Data Centers

→ A data center is a facility composed of networked computers and storage that businesses or other organizations use to organize and storage.

→ Data Centers are not a single thing, but rather, a conglomeration of elements.

→ A data center must also contain an adequate infrastructure.

→ A data center's design is based on a network of computing and storage resources that enable the delivery of shared applications and data

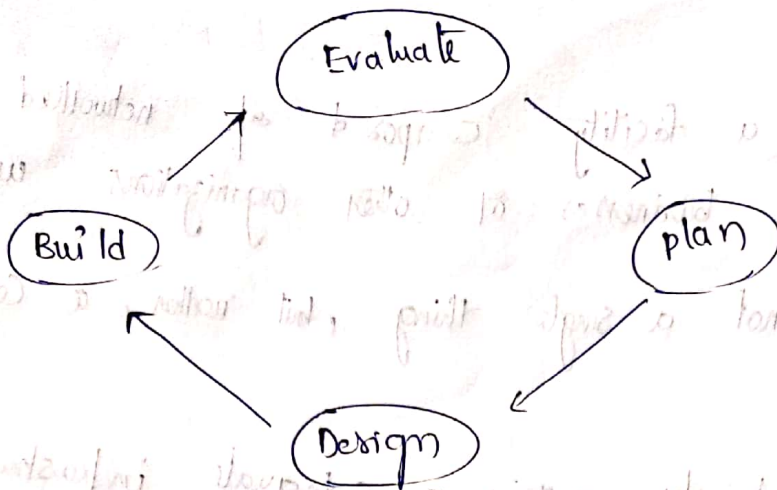## Data Center Consolidation and Colocation

→ Data Center Consolidation is the process of downsizing or consolidating many servers, storage systems, Network systems.

↪ The purpose is to lower cost and improve performance, among other things.

→ Colocation is an appealing option for organizations that want to avoid the large capital expenditures.

Benefit

1. physical locations
2. Procurement
3. software
4. Security
5. Reduce errors.

Evaluate

Build

plan

Design

Data Center Tiers

→ Data Center tiers are a standardized ranking system that indicates the reliability of data center infrastructure.

→ The clarifications, ranks facilities from 1 to 4, with 1 being the want and 4 is the highest performing level.

→ The ranking is based on
1. uptime guarantees
2. fault tolerence
3. service cost

Tier 1 :

→ A data center with single path for power and cooling and no backup components

→ This tier has an expected uptime of 99.671% per year

Tier 2 :

→ A data center with single path for power & A Cooling and some redundant and backup components available

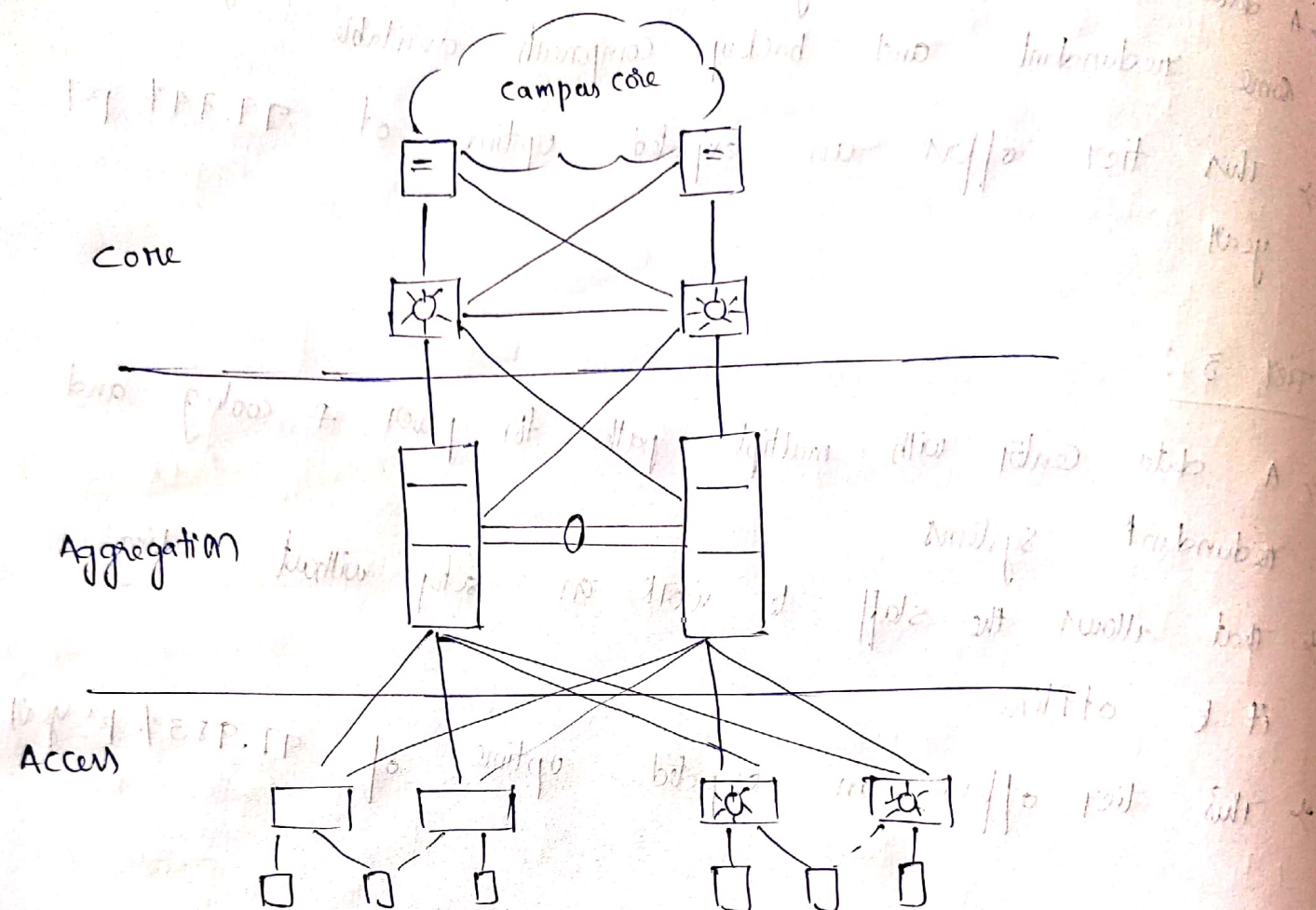→ This tier offers an expected uptime of 99.74% per year

Tier 3 :

→ A data center with multiple paths for power & cooling and redundant systems

→ That allows the staff to work on setup without taking it to offline

→ This tier offers an expected uptime of 99.983% per year

Tier 4:

→ A Completely faulty tolerant data center with redundancy for every components

→ This tier offers with an uptime of 99.995% per year.

Data - Center Architecture

Core Layer :

→ provides high-speed packet switching back plane for all flows going in and out of the data Center

Aggregation :

→ provides important functions
- service module integration
- Layer 2 domain definitions.

Access Layer :

→ The access layer network infrastructure consist of
- Module switches
- fixed configuration (0r 2RU switches
- integral blade server switches.

1. Virtualization 2.

* virtualization allows multiple operating system instances to run concurrently on a single computer.

* it means of separating hardware from a single os.

Before using virtualization, we had :

* single os per machine

* software and hardware tightly coupled

* underutilized resources (idle time)

* inflexibility

virtualization gives you :

* Hardware independence of os and applications

* Ability to encapsulate os and applications into VM

* Ability to provision VM to any system

Approaches or ways to virtualizes cloud servers

1. Grid Approach :

* Where the processing workloads are distributed among different physical servers, and their results are then collected as one.

2. OS - level virtualization :

-> Here, multiple instances of an application can run in an isolated form on a single os

3. **Hypervisor - based virtualization**

→ with hypervisor's virtualization, there are various sub-approaches to fulfill the goal to run multiple applications & other loads on a single physical host

4. **Hardware virtualization**

→ it is the abstraction of computing resources from the software that uses cloud resources.

Types

1. **Full virtualization**
   → Here the hardware architecture is completely simulated.

2. **Emulation virtualization**
   → Here the virtual machine simulates the H/w & is independent.

3. **Para - virtualization**
   → Here the H/w is not simulated, instead the guest s/w runs its isolated system.

5. **Software virtualization**

→ it is also called application virtualization

→ software virtualization is similar to that of virtualization except that it is capable to abstract the software installation procedure and Great virtual s/w installation.

6. Server virtualization:

→ In this process, the server resources are kept hidden from the user.

→ This technique is mainly used in web-servers which reduces the cost of web-hosting services.

→ Instead of having separate system for each web-server, multiple virtual servers can run on the same system/computer.

Types of virtualization

1. Hardware
   - full H/W V
   - partial H/W V
   - para H/W V

   H/W = Hardware
   V = virtualization

2. Network
   - Internal N/W V
   - External N/W V

3. storage
   - Block V
   - file V

4. Memory
   - Application level integration
   - OS level integration

5. software
   - OS level
   - Application level
   - service level

6. Data - Database

7. Desktop - VD infra, Hosted VD

   VD = virtual desktop

3. Types of Virtualization

1. Hardware Virtualization

→ Hardware or platform virtualization means creation of VM that act like real computer.

→ Example, computer running Microsoft windows 7 may host the virtual machine look like a ubundu

→ Hardware virtualization is known as server virtualization

→ The Hardware virtualization resource allotment is done by the hypervisor
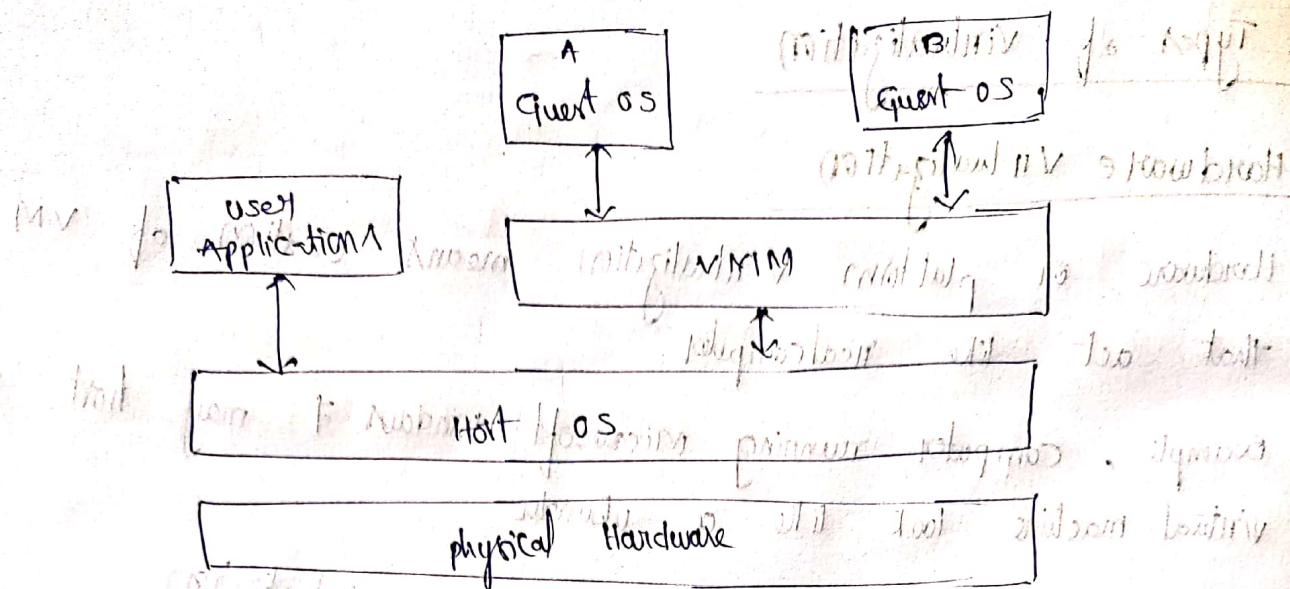
Types of Hardware virtualization

1. Full virtualization
2. Partial virtualization
3. Partial virtualization

2. Software virtualization

→ The ability to computer to run and create one or more virtual environments.

→ it is used to enable a computer system in order to allow a guest os to run

Types

1. os virtualization
2. Application virtualization
3. Service virtualization

```
┌──────────┐           ┌──────────┐
│    A     │           │ Guest OS │
│ Guest OS │           └──────────┘
└──────────┘                ↕
     ↕            ┌──────────────────────┐
┌──────────┐      │        VMM           │
│  User    │      └──────────────────────┘
│Application│              ↕
└──────────┘
     ↕
┌──────────────────────────────────────┐
│              Host HOS                 │
└──────────────────────────────────────┘
┌──────────────────────────────────────┐
│         physical Hardware             │
└──────────────────────────────────────┘
```

3. Network virtualization

✶ it refers to the management and monitoring of a computer network as a single managerial entity from a single software - based administrator's console.

✦ Multiple sub-networks can be created on the same physical network

✶ it allows network of data transfer rates, scalability, reliability, flexibility and security

Types

1. Internal N.V

2. External N.V
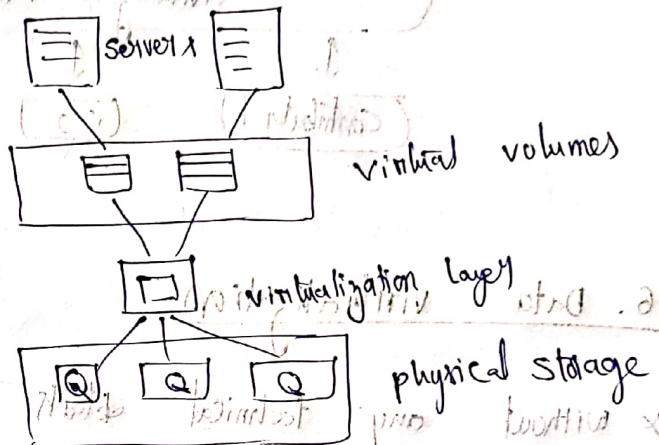
4. Storage virtualization

* Multiple physical storage devices are grouped together, which look like a single storage device.

Eg: partitioning owl hard drive into multiple partitions.

Types

   1. Block SV

   2. File SV

virtual volumes

virtualization layer

physical storage

5. Memory virtualization

* The way to decouple the memory from the server to provide a shared, distributed or networked function.

-* it enhances performance by providing greater memory capacity without any addition to the main memory.

Types

1. Application - level integration

| Application | Application | --- | Application |

virtualized memory pool

| Contributor 1 | C₂ | --- | Cₙ |