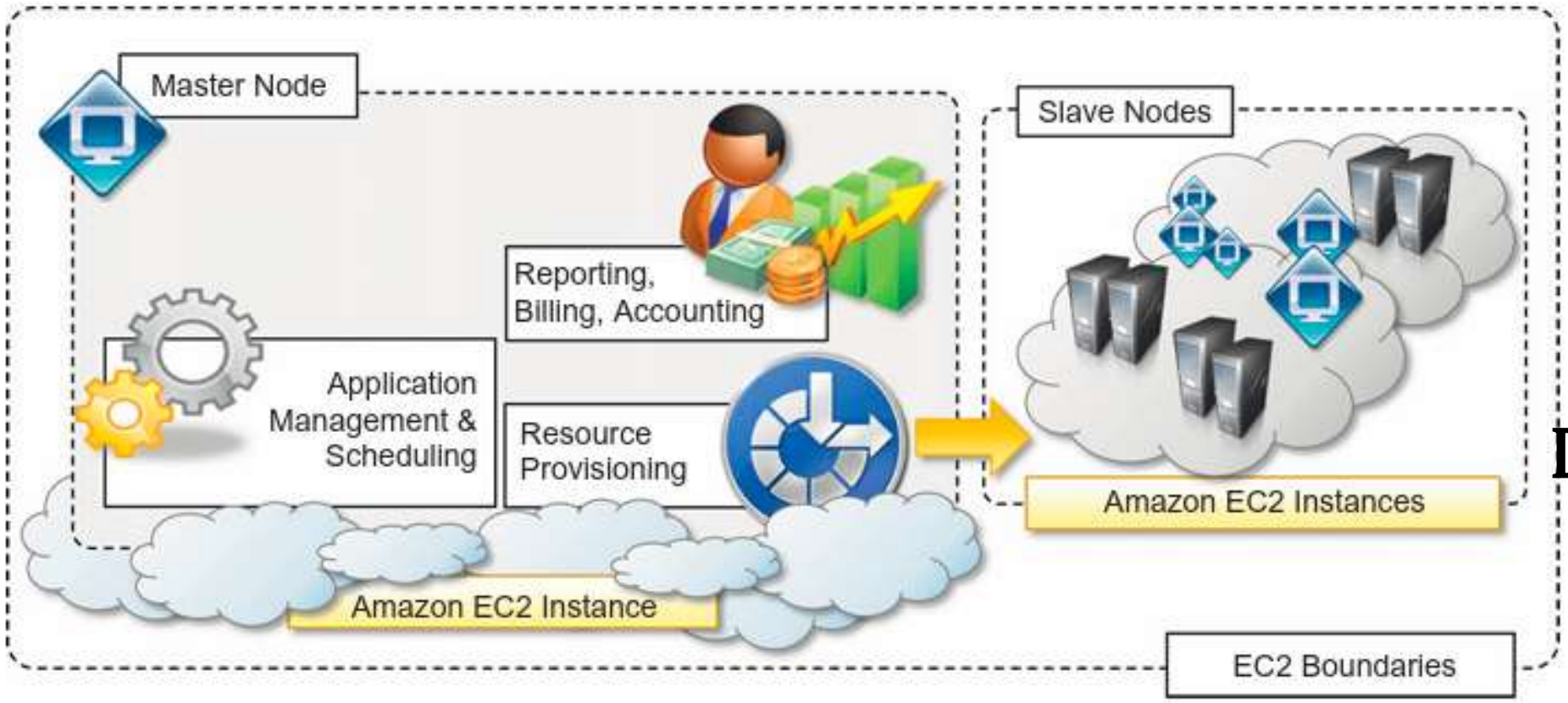


FIGURE 5.6

Public Aneka cloud deployment.

Aneka Public cloud Deployment Mode

• Hybrid Cloud Deployment Mode

- Hybrid cloud deployment mode is the most common and comprehensive deployment of Aneka, combining the strengths of both private and public cloud environments.
- This model leverages existing computing infrastructure and dynamically scales it on-demand using additional resources when needed.
- Uses existing local infrastructure, including virtual machine management, to provide a reliable, cost-efficient environment for most applications.
- The hybrid cloud model enables several key capabilities of the Aneka framework, including
  - Dynamic Resource Provisioning
  - Resource Reservation
  - Workload Partitioning
  - Accounting, Monitoring, and Reporting
- The local infrastructure is supplemented by external IaaS providers to handle additional computing demands. This mixed environment benefits from the flexibility of public clouds while maintaining control over sensitive data and critical applications within the private infrastructure. The Resource Provisioning Service in Aneka plays a crucial role by enabling the simultaneous use of multiple resource pools and implementing policies to choose the best resources for specific provisioning requests

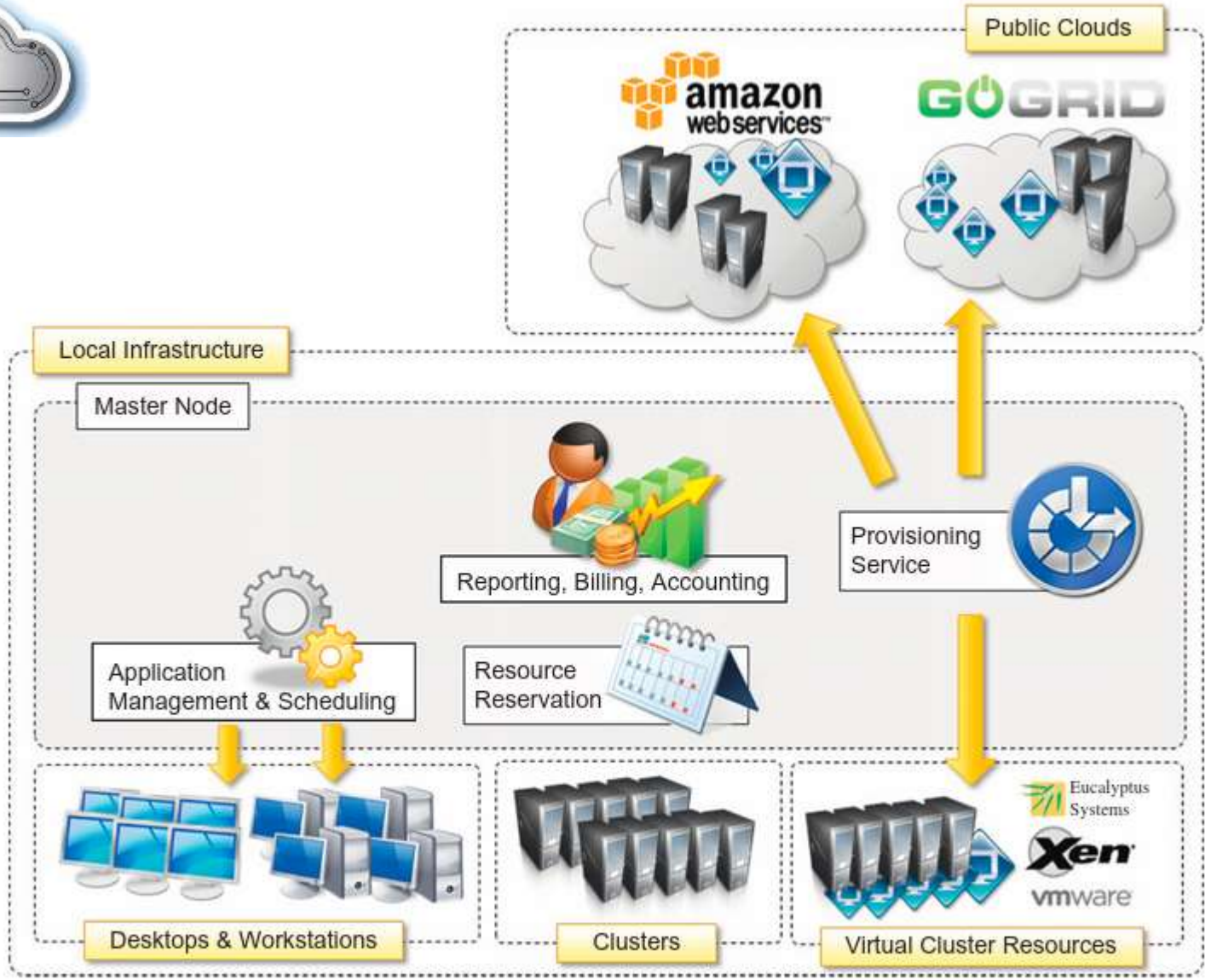


FIGURE 5.7

Hybrid cloud deployment.

Aneka Hybrid cloud Deployment Mode