Cloud Computing

Platform as a Service

Agenda

- Introduction
  - From IaaS to PaaS
  - What is PaaS
  - PaaS properties and characteristics
- Cloud Platform
  - Case studies

From IaaS to PaaS

What is PaaS

PaaS properties and characteristics

INTRODUCTION

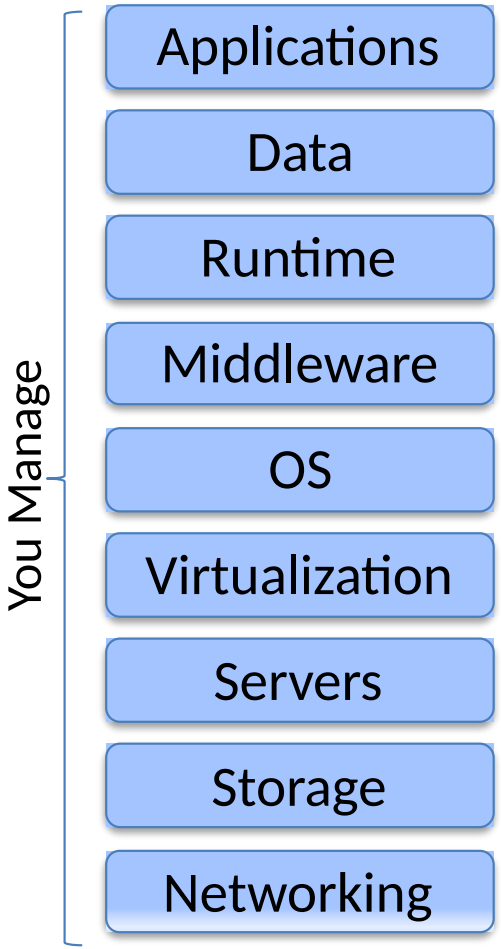
What Has IaaS Done

- IaaS provides virtual machines and resources such that IaaS vendors can segment resources for each user
- IaaS providers can also make users do not need to purchase the hardware
- IaaS can make better use of resources

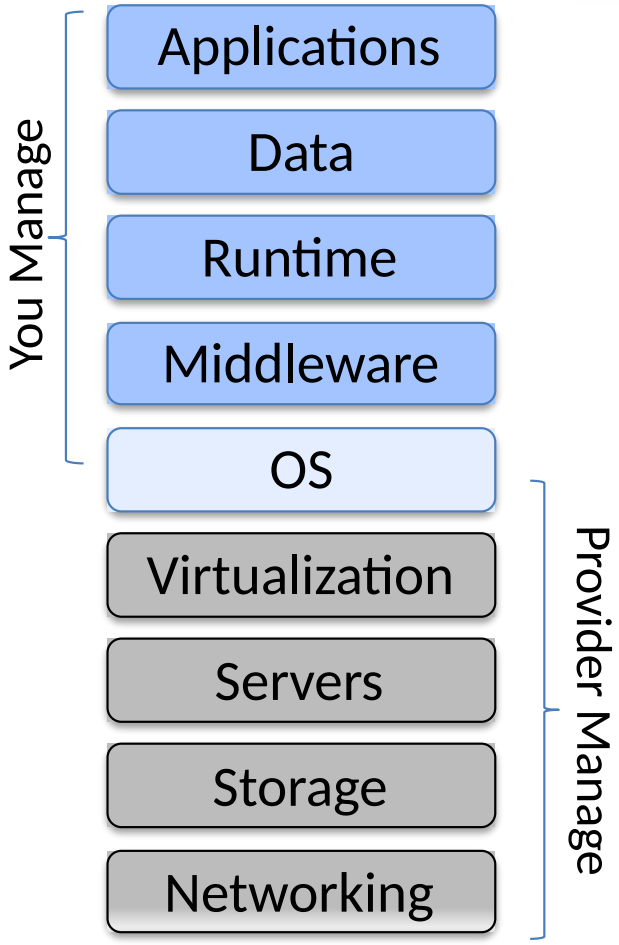
But is it enough?

What IaaS Can Do

- Traditional IT



- IaaS



IaaS is Not Enough

- IaaS provides many virtual or physical machines, but it cannot alter the quantity automatically
- Consumers might
  - Require automatic make-decisions of dispatching jobs to available resources
  - Need a running environment or a development and testing platform to design their applications or services

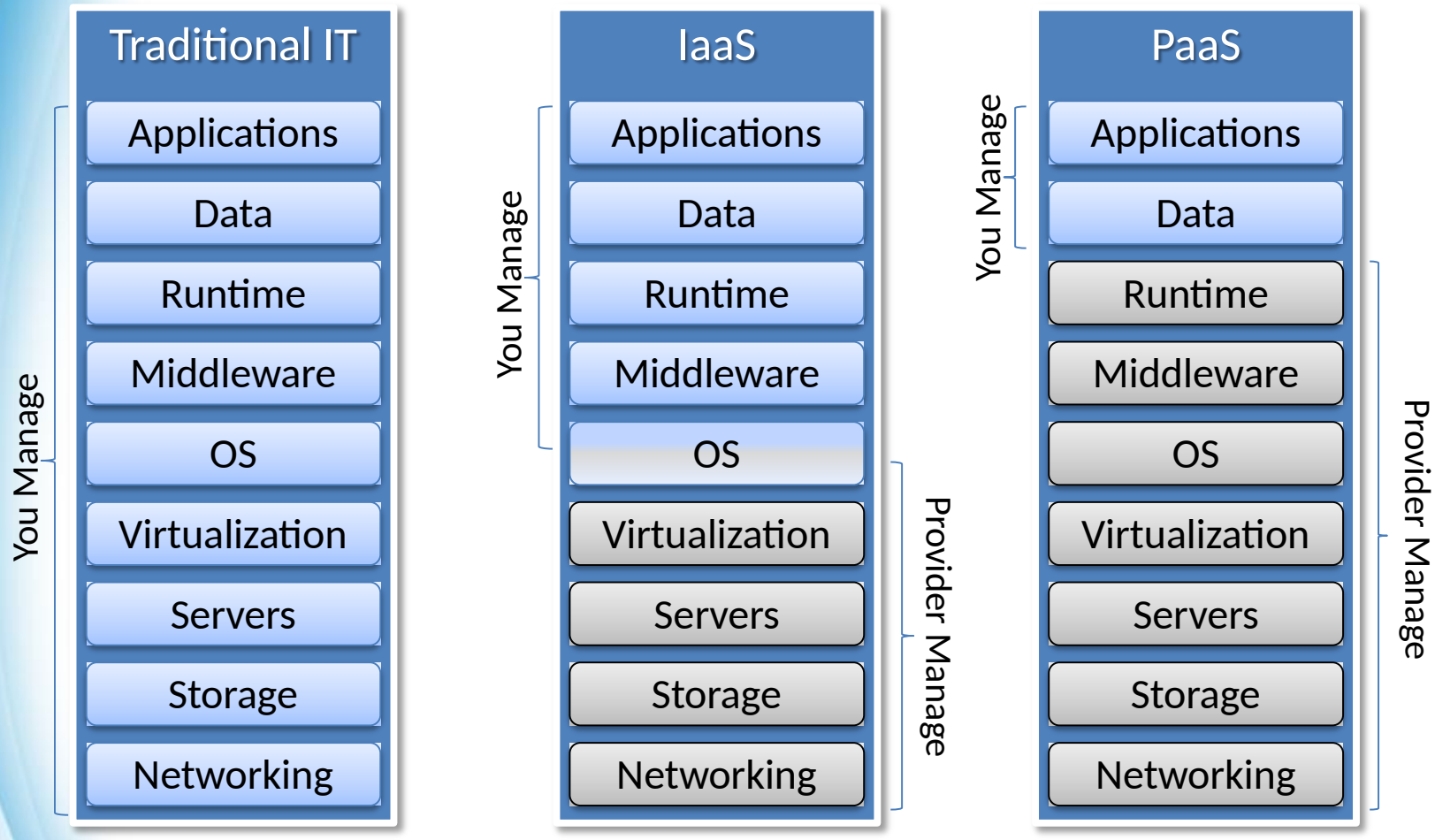
More Requirements

- Consumers require more and more…
  - Large-scale resource abstraction and management
  - Requirement of large-scale resources on demand
  - Running and hosting environment
  - Automatic and autonomous mechanism
  - Distribution and management of jobs
  - Access control and authentication
  - …

PaaS Buys It for You

- PaaS provides a series of properties that can satisfy user's requirements
- PaaS guarantees the quality of resources, services and applications

From IaaS to PaaS



From IaaS to PaaS

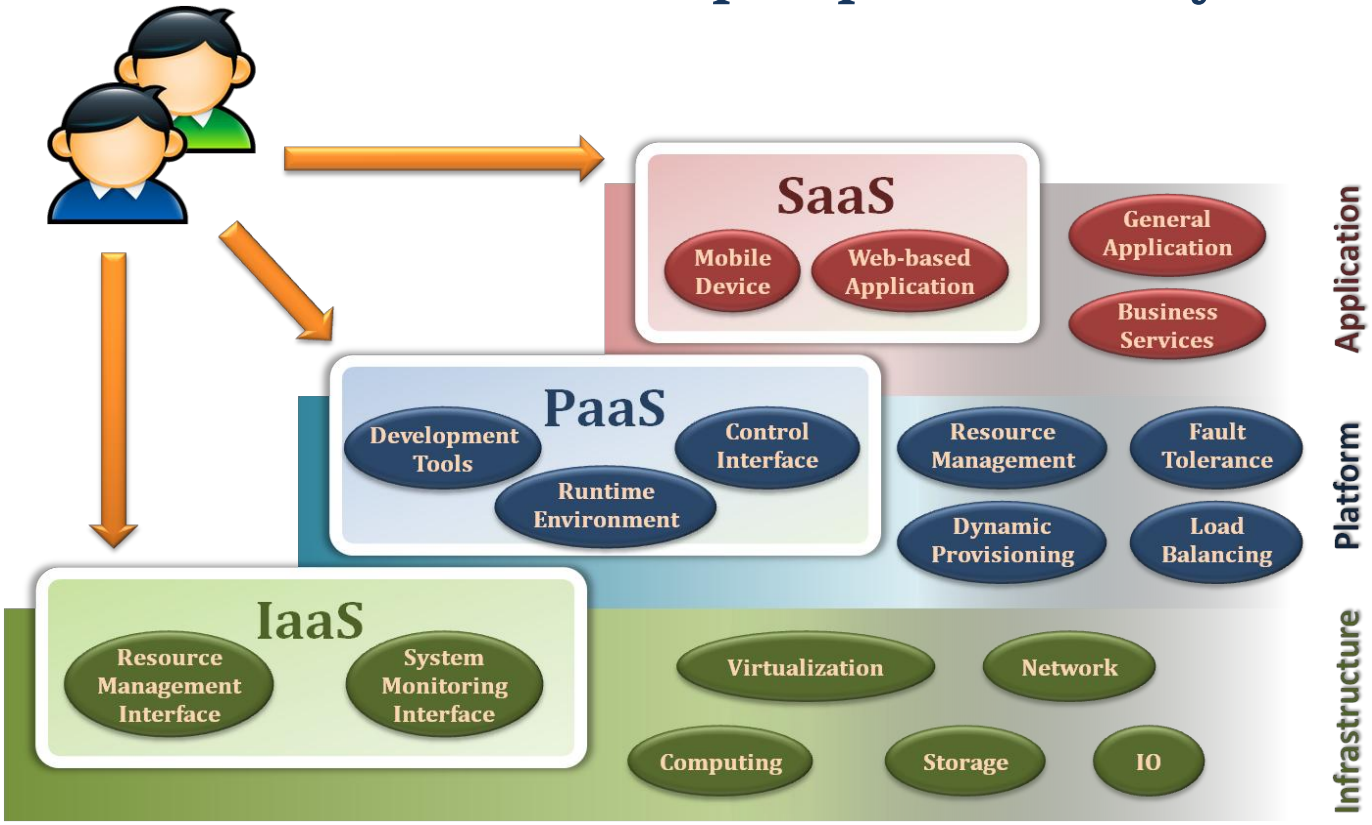
What is PaaS

PaaS properties and characteristics

INTRODUCTION

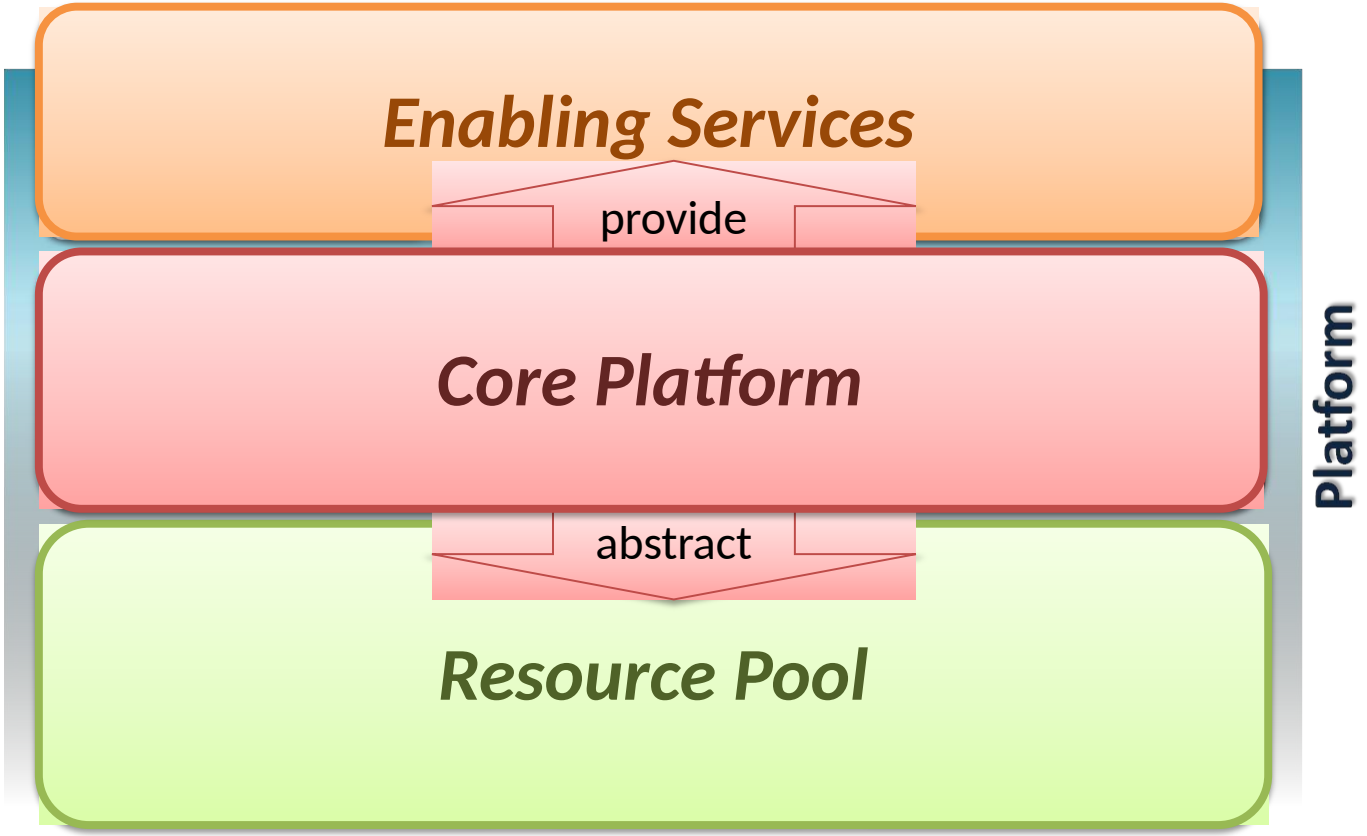
Platform as a Service

Platform as a Service (PaaS) is a computing platform that abstracts the infrastructure, OS, and middleware to drive developer productivity



Platform as a Service

- Deliver the computing platform as a service
  - Developing applications using programming languages and tools supported by the PaaS provider
  - Deploying consumer-created applications onto the cloud infrastructure

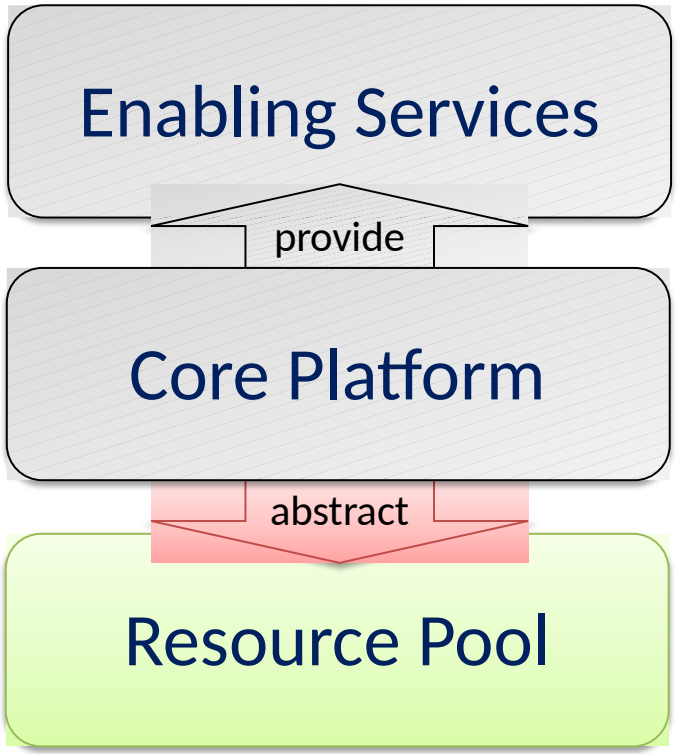


Resource Pool

The capacities to abstract and control all the underlying resources

- Resource Pool dynamically provides an abstraction and consolidation of large-scale resources

- Consumers can acquire and return resources from the resource pool on demand



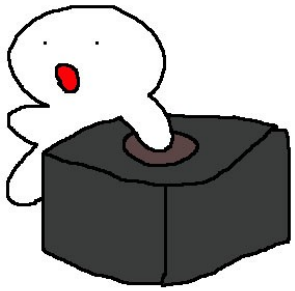
Resource Pool

- Reduce the complexity and responsibility of cloud infrastructure
- Provide the automatic management to provision resources
- Access resources from the resource pool on demand

Resource Pool

- PaaS providers define the smallest unit of resource
  - 1GHz CPU computation ability
  - 1GB storage space
  - 1MB memory capacity
  - …etc

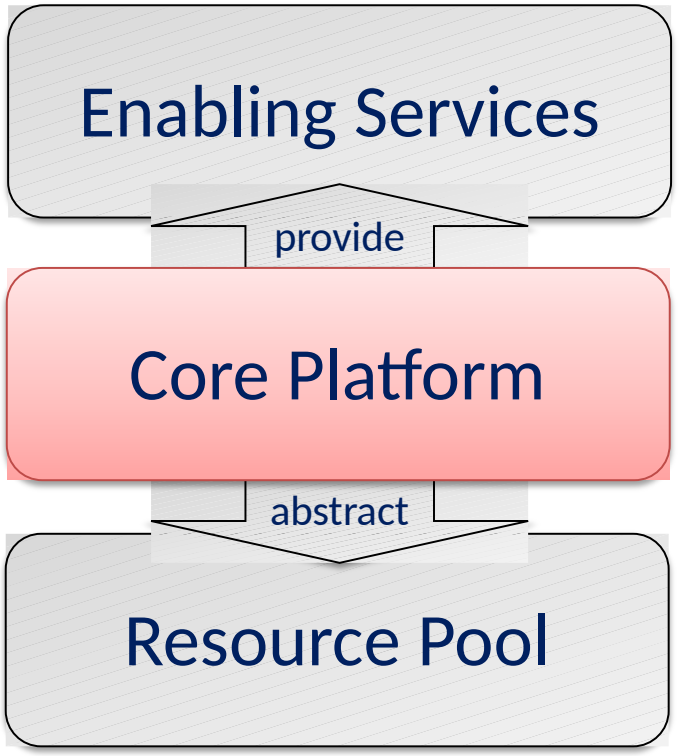
- PaaS consumers can require units on their demand
- Consumers may not be aware of whether provided resource is dedicate or shared



Core Platform

To provide a reliable environment for running applications and services

- Core Platform provides basic functionalities of a PaaS environment
- Act as a bridge between consumer and hardware



Core Platform

- Reduce the responsibility of the runtime environment
- Based on the core platform to develop their applications
- Do not need to care about how to built, configure, manage and maintain the backend environment

Core Platform

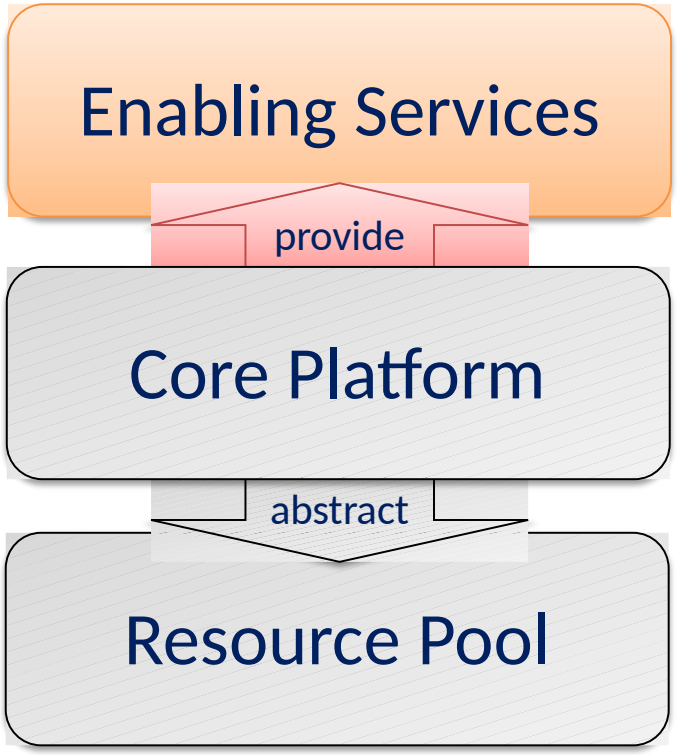
- PaaS providers can provide a runtime environment for the developer platform
- Runtime environment is automatic control such that consumers can focus on their services
  - Dynamic provisioning
    - On-demand resource provisioning
  - Load balancing
    - Distribute workload evenly among resources
  - Fault tolerance
    - Continuously operating in the presence of failures
  - System monitoring
    - Monitor the system status and measure the usage of resources

Enabling Services

To provide platform interfaces and services to drive the development productivities

- Enabling Services provide programming IDE and system control interfaces to access the PaaS environment

- Consumers can develop their applications through the APIs and development tools



Enabling Services

- Provide a development and testing platform for running developed applications on the runtime environment
- Reduce the responsibility of managing the development environment
- Decrease the development period

painful

Enabling Services

- Enabling Services are the main focus of consumers
- Consumers can make use of these sustaining services to develop their applications
  - Programming IDE
    - Integrate the full functionalities supported from the runtime environment
    - Provide some development tools, such as profiler, debugger and testing environment
  - System Control Interfaces
    - Make the decision according to some principles and requirements
    - Describe the flow of installation and configuration of resources

From IaaS to PaaS

What is PaaS

PaaS properties and characteristics

INTRODUCTION

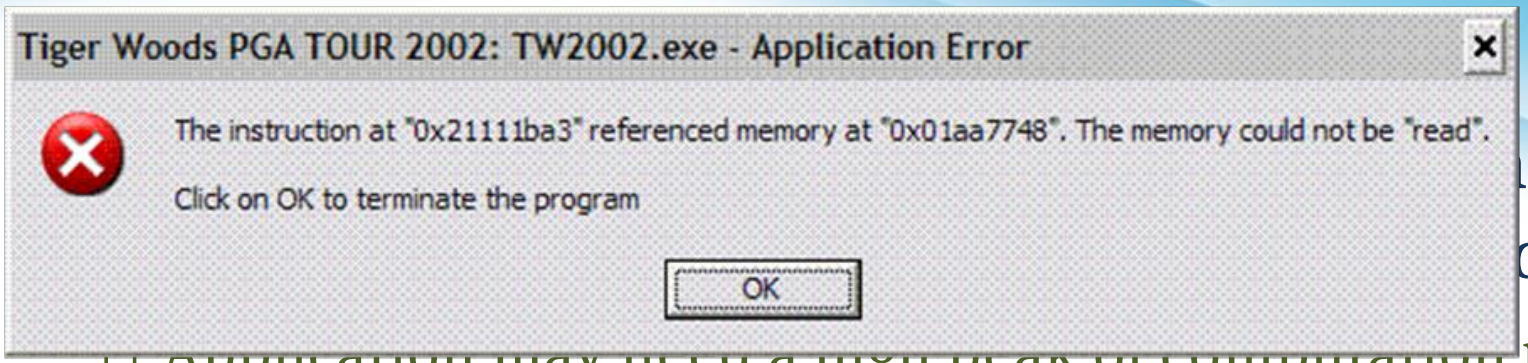
Platform as a Service

- Guarantee some properties and characteristics
  - Scalability
  - Availability
  - Manageability
  - Performance
  - Accessibility

Scalability

- PaaS needs to support dynamic provisioning that can increase or decrease resources on demand
- PaaS provides the abstraction of cloud infrastructure and the automatic management

Scalability



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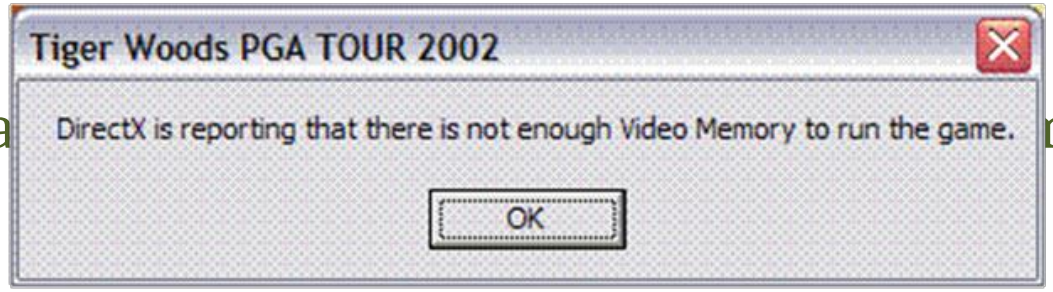
- Application may need a high peak of computation usage on
- It a ne time

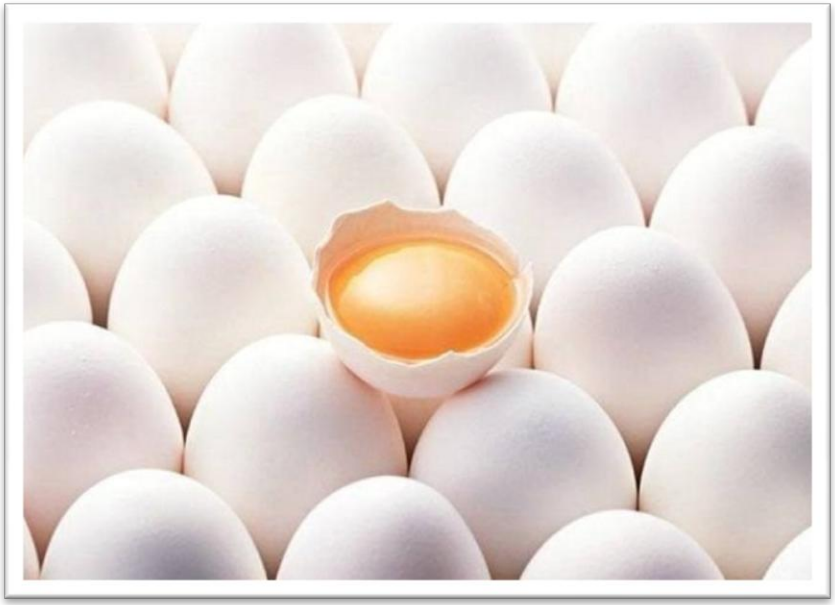


- For end users, they could
  the lack of memory or sto
  - For example…

Availability

- PaaS needs to support the fault tolerance ability such that system would not crash on failure

- PaaS also needs to provide system resilience by duplicating applications or services



Availability

- PaaS supports automatic backup and disaster recovery such that consumers do not need to worry about system failures
- When some resources are failed, PaaS would start up the backup resources
- When applications occur fault, PaaS would migrate services to the duplicate one

There is no error

Manageability

- PaaS needs to support self-management for running applications and services on the cloud platform

- PaaS needs to provide automatic control, analysis and measurement for the resource usage

Manageability

- PaaS provides automatic mechanisms to control the utilization of platform resources
- Monitoring service provides the ability of management, analysis and operation for resources and jobs
- Based on the system monitoring, PaaS can record and report the usage of resources
- Consumers can pay for what they use

Billing

- Consumers pay the bill according to how many units of resources and services they use
  - Input/output network bandwidth
  - Management report or warning
  - CPU time
  - Storage space
  - Data migration
  - …etc

Billing

- Consumers can set the boundary they would not like to pay the overestimate
- PaaS vendor may provide the free quota for users
- PaaS vendor can also alert consumer the suddenly increased usage
- As a result, consumers only pay what they use on demand

Performance

- Enterprise runs complicated applications on PaaS which can allocate jobs to available servers
- If possible, PaaS would run application in parallel
- No resource is always overloading on the load balancing PaaS
- Utilization and performance could be further improved

Security

- Security is an important characteristic in PaaS
- PaaS needs to provide authentication and authorization to differentiate the access rights of different users

Security

- Authorization can be used to control the user's access right and reject the malicious request
- Authentication is the act of establishing or confirming something or someone as authentic
- All of these can limit the malicious behavior

Accessibility

- PaaS needs to provide an interactive interface for consumers to access cloud services or monitor the system status
- Consumers could develop and test their applications via web browsers or other thin-clients

Summary

- PaaS is a magic box
  - Request anything on demand, and return the rent of resources dynamically
  - Automatically build an initial environment and support self-management with high quality of service and performance
  - Provide an ability of fault tolerance and disaster recovery that make services be more available and reliable
  - Support the security property to limit malicious behavior in cloud environments
- More important
  - Do not care about how it works
  - Pay as you go

Case Studies

CLOUD PLATFORM

PaaS Players

- PaaS venders
  - Microsoft Windows Azure
  - Hadoop
  - Google App Engine