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**Answer1 A: essential characteristics of cloud computing.**

***On demand self-service:***

**For consumer there is online storage and server provided to them and as they need they can access to it through network without human interaction with each service provider.**

***Broad network access:***

**Data are store online on the server and can be access by consumer anytime through standard mechanisms that promote use by heterogeneous thin or thick client platforms.**

***Resource pooling:***

**The providers computing resources are pooled to serve multiple consumers resource can be dynamically assigned and reassigned according to customer demand customer not care about the physical location where there data store but should be aware of risks if they are located offshore**

***Rapid elasticity:***

**Capabilities can be expanded or released automatically. To customer this appears seamless, limitless, and responsive to their changing requirements**

***Measured services:***

**Customers are charged for the services they use and the amounts. There is a metering concept where customer resource usage can be monitored controlled and reported providing transparency for both the provider and consumer of the utilized service.**

**B) Key properties of cloud computing.**

***Cloud Computing Is User Centric:***

**Once as a user are connected to the cloud, whatever is stored there videos, documents, messages, images, applications, whatever becomes authorized to the user access them. In addition, the user can share it with others. In effect, any device that accesses your data in the cloud also becomes yours.**

***Cloud Computing Is Powerful:***

**Connecting hundreds or thousands of computers together in a cloud creates a wealth of computing power impossible with a single desktop PC.**

***Cloud Computing Is Task-Centric:***

**Instead of focusing on the application and what it can do, the focus is on what one need done and how the application can do it for us. Traditional applications—word processing, spreadsheets, email, and so on—are becoming less important than the documents they create.**

***Cloud Computing Is Intelligent:***

**With all the various data stored on the computers in a cloud, data mining and analysis are necessary to access that information in an intelligent manner.**

***Cloud Computing Is Accessible:***

**Because data is stored in the cloud, users can instantly retrieve more information from multiple repositories. We are not limited to a single source of data, as we do with a desktop PC.**

***Cloud Computing Is Programmable:***

**Many of the tasks necessary with cloud computing must be automated. For example, to protect the integrity of the data, information stored on a single computer in the cloud must be replicated on other computers in the cloud. If that one computer goes offline, the cloud’s programming automatically redistributes that computer’s data to a new computer in the cloud.**

**Answer2 A: Service models of cloud computing.**

**There is three service models of cloud computing**

**1. Platform as a Service (PaaS)**

**2. Infrastructure as a Service (IaaS)**

**3. Software as a Service (SaaS)**

***1. PaaS:***

**Is a set of software and development tools hosted on the provider's servers. It is one layer above IaaS on the stack and offers an integrated set of developer environment that a developer can tap to build applications without having any clue about what is going on underneath the service. It offers developers a service that provides a complete software development life cycle management**

***2. IaaS:***

**As on demand scalable service.**

**Provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.**

**Usually multi-tenant virtualized environment**

**Usually billed based on usage**

**Can be coupled with Managed Services for OS and application support**

***3. SaaS:***

**Allows to use software applications as a service to end users.**

**A software delivery methodology that provide licensed multi-tenant access to software and its functions remotely as a Web-based service.**

**1. Usually billed based on usage**

**2 .Highly scalable architecture**

**3 .Usually multi-tenant environment**

**B) Deployment model:**

**It describes how the cloud is located and access to cloud there is four types to access to cloud.**

**1). Private cloud 3. Community cloud**

**2). Public cloud 4. Combined cloud or hybrid cloud**

***1. Private Cloud:***

**It is set up within an organization’s internal enterprise data center. In the private cloud, scalable resources and virtual applications provided by the cloud vendor are pooled together and available for cloud users to share and use. It differs from the public cloud in that all the cloud resources and applications are managed by the organization itself, similar to Intranet functionality. Utilization on the private cloud can be much more secure than that of the public cloud because of its specified internal exposure. Only the organization and designated stakeholders may have access to operate on a specific Private cloud**

***2. Public Cloud:***

**Allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness, e.g., e-mail.**

***3. Community cloud:***

**Allows systems and services to be accessible by group of organizations.**

***4. Combined Cloud:***

**Is mixture of public and private Cloud however, the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.**

**Answer3 A:**

**Roles and boundaries in cloud:**

***Cloud provider:***

**An organization that provides cloud based resources as services.**

**Responsible for making cloud services available for consumers and guaranteeing required administrative duties delivered in order to ensure the on-going operation of the overall cloud infrastructure**

**Makes the IT resources available to other cloud customers for lease.**

***Cloud customer:***

**An individuals that signs for a formal contract or arrangement with a cloud providers IT resource lease.**

***Cloud service consumer:***

**Consumers of services provided by a cloud consumer.**

**Cloud service owner:**

**The individuals or organizations that legally own the cloud services.**

***Cloud resources administrator:***

**The individual or organization responsible for cloud based resources the cloud consumers or the cloud providers**

**1) Cloud service administrator.**

**2) Cloud auditor.**

**3) Cloud broker.**

**4) Trust boundary.**

***2) Cloud auditor:***

**A third party contractor for independent assessment of cloud environments evaluating security control, performance and so on.**

***3) Cloud broker:***

**A party responsible for managing and negotiating the usage of cloud service between cloud customers and cloud providers**

***4) Trust Boundary:***

**A logical parameter that spans beyond physical boundaries to represent the extent to which the IT resources are trusted.**

**B) Cloud risk and challenges.**

**Several of the most critical cloud computing challenges and the security risk pertaining mostly to cloud consumers that use one of the services.**

**1). Increased Security Vulnerabilities**

**2). Multi-Regional Regulatory and Legal Issues**

**3). THREATS IN CLOUD**

***1). Increased Security Vulnerabilities:***

**The moving of private and organizational data to the cloud guarantee access to share the data with the cloud provider. The remote usage of the services requires an expansion of trust boundaries by the cloud consumer to include the external cloud. It can be difficult to establish a security architecture that spans such a trust boundary without introducing vulnerabilities, unless cloud consumers and cloud providers happen to support the same or compatible security frameworks which is unlikely with public clouds.**

***2). Multi-Regional Regulatory and Legal Issues:***

**Some countries have laws that require some types of data to be disclosed to certain government agencies or to the subject of the data. For example, a European cloud consumer's data that is located in the U.S. can be more easily accessed by government agencies (due to the U.S. Patriot Act) when compared to data located in many European Union countries.**

***3). THREATS IN CLOUD:***

**The threats to information assets residing in the cloud can vary according to the cloud delivery models used by cloud user organizations.**

**The following are the threats to data.**

**1). Traffic Hijacking.**

**2). Insecure Interface.**

**3). Abuse of Cloud Services.**

**4). Insufficient Due Diligence.**

**5). Unknown Risk Profile.**

**6). Perimeter Security Model Broken.**