UNIT- 1 Robbert Cloud F Cloud Deployment Models: The concept of cloud computing has evolved from cluster, gouid and utility computing. Utility and Septemare as a Service (Saas) provide Computing resources as a resurice with a notion of pay per me. Cloud computing leverages dynamic resources to deliver large no. of resurices to end uners. 1. TEN By Cloud. Cloud computing: It is a High Thoroughput Computing (HTC) preadigne whereby the infrastructure provider services through a large data center or reriver farms. The cloud Comparting model enables users to secon shore access & resources from anywhere at any time through their Connected device. All computations in cloud applications are distributed to server in data center. Visitual Machines (VM) in victual clusters created out of data center resources.

Public cloud'r . It is built over Internet and can be accoused by any user who has paid for the service. Plublic Clouds are owned by service providers and are accertible through a subscription. Public Cloud provider. - Google App Engine (GIAE), - Amargon Web Services (AWS) - Miconosoft Azure -IBM Blue cloud. - Salesforce. com. - They were commercial provider that after a publicly accertible sempte interface for creating and managing VM instances within their proprietary infrastructure. . A public cloud delivers a relected set of basiness processes. The Application and infrastructure sourices are offered on a flexible price par use bain (VMD) in vintual clasters content out of data center

Private cloud's - It is built over within the domain of an asanet owned by a ringle Organization. - It is client owned, and managed and - access is limited to owning clients and their partners. (ball and the - Private clouds give local users a flexible ad ogile private infrastructure to run service seloade within their administrative domain. - A poivate cloud is supposed to deliver efficient and convenient cloud resurices. - clouds :--It is built with both public and serate clouds. -Private clouds can support a hybrid del by supplementing local infrastructure with menting capacity from an external public cloud. 4 - Research Compute cloude (RC2) developed by Is to connect the computing, IT resources at ight IBM screarch centres... - Hybrid cloude operate in the middle with many compromises interms of resource sharing.

Seever Cluster (VH) Cloud Services Atypical the platform frontend (webservice AA) Cloud Storage ho Microsoft Amazon Azure Ang Public 1 BM Blue cloud) Internet hybrid Salesfree Google App Engine Private Cloud Cloud were (RC2 An Intranet. Public, Brivate & Hybrid Cloud. Data Conten Networking :-- A core of the cloud is the server Cluster (VM cluster). Cluster noder are used as Compute noder. A few control nodes are used to manage and monitor cloud activities. - Data Contesa networks are mostly IP- based Commodity networks such as loGebps which is optimized for Internet allers. with many Companying interime & response sharing.

- The server racks at bottom layer 2, they are connected through fast switches (c) as the hardware cone. The datacenter is connected to Interest at layer 3 with many access souters (AR) ita - The scheduling of user jobs requires that to arrigh work to viertual clusters created for (vi) New the shade and tate - The gate way nodes can also be used for usen. security control for entire cloud. It also provides access points of the service. from outside would. Standard Data Center Networking Biternet Internet RR Data Contes 6 layer 3 BR-L3 border Router (AR) AR AR-Access Routes. Tul ST I based FLB 1B- Load Balances 3 layer 2 1LB S- Switch. - 3ed 5 5 A - Rack of servers. A

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Cloud Davign Objectives; There are in design objectives for Cloud computing. (i) Shifting Computing from desktops to data centers. (ii) Service provisioning and cloud economics. (117) Scalability in performance. (23) moderal rebal bro (11) Data Privacy protection. (v) High quality of cloud resurces. (vi) New standarde and interfacer. Cloud Service Models at different Service levels; There were three different cloud service models. based on Subscription band services a) Infrastructeure as a Service (Eaa S) 6) Platform as a Service (Paas) () Sapturare as a Service (Saas) There three models allow users to accent services over the intermet, relying entirely on infrastructure of cloud resurice provider.

agens Cartender's - included - Amer Billing Q Client Interface lonitor Launch Monitor Q Taunch Q. Ctab Distributed Master Worker file Status DB Caterio Netwood a) Infrastructure as a Service (Iaas) -This model allows areas to use In Visitualized IT resources for computing, storage and networking. (() ())) and) is in sendous (- The service is performed by rented cloud infrastructure. The user can deploy and run applications over chosen OS environment. - The user does not control or manage the cloud infrastancture but has control over os, storage, applications and possibly select networking Components. - This I aa S model encomparses a) Storage as a Service. b) Instances as a Service.

Customer's isolated AWS Resources, Subrete. Subnet Cloud. owica Cloud Ponter VPN Grateway Secure VPN Connection. Over Internet . Customen Network. -The cloud services are a) resources from multiple data centers globally distributed. 6) Web resurvices (DAP & Query)) web based console when interfaces. d) Access to VM instances (Via) SSH. 5) Platform as a Souvice :- maint produce and produce prove This model allows to develop, doploy and manage the execution of applications using provisioned resources demands a cloud platform. with proper software environment. a) storage as a leverte . D' Cartancas as a Service. () Communication as a Service.

= It includes operating system and runtime library support. - The platform cloud is an integrated system consisting of hardware and software. appending the second infrastructure. - The user application can be developed on this virtualized cloud platform using some programming languages and raftware tools supported by the provider. - The user doesnot manage the underlying cloud infrastructure. - The cloud provider supports user application development and testing a well defined service platform. - This model enables reftware development platform for different upon - It also encourages third parties to provide software management, integration and service monitoring solution.

APP Admin Manage traffic monitor area. Interfe local development Google load balance Build) Text upgade Data Data Data Deploy 29: Groegle App Engine c) Software as a Service (Saa S) - It is a browser initiated application 12 software over thousands of cloud customers. - On customer side, there is no upfront 30 investment in servers or software licensing, on provider ride, costs are low, In fle - Customer data is stored in the cloud whether it is vendor proprietary (A) publicly hosted to support Paas and Icas. ap -g: Google Gunail and docs Microsoft share Point Las dou CRM from salesforce.com. hyp

gy - New york Times has applied Amazontes and S3 services to retrieve useful pictorial information quickly from millions of articles and newspaper. The New york Times has significantly reduced the time and cost in getting the job done. Implementation levels of Viertualization. 3 Openality System lovel . Viertualization :-- It is a computer auchitecture technology by which multiple viatual machines (VM) are multiplexed in same hardware machine, - The propose of VM is to enhance resource Shasing by many users and improve computer performance interms of resource utilization and application flexibility. (12024/1210) ond - After Virtualization different user applications managed by their own OS can fun on the same hardware independent of host OS. This can be done by adding software layer called viritualization layer. - Visitualization layer in also known as hypequine (a) Vintual Machine Monitor. (VMM)

- The main for of this layer is to viertualize the physical hardware of a host machine into virtual resources to be used by VM. . The Viritualization layer includer. a) Instruction Set Architecture (ISA) buel. b) Hardware Abstraction layer (HAL) level. c) Operating System level. d) Library (user-level APE) level. e) Application level. multipland in dama madridad Application level. (JVM/. Net CLR/Panot) Library level. Milid's tel (WINE/WABI/VCUDA). OS level. (Jail / Virtual Environment / Environ & VPS/FVM) Handware Abstraction Layer (HAL) level. (Volume / virtual Pc / Denali / Xen/ L4) Instruction Set Auchitecture (ISA) level (Boche Crube (BIRD) Dynamo)

> Instruction Set Auchitecture level. - Detain Vintualization is performed = emulating a fiven ISA by the ISA of the host machine. - It is possible to sur a large amount of Lancy binary code written for various processors on any Even new hoodwasie host machiner. -Instruction set emulation leads to virtual Ist's created on any hardware machine. . There were two methods (or) approaches. adi) code Interpretation. (1) Dynamic Binary Translation. (i) Code interpretation: - is a basic emulation method, An interpreter program interprets the source instructions = taget instructions one by one. One source instructions requires hundreds of target instructions to perform its -anction. So this process is slow, Dyamic Binary Translation: - it translates. The basic blocks of dynamic source instanctions to target instanctions. The baric block can also be extended to program

trates (or) super block to intrease efficiency. - Instruction set emulation requires binary translation and optimization. - Virtual - Instruction set Architecture (V-ISA) requirer adding a processor specific software tranlets 2 layer to the compiler. b) Handware Abstraction level. - it is performed on tope of base hardwar -This approach generates a virtual hardware environment for a visitual Machine. - The process manages the underlying hardwoore through Viertualization. - The intention is to upgrade the hardware utilization rate by multiple users concurrently. damers drakers () Operating System level; -refers to an abstraction layer between OS and una applications. - OS level viortualization creater isolated Containers on a nigle physical legen rerver and os

instances to citilize the hardware and software in data centers. - The containers behave like real sources. - This level is used in creating virtual hosting environments to allocate hordware resources among a læge number og mutually distansting user. tion d) Library Support Level :-- Most applications use API exported to user level libraries ration than longthy system calls. ware - Viatualization with library function (or) interfaces is possible by controlling the communication link between applications and next of system through APS hook. - 2g'- VCUDA 2) User Application Level; ware - Application Level viortualization is also known as process level viertualization. - The popular approach is to deploy High level language (HLL) VMA, BOLA - The Virtualization layer site as an application program on top of operating system and ted the layer exports an abstraction of VM that can sum

program written and compiled the to particular abstract machine definition. - The other form of Application level vioitualization are (i) Application Isolation. (ii) Application Sandboscing (or) Streaming. - The process involves wrapping the application to in a layer that is isolated from the host as and other applications. The result in an application is earier than to distribute and remove from men workstation. b) VMM Derign requirements and providen; Virtual Machine Monitor's - It manages the hardware resources of a computing system. Each time program accors the handance, the VMM captures the process. So vmon acts as traditional as. - These were three requirements for vrin they are (1) It should provide an environment for programs which is essentially identical to original Mathdown respects an abstraction. machine.

(ii) program sun in this environment show at wort, only minor decreases in speed. (iii) when should be in complete control of the Aspeni Station all the City system resources.) but visitualization and losduman level - The hardware resource leguieement. such as memory of each NM are reduced, but the sum of them is greater than that of real machine installed. -To generate the efficiency of a VMM, a statistically dominant subset of viertual processors instructions need to be executed directly by real processor with no roftware intervention by the VMM. - The complete control of resources iavolver three main aspect. (i) The VMM is responsible for allocating hardware resources for program. (ii) It is not possible for a program to access any resource not explicitly allocated to it. M (11) To regain control of resources already allocated.

Viatualization support at as level ; - The hardware level Niertualization issues arises such as. (i) storing VM images. (ii) full visitualization at hardenare level. -leade to slow performance, low density Roderod but the - To solve there issues, OS level virtualize is needed. - OS virtualization insects a virtualization layer inside an operating system to partition a machine's physical resources. It enables multiple isolated VMs within a single Operating system kennel. This kind of VM is called as Vierteal Execution Environment (VEE), Viatual Paivate system (VPS). - Advantages of OS Extensions (or) virtuelization. (i) Minimal startup / shutdown cost. (ii) lous resource requisement. (iii) high scalability (iv) synchronize state changes when needed, - It is also known as Single os image all otabel in the Visitualization.

-Disadvantages: (i) all the VMx at Operating System level on a ingle container must have the same kind of guest as. (ii) Isolated execution environment should be created bared on a ringle OS kernel. - Two ways to implement Viertual root directories, they are. a) duplicating Common resources to each va partition. Lyper placed balls. b) Sharing most resources with host environment and only create private resource copies on the VM ordemand. of Vixed Hawkill (b) 2) Middlennie support for Virtualization. - Library level viertualization is also known as user level Application Binary Interface (AB) or API emulation. N. 46 . 15. 15. - This type of Virtualization can create execution environments for running alien programs on a platfam rather than creating a VM to run the entire Operating system. - API call interception and re-mapping key devictions performed.

a) WABI - officer middleware to convert winds system calls to Solarin system call. (ii) Tobted executions excision b) Lieun - ir really a system macall emulato that enables LINUX applications weitten for X86 hosts to sun on Unix system. C) WINE - offer library support for virtualing X86 processors to run windows applications on Unix host. - offers a compiler support system to develop windows application using visual studio to sun on some Unixhosti, API analytion Eqt. e) VCUDA. - vintualization support for using general purpose GPUs to sun data intensive application under a special grout os. the cutine Openating system. - API Call interception and he wapping are the key functions performed.

V CUDA Architecture:	
to those of	Guest OS. [CUDA application]
NCUDA Stub	CUDA application
CUDA library	NCUDA library
Device Drivery.	and the second
	VMM.
- Thuis (GIPU, Hard dirk, N/w Cord)
	Contraction of the second s
	DA is a programming model
and Library for gen	eral propose GiPUs. It
leverages the high	serformance of GIPU to run
Compute - intensive a	pplications on host Operating
System.	
V Cudo	employs a client server model
to implement CUDA vi	itualization. It consists of three
user space component.	and the second
a) vCuDA li	
	apu in guest OS.
- vcoba -	stub in the host os.