



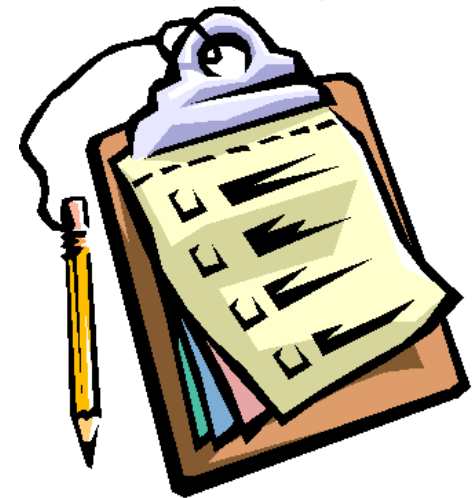
Data Center Knowledge

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Outline

1. Introduction
2. What is Data Center?
3. Storage Equipment in DC.
4. Data Center Vs Cloud Computing
5. Cloud Computing
6. Conclusion



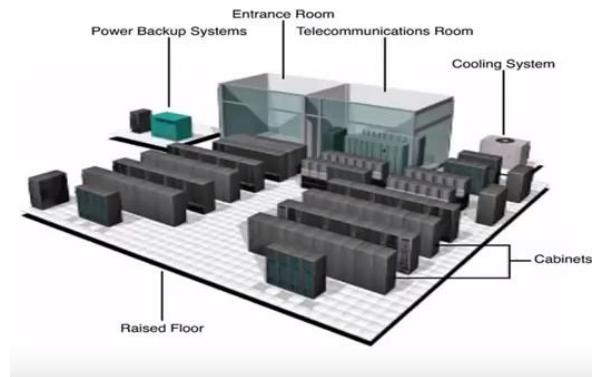


Introduction

My focuses on

1. How Data Center (DC) is look like?

Data Center Physical Layout



2. Merrill Lynch Data Center (London)

- Job Responsibilities.

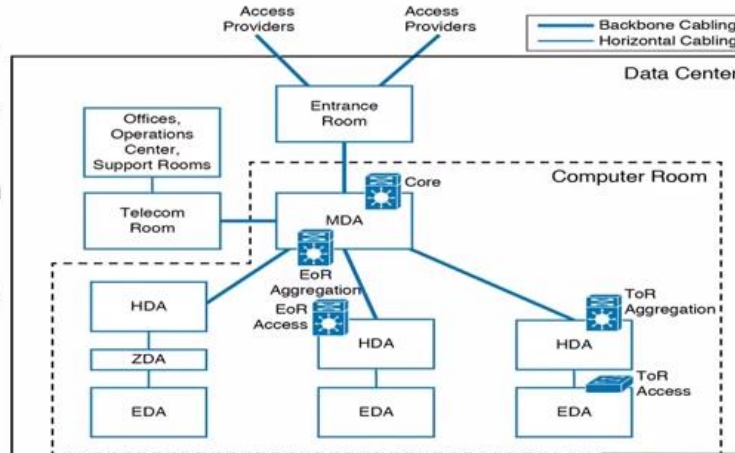




Data Center Topology

ANSI/TIA-942-2005 Standard

- › Main Distribution Area (MDA)
- › Horizontal Distribution Area (HDA)
- › Equipment Distribution Area (EDA)
- › Zone Distribution Area (ZDA)



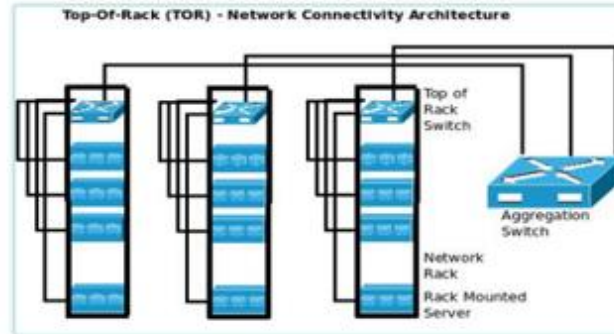
ANSI/TIA-942-2005 Standard

Note: need to define TOR and EOR

- › Computer Room: Main servers
- › Entrance Room: Data Center to external cabling
- › Cross-Connect: Enables termination of cables
- › Main Distribution Area (MDA): Main cross connect. Central Point of Structured Cabling. Core network devices
- › Horizontal Distribution Area (HDA): Connections to active equipment.
- › Equipment Distribution Area (EDA): Active Servers+Switches. Alternate hot and cold aisle.
- › Zone Distribution Area (ZDA): Optionally between HDA and EDA.
- › Backbone Cabling: Connections between MDA, HDA, and Entrance room

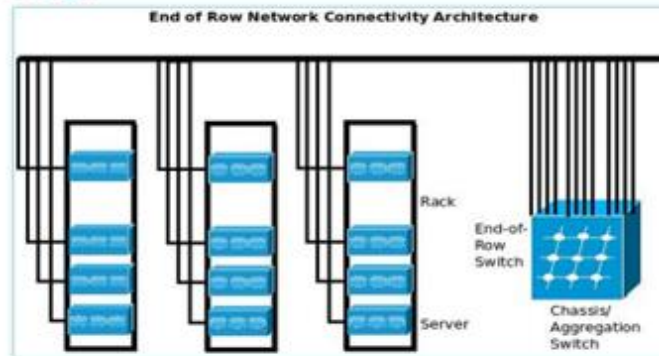


TOR - Top of Rack design:



In a Data Center, there are several racks of servers/ storage equipment. Each rack contains multiple computing devices. The TOR - Top of Rack approach recommends Network Switches to be placed on every rack and all the computing devices present in the rack to be connected to them. In turn, these Network Switches can be connected to Aggregation Switches using one/few cables.

EOR - End of Row design:



In the EOR (End of Row) Network design, each server in individual racks are connected to a common EOR (End of Row) Aggregation Switch directly, without connecting to individual switches in each rack. Obviously, bigger cables are used to connect each server to Chassis based EOR/ Aggregation Switches. There might be multiple such EOR switches in the same data center, one for each row/ certain number of racks.



What is Data Center?

- A Data center (DC) is a facility on some location where multiple servers are engaged in collection, storing, processing and distribution of huge amount of data.
- A DC is a critical and provides 24/7 operations.
- Priority of DC is security and reliability at top level.



Why we need of Data Center?

- Shared resources.
- Data classification.
- Storing massive amount of data.
- Storage disaster recovery.
- Conducting day to day business operations.
- Priority of DC is security and reliability at top level.
- Highly Customized.
- Storage management.



Data Center Classification

DC can be classified into four Tier.

1. Tier-I

- No Redundent Capacity, Single path to power with 99.671% availability.

2. Tier-II

- Tier-I+Redundent Capacity+99.671% availability.

3. Tier-III

- Tier-I+Tier-II+ Dual Power Systems+ 99.821% availability.

4. Tier-IV

- Tier-I+Tier-II+Tier-III+Dual Power Systems + 99.995% availability. (HVAC-Heating, Ventilation and Air Conditioning Systems)



uptime and downtime

 This definition is part of our Essential Guide: [Server uptime and hardware failure guide](#)

Uptime is a computer industry term for the time during which a computer is operational. Downtime is the time when it isn't operational. Uptime is sometimes measured in terms of a percentile. For example, one standard for uptime that is sometimes discussed is a goal called [five 9s](#) - that is, a computer that is operational 99.999 percent of the time.

99.999 (Five nines or Five 9s)

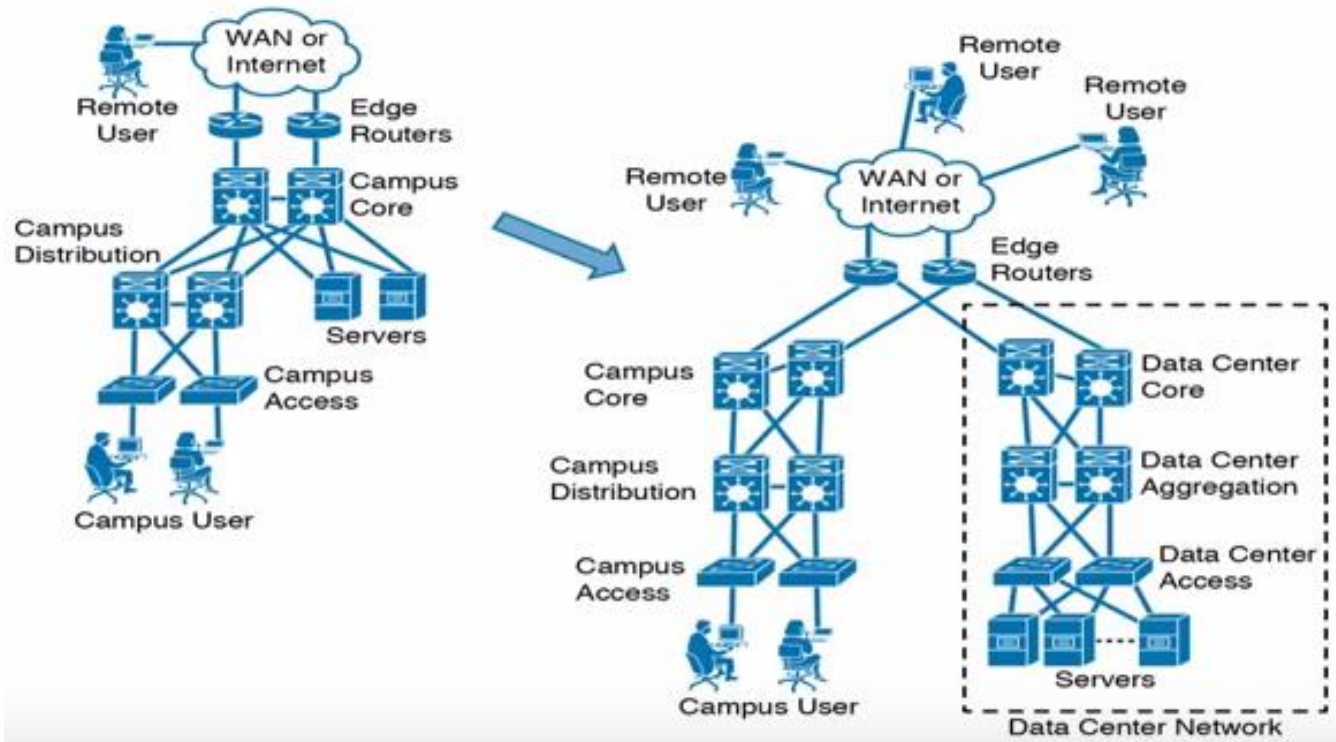
In computers, 99.999 (often called "five 9s") refers to a desired percentage of [availability](#) of a given computer system. Such a system would probably have what some refer to as [high availability](#). As Evan Marcus, Principal Engineer at Veritas Software, observes, 99.999 availability works out to 5.39 minutes of total downtime - planned or unplanned - in a given year.

In one view, there are three approaches to 99.999 (or even 100) percent availability:



Traditional of Data Center Network

- This is Tier-III Network.



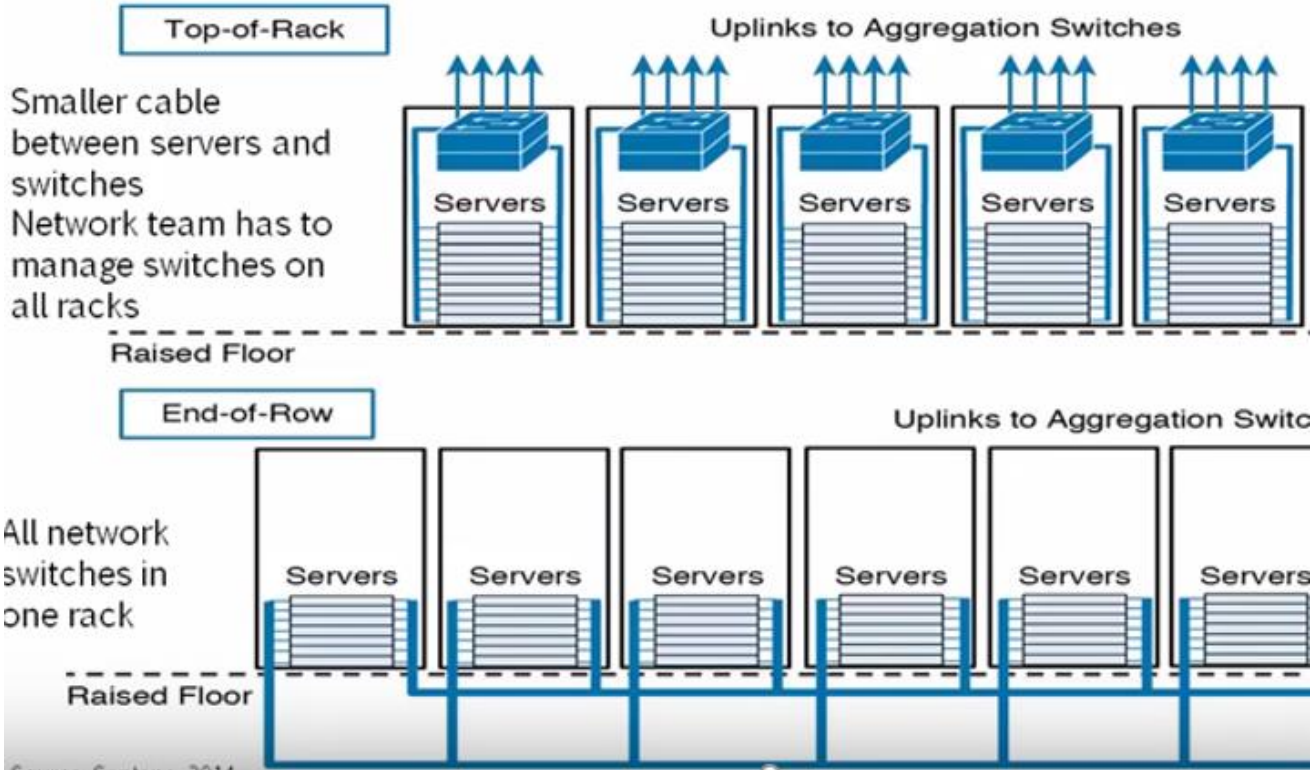


Data Center Networks

- › 20-40 servers per rack
 - › Each server connected to 2 access switches with 1 Gbps (10 Gbps becoming common)
 - › Access switches connect to 2 aggregation switches
 - › Aggregation switches connect to 2 access routers
 - › Access routers connect to core routers
 - › Aggregation layer is the transition point between L2-switched access layer and L3-routed core layer
 - › Low Latency: In high-frequency trading market, a few microseconds make a big difference.
 - ⇒ Cut-through switching and low-latency specifications
-
- › Most traffic is internal to the data center.
 - › Network is the bottleneck.
Uplinks utilization of 80% is common.
 - › Most of the flows are small.
Mode = 100 MB. DFS uses 100 MB chunks.



Switch Locations



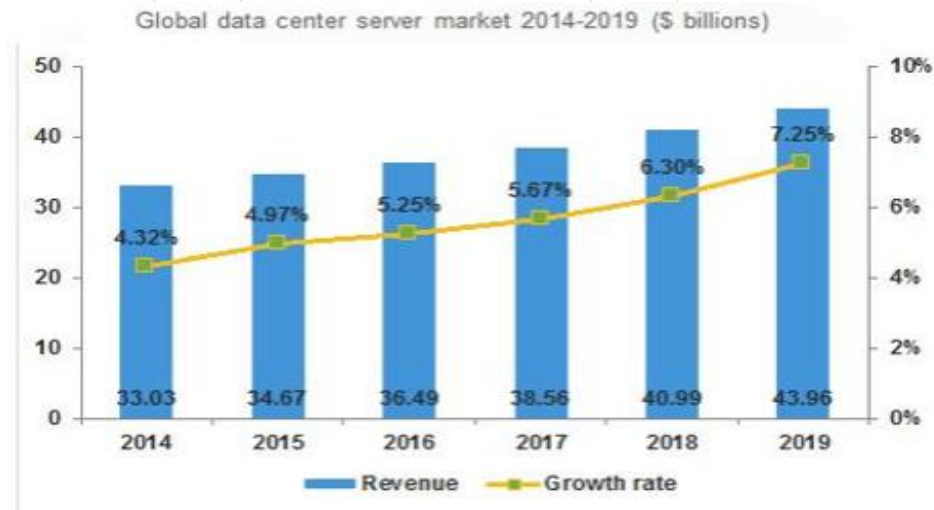


Types of Data Center

Generally, There are three types of Data Centers.

1. Internet Data center (IDCs).
2. Cloud Data Centers (CDCs).
3. Dark Data Centers (DDCs).

- Growth Rate of Data Center





Storage Equipment Data Center

Usually, many type of storage equipments are available in the market, however we will discuss SAN and NAS in what follows,

1. SAN (Storage Area Network)

- Suitable for large data centers.
- Accessed from servers.
- Require fiber channel
- Difficult to expand

2. NAS (Network Attached Storage)

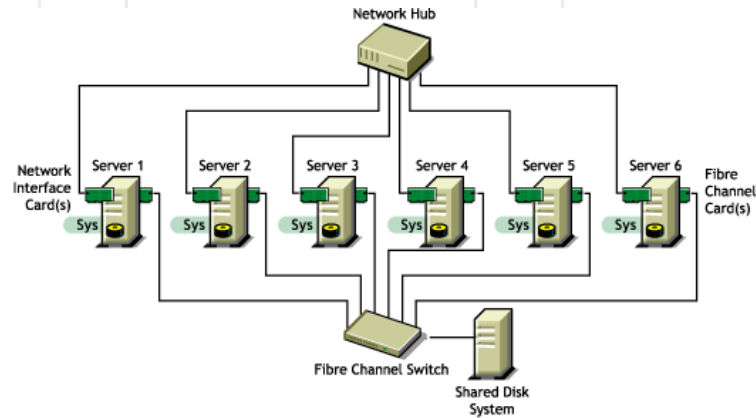
- Local Network resource.
- Accessed from servers.
- Minimal overhead.

3. DAS (Direct Attached Storage)(Not for DC)

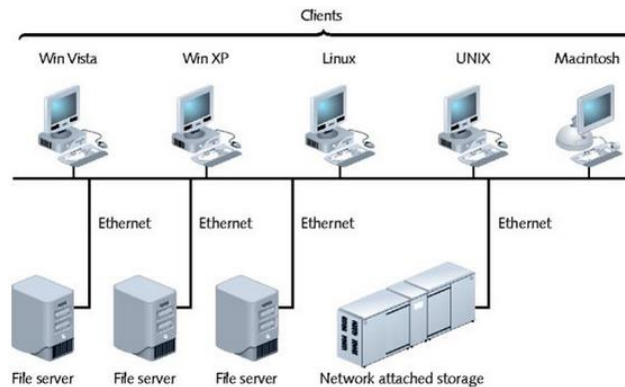


Storage Equipment Data Center (Continue)

1. SAN (Storage Area Network)



2. NAS (Network Attached Storage)





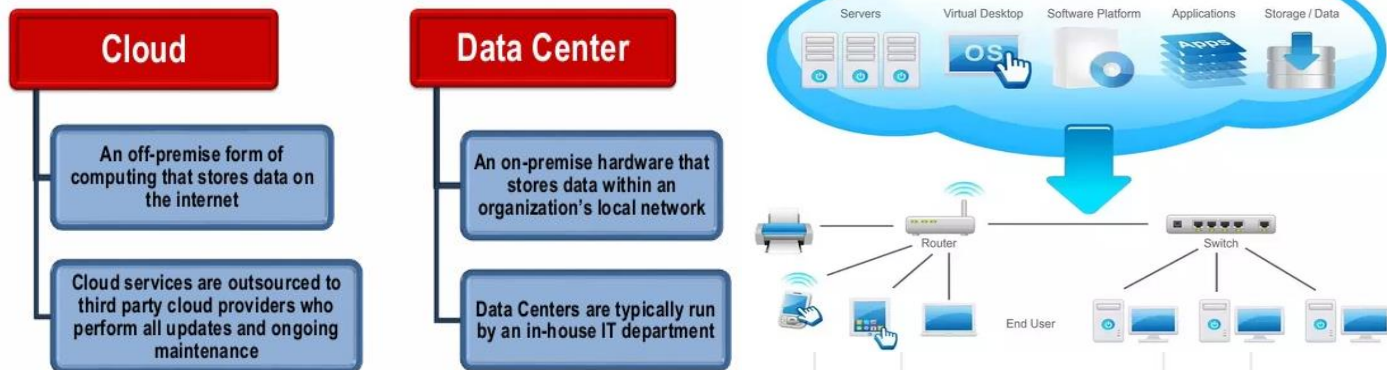
Case Study Scenario (Quiz)

1. As a data Storage or Network specialist you need to classify, which solution is good for different organization depending on their volume and enterprise level.
 - A. Photographic and computer animation firm, no of employees 10, (CEO. Mr. Alar).
 - B. Accountancy Firm, no of Employees 70, (CEO. Mr. Jaan).
 - C. Wind turbine provider, no of employees around 200, (CEO. Ms. Julia)

Data Center Vs Cloud Computing

1. Is a cloud a data center? Is a data center a cloud? Or are they two completely different things?

MAIN DIFFERENCE BETWEEN CLOUD AND DATA CENTER

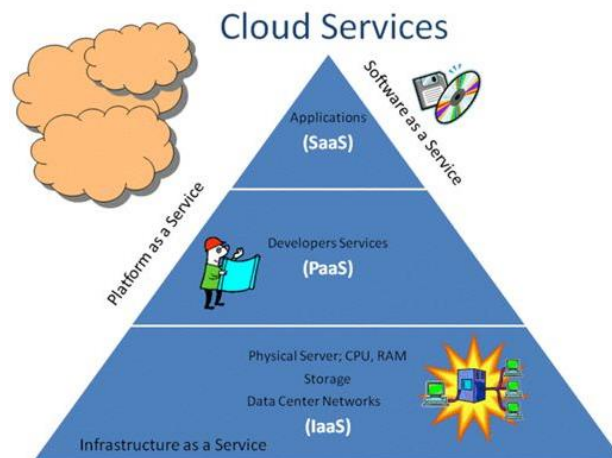


- Cloud security vs data center security.
- Cloud vs data center costs.



Cloud Computing

- Cloud computing entails the delivery of data and shared resources via a secure and centralized remote platform.
- Cloud Computing Services,
 1. Infrastructure as a Service (IaaS)
 2. Software as a Service (SaaS)
 3. Platform as a Service (PaaS)





Conclusion and Future Work

- Many companies own multiple data centers in different geographic locations to ensure redundancies against data center failures.
- The next step in the evolution of data centers, virtualization and cloud computing.
- Future data centers will, however, have a much smaller physical footprint as more components of the data center are virtualized.



Research Topics for Data Center

- How to reduce the power consumption of Data center.
- Energy harvesting and estimating for the next time slots to operate low power device.
- The combination of server virtualization, software-defined networks (SDN), software-defined storage (SDS), and then finally virtualized data center.

Thank you!