Lecture 5

- **Infrastructure as a Service (IaaS)**
- **Platform as a Service (PaaS)**

Introduction to IaaS

- **IaaS**— Infrastructure as a Service (IaaS) is a form of cloud computing that provides virtualized computing resources over the Internet.
- **IaaS** iS one of three main categories of cloud computing services, alongside
- In an **IaaS** model, a third-party provider hosts hardware, software, servers, storage and other infrastructure

- **IaaS** providers also host users' applications and handle tasks including system maintenance, backup and resiliency planning. Software as a Service (SaaS) and Platform as a Service (PaaS)

Advantages of IaaS

- ❑ Eliminates capital expense and reduces ongoing cost,

- ❑ Improves business continuity and disaster recovery.

- ❑ Innovate rapidly.

- ❑ Respond quicker to shifting business conditions.

- ❑ Focus on your core business.

- ❑ Increase stability, reliability and supportability.

- ❑ Better security.

- ❑ Gets new apps to users faster.

IaaS

STORAGE MANAGEMENT

MONITORING, ALERTING, & NOTIFICATION

DATABASE MANAGEMENT

APPLICATION MANAGEMENT

IT INFRASTRUCTURE SERVICE

NETWORK MANAGEMENT

SECURITY MANAGEMENT

SERVER MANAGEMENT

SERVER PROVISIONING

Common IaaS business scenarios

Typical things businesses do with IaaS include

❑ Test and development. Teams can quickly set up and dismantle test and development environments, bringing new applications to market faster, IaaS makes it quick and economical to scale up dev-test environments up and down.

❑ Website hosting. Running websites using IaaS can be less expensive than traditional web hosting.

❑ Storage, backup and recovery. Organizations avoid the capital outlay for storage and complexity of storage management, which typically requires a skilled staff to manage data and meet legal and compliance requirements. IaaS is useful for handling unpredictable demand and steadily growing storage needs. It can also simplify planning and management of backup and recovery systems.

Common IaaS business scenarios

- **Web apps**. IaaS provides all the infrastructure to support web apps, including storage, web and application servers and networking resources. Organizations can quickly deploy web apps on IaaS and easily scale infrastructure up and down when demand for the apps is unpredictable.

- **High-performance** computing. High-performance computing (HPC) on supercomputers, computer grids or computer clusters helps solve complex problems involving millions Of variables or calculations. Examples include earthquake and protein folding simulations, climate and weather predictions, financial modeling and evaluating product designs.

- **Big data analysis**. Big data is a popular term for massive data sets that contain potentially valuable patterns, trends and associations. Mining data sets to locate or tease out these hidden patterns requires a huge amount of processing power, which IaaS economically provides.

Resource Virtualization

❑ Anything required for the execution of a program is called a resource. The processor; memory, displays, mice; keyboards, disk storage, printers, and networks are all examples Of resources.

❑ The primary functions of an operating system are management of resources and virtualization of resources.

1- Server Virtualization

2- Storage Virtualization

3- Network Virtualization

Server Virtualization

❑ Server virtualization can be defined as the conversion of one physical server into several individual & isolated virtual spaces that can be taken up by multiple users as per their respective requirements.

❑ This virtualization is attained through a software application, thereby screening the actual numbers and identity of physical servers.

❑ TYPES OF SERVER VIRTUALIZATION

❑ Complete virtualization,

❑ Para-virtualization

❑ Operating System (OS) virtualization.

❑ While all the three modes have one physical server acting as host and the virtual servers as guests, each of the methods allocates server resources differently to the virtual space.

Server Virtualization

❑ Complete virtualization is done using the hypervisor software that directly uses the physical server's CPU and hard disk storage space.

❑ However, the guests can use their respective versions and types Of OS, as the hypervisor keeps the virtual servers separate and independent of each other.

❑ Para-virtualization, the guests are aware about all the existing virtual servers, and work cohesively as a unit. The hypervisor in this case keeps their OS independent, while making them aware of the load put on the physical server by all the virtual creations.

❑ OS-level virtualization no hypervisor is required and the host's OS is the controller.

❑ It usage of the some OS on all the guest users' systems.

Server Virtualization

❑ But this homogenous environment still maintains the individual identity and independence of virtual servers.

Significance Of Server Virtualization

❑ Server virtualization leads to space consolidation, efficient & effective usage Of server resources & capabilities,

❑ Moreover, the redundancy practice of running one application on multiple systems is a boon for commercial sector and software programmers.

❑ Also, the assistance offered in disaster recovery, server administration, and system upgrading are all supporting factors in server virtualization.

Storage Virtualization

Storage virtualization is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console.

Or

Storage virtualization is the process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device.

- ❑ Storage virtualization is also known as cloud storage.
- ❑ Storage virtualization helps the storage administrator perform the tasks of backup, archiving and recovery more easily and in less time by disguising the actual complexity of a storage area network (SAN), Storage virtualization can be implemented by using software applications or appliances.

Storage Virtualization

There are three important reasons to implement storage virtualization:

1. Improved storage management in a heterogeneous IT environment

2. Better availability and estimation of down time with automated management

3. Better storage utilization

Storage virtualization can be applied to any level of a SAN. The virtualization techniques can also be applied to different storage functions such as physical storage, RAID groups, logical unit numbers (LUNs), LUN subdivisions, storage zones and logical volumes, etc.

The storage virtualization model can be divided into four main layers:

1. Storage devices

2. Block aggregation layer

3. File/record layer

4. Application layer

Some of the benefits of storage virtualization include automated management, expansion of storage capacity, reduced time in manual supervision, easy updates and reduced downtime.

Network Virtualization

- Network virtualization refers to the management and monitoring of an entire computer network as a single administrative entity from a single software-based administrator's console.

- Network virtualization also may include storage virtualization, which involves managing all storage as a single resource.

- Network virtualization is designed to allow network optimization of data transfer rates, flexibility, scalability, reliability and security.

- It automates many network administrative tasks, which actually disguise a network's true complexity.

Network Virtualization

- All network servers and services are considered one pool of resources, which may be used without regard to the physical components.
- Network virtualization is especially useful for networks experiencing a rapid, large and unpredictable increase in usage.
- The intended result Of network virtualization is improved network productivity and efficiency, as well as job satisfaction for the network administrator.
- Network virtualization is accomplished by using a variety of hardware and software and combining network components.

Network Virtualization

Network Virtualization Gives you

- optimize network

- speed

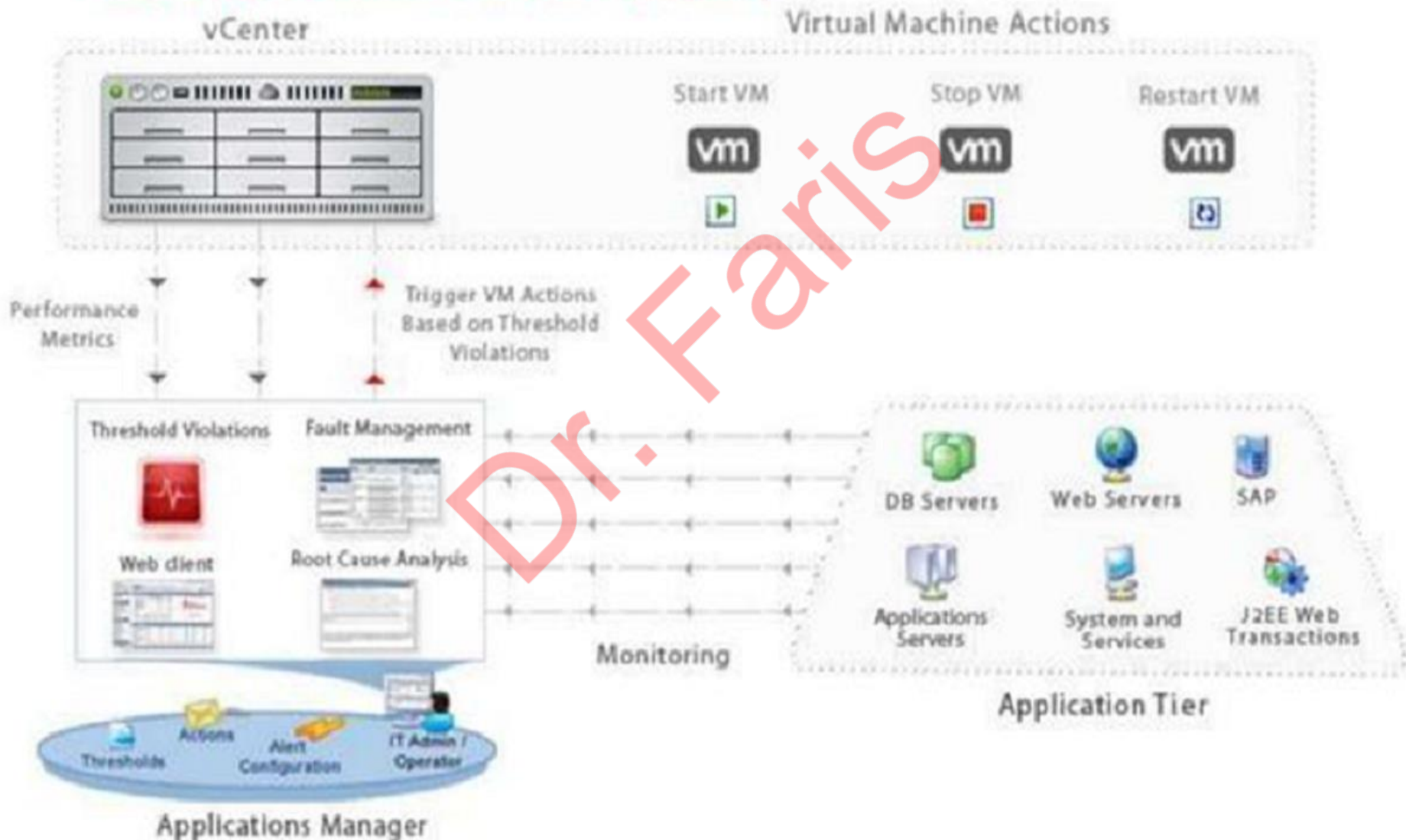- reliability

- flexibility

- scalability

- security

Virtual Machine

Resources Provision and Manageability

• Most business applications run in a mix of physical, virtual and cloud IT environments.

• Virtual environments are very dynamic by their nature.

• Virtualization solutions dynamically allocate IT resources to applications, perform load balancing based on resource utilization levels as well as perform dynamic power management to cut down power costs.

• IT administrators need to ensure that sufficient server power is available to support these dynamic environments.

• However, this process can be time consuming and error prone if done manually.

Virtual Machine

Virtual Machine

- **Storage as Service**

- Storage as a Service is a business model in which a large company rents space in their storage infrastructure to a smaller company or individual.

- Storage as a Service is generally seen as a good alternative for a small or mid-sized business that lacks the capital budget and/or technical personnel to implement and maintain their own storage infrastructure.

Virtual Machine

- **Data Storage in Cloud Computing**

- In which the digital data is stored in logical pools, the physical storage spans multiple servers (and often locations), and the physical environment is typically owned and managed by a hosting company.

- These cloud storage providers are responsible for keeping the data available and accessible, and the physical environment protected and running.

- People and organizations buy or lease storage capacity from the providers to store user, organization or application data.

Examples

amazon web services™ | **EC2**

- **Amazon E2C**

- Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) cloud.

- Powerful, Scalable GPU instances for high-performance computing.

- **Pricing for Amazon EC2**

- When you sign up for AWS, you can get started with Amazon EC2 for free using the AWS Free Tier.

- Amazon EC2 provides the following purchasing options for instances:

- On-Demand instances

- Reserved Instances

- Spot instances

What is PaaS ?

- PaaS, is a category of cloud computing that provides a platform and environment to allow developers to build applications and services over the Internet.

- A "cloud aware" application development and deployment environment.

- An abstraction layer between your cloud application and your IaaS provider,

What is PaaS ?

- PaaS services are hosted in the cloud and accessed by users simply via their web browser.

- Fundamentally provides elastic scaling of your application.

- Deployments include public, private and hybrid cloud configurations. **Example PaaS services:**

- **Data services,**

- **Application runtime,**

- **Messaging & queueing,**

- **Application management.**

PaaS

- Platform as a Service (PaaS) is a way to rent hardware, operating systems, storage and network capacity over the Internet.

- The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.

- It is an outgrowth of SaaS, a software distribution model in which hosted software applications are made available to customers over the Internet.

How PaaS Works?

- Platform as a Service allows users to create software applications using tools supplied by the provider.

- PaaS services can consist of preconfigured features that customers can subscribe to; they can choose to include the features that meet their requirements while discarding those that do not.

- The infrastructure and applications are managed for customers and support is available.

- Services are constantly updated, with existing features upgraded and additional features added.

PaaS Does that

- Leverage key middleware services without having to deal with the complexities of managing Individual hardware and software elements.

- Access a complete stack of development and deployment tools via a web browser, a middleware environment where APIs can be used to plug Into selected development and deployment tools. A developer might also leverage a full desktop development environment.

- Overcome the challenges of managing lots of individual development and deployment tools by providing a suite of integrated and standardized tools operating systems, security products, and the like — that meet company requirements.

PaaS offers

- Operating system

- Server-side scripting environment

- Database management system

- Server Software

- Support

- Storage

- Network access

- Tools for design and development

- Hosting

Who can use PaaS services?

- Software developers, web developers and businesses can benefit from PaaS.

- For example, web developers can use individual PaaS environments at every stage of the process to develop, test and ultimately host their websites. However, businesses that are developing their own internal software can also utilize Platform as a Service, particularly to create distinct ring-fenced development and testing environments.

PaaS
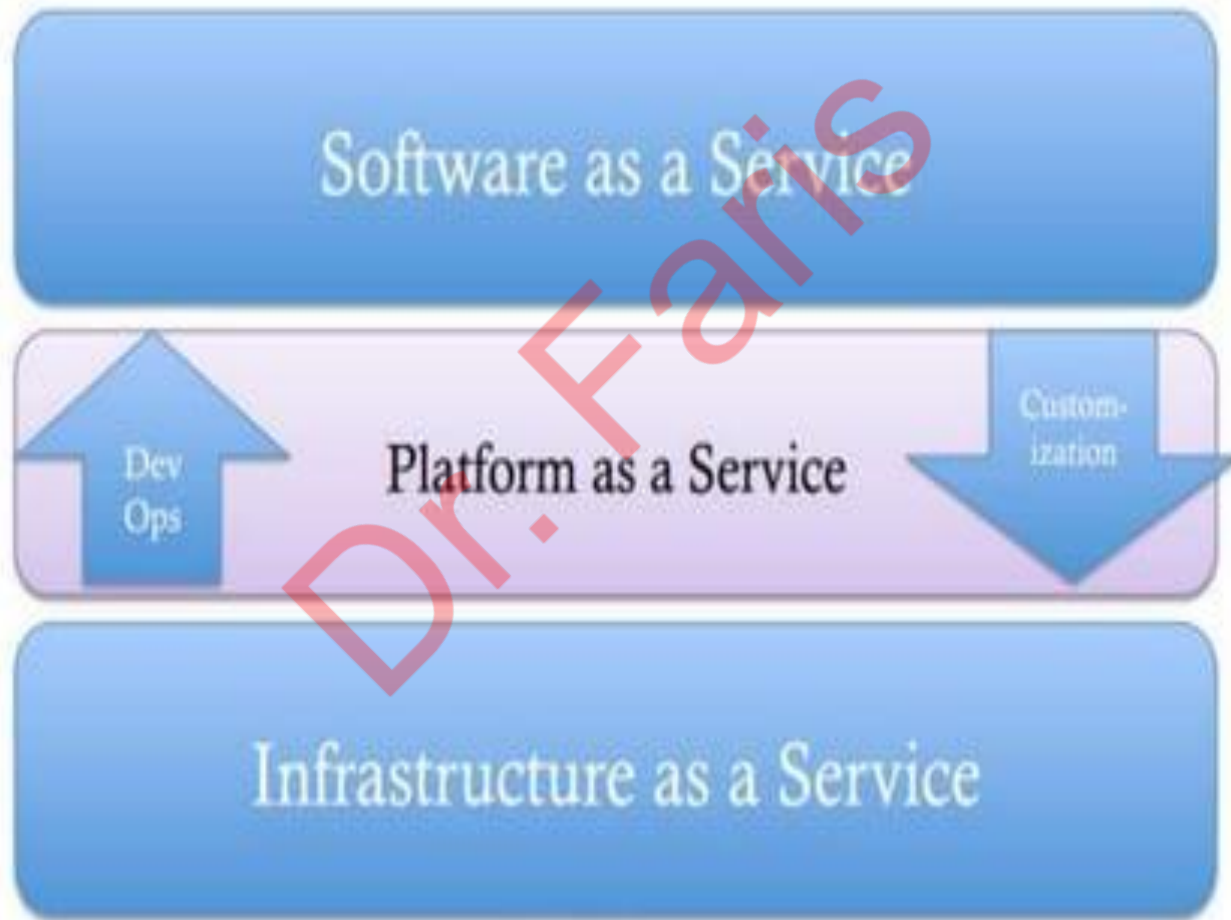
Evolving from different standards

- Evolving "upwards" from IaaS

- Amazon (Mail, Notification, Events, Databases, Workflow, etc.)

- Evolving "downwards" from SaaS

- Force.com -a place to host additional per-tenant logic.

- Google App Engine

- Evolving "sideways" from middleware platforms

- WS02, Tibco, vm Ware, Oracle, IBM

As a developer, what do I care about?

- My code— running

- Not a VVM" but a Virtual App Server

- Not just code

- I like Queues and Topics, ESB flows, Workflows, Databases, Logs, Portals, etc,

- Not just Runtime

- I like SVN, Git, build, continuous integration, code coverage, automated test

- Moreover, if you are a manager of a group of developers, you probably like governance.

Best Practices

- Start with the data, and work up to the services and UI. No matter what the PaaS provider suggests.

- Define a staging and testing strategy before you begin development.

- Consider SOA approaches in the design and deployment of the PaaS bases application.

- Make sure to do load testing along with functional testing.

- Make sure to model performance.

- Don't fall in love with a PaaS player, you may need to use several.

Primary Benefits of PaaS

- Lower development costs (%30+)

- Lower deployment and Developers costs (Nearly eliminate)

- Application portability (depends on the PaaS)