Data Center Virtualization and Cloud Computing Infrastructure

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Introduction to Cloud Computing

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Definition of Data Center

Data Center: A Facility that houses, access and processes data to produce information

Data is raw, unorganized facts that need to be processed. Data can be something simple and seemingly random and useless until it is organized.

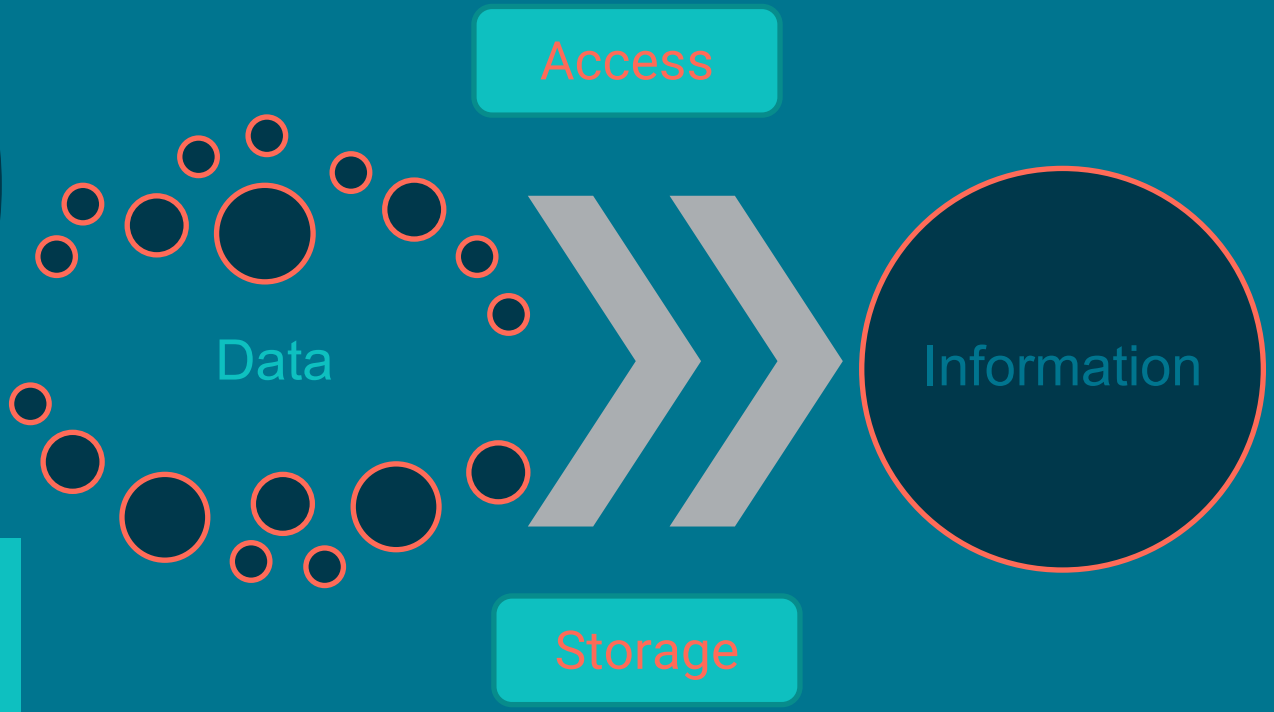
When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.

Example:

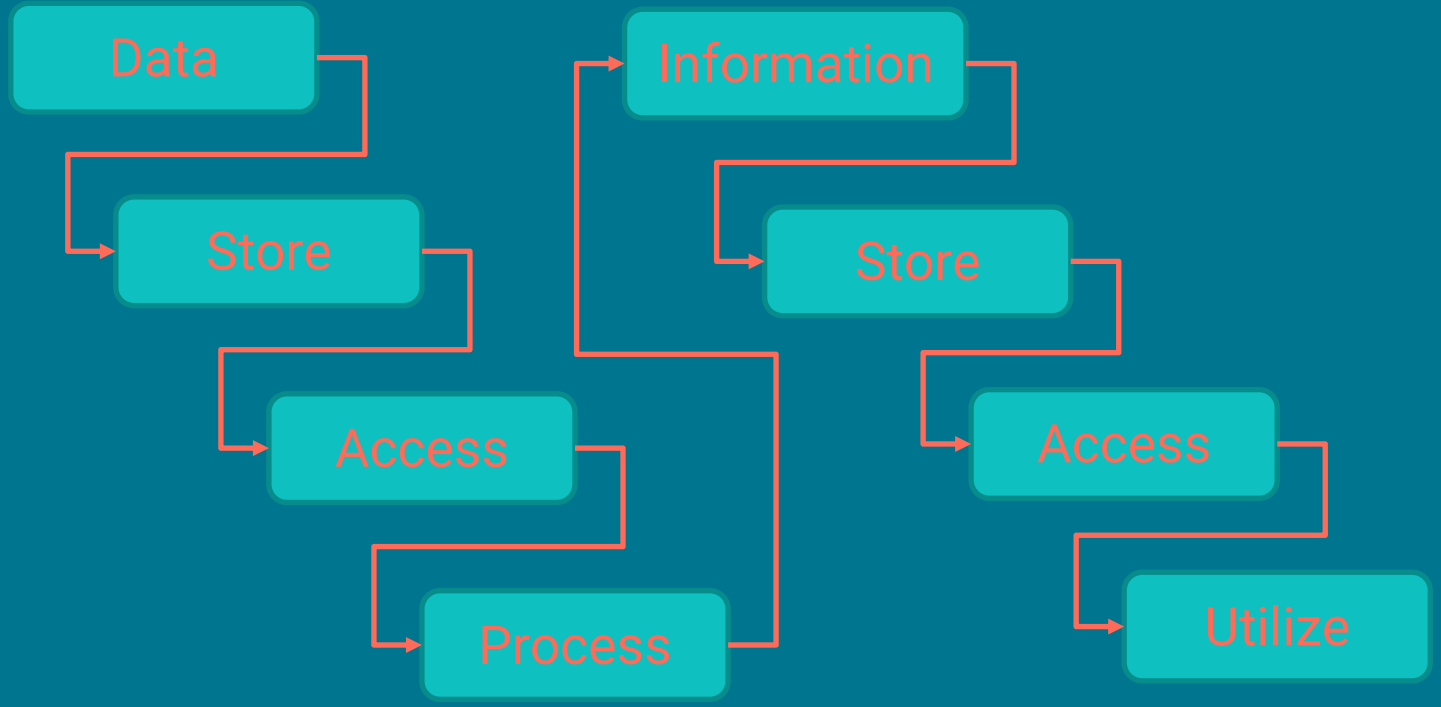
Each student's test score is one piece of data.

The average score of a class or of the entire school is information that can be derived from the given data.

Processing of Data



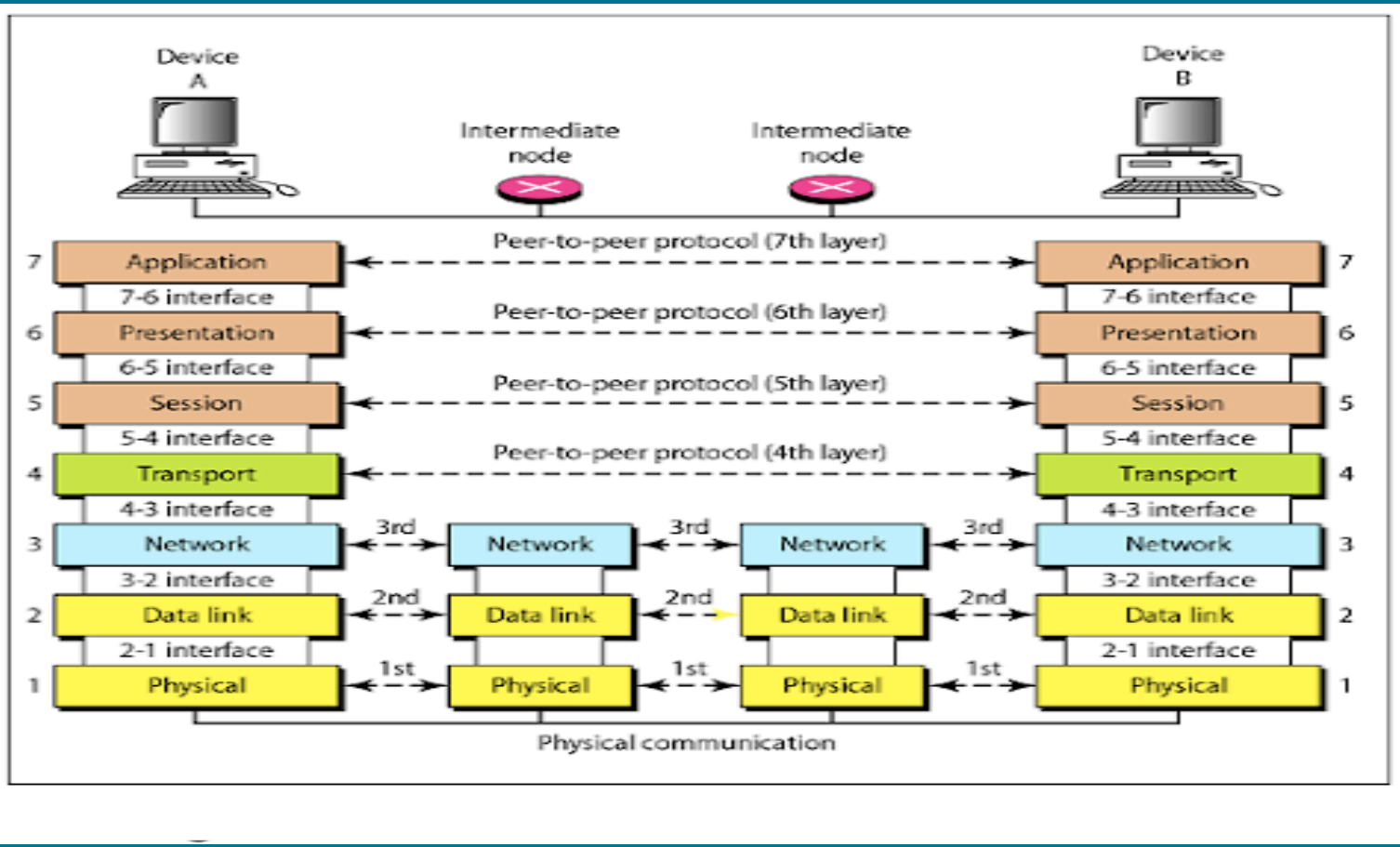
Processing of Data



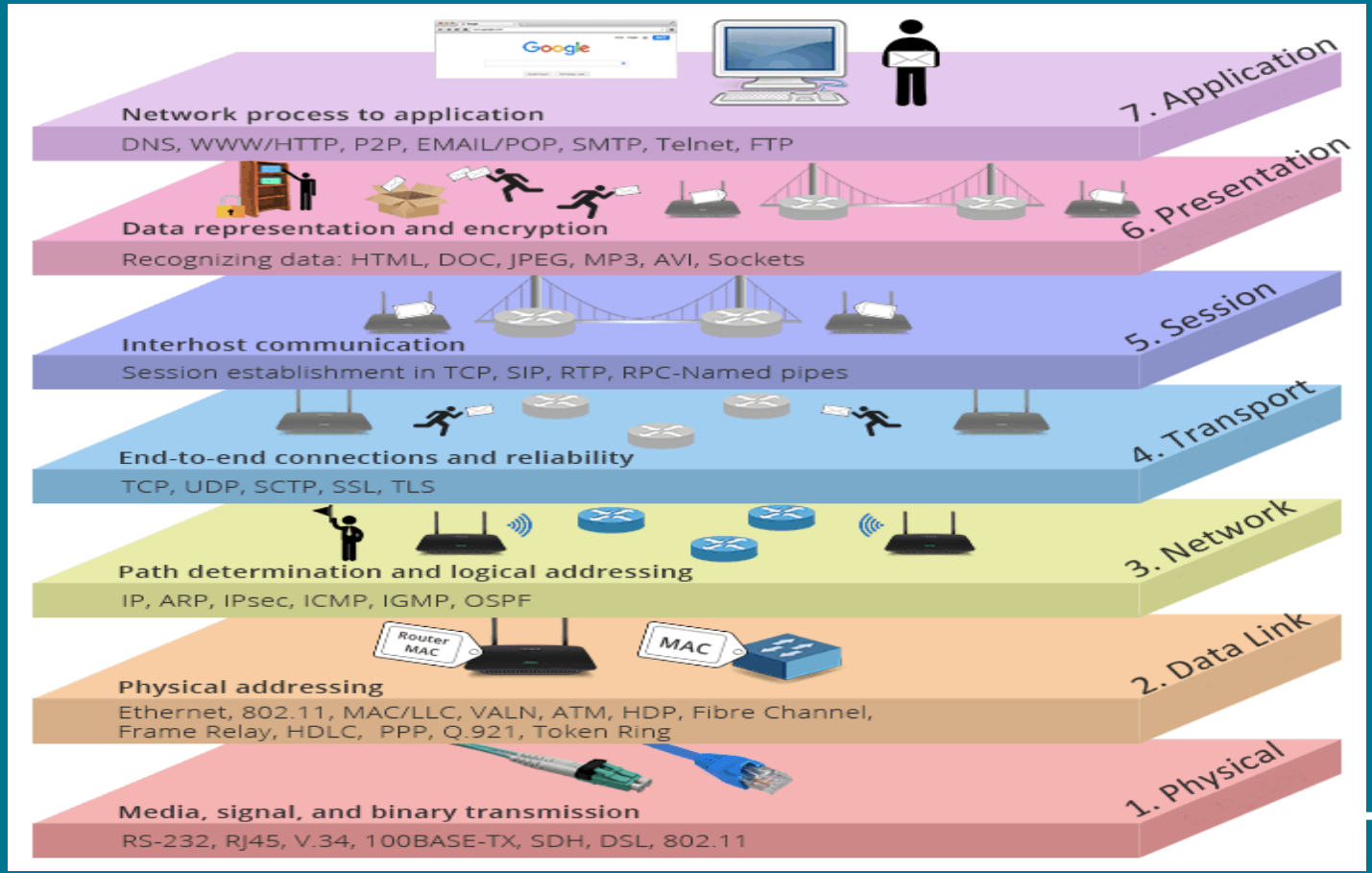
Processing of Data

Activity	Methods or Devices
Store	Storage Devcies (HDD, Tape, Removable Devices)
Access	Communication Devices, Security Devices ○ Among Data Centers ○ Data Center to Edge ○ Edge to Edge
Process	Compute Devices, Operating Systems, Applications

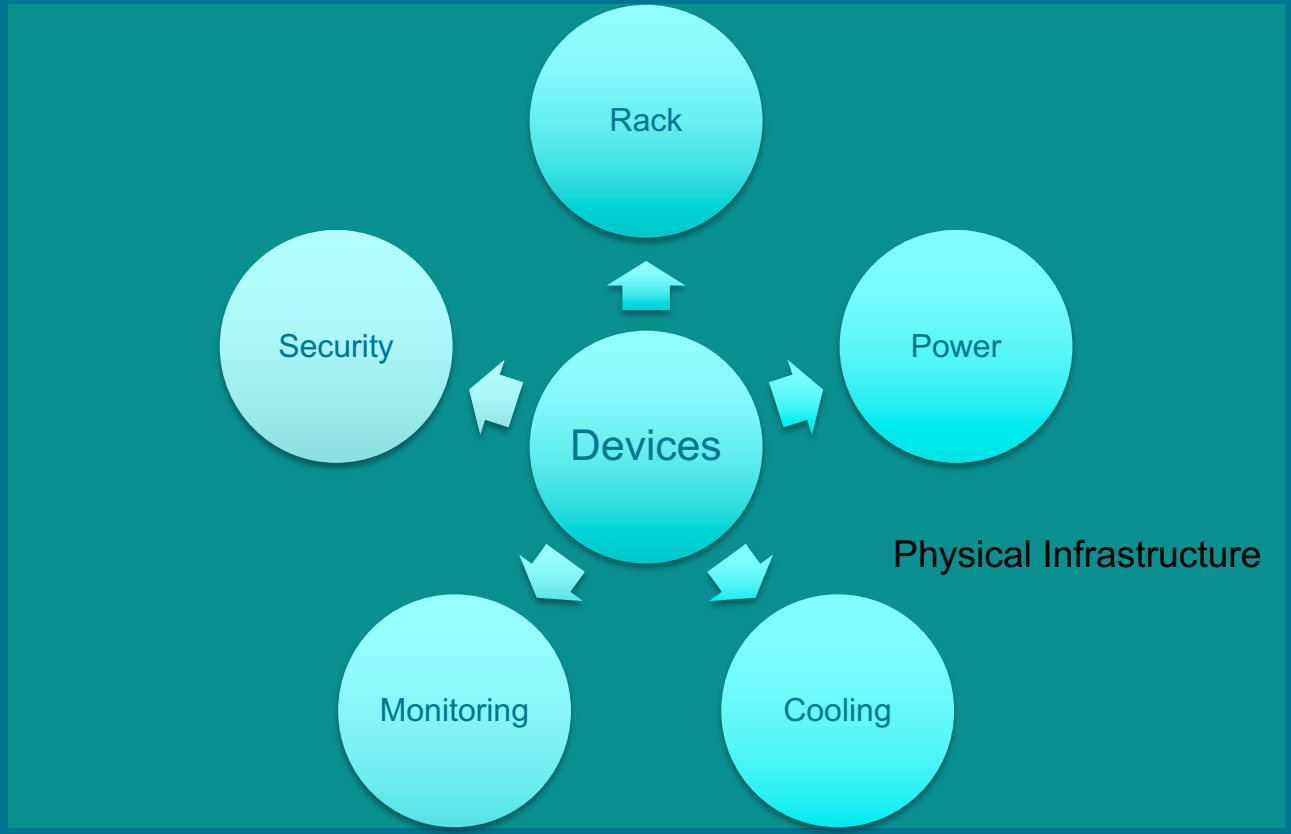
Data Communication (Access)



Data Communication (Access)



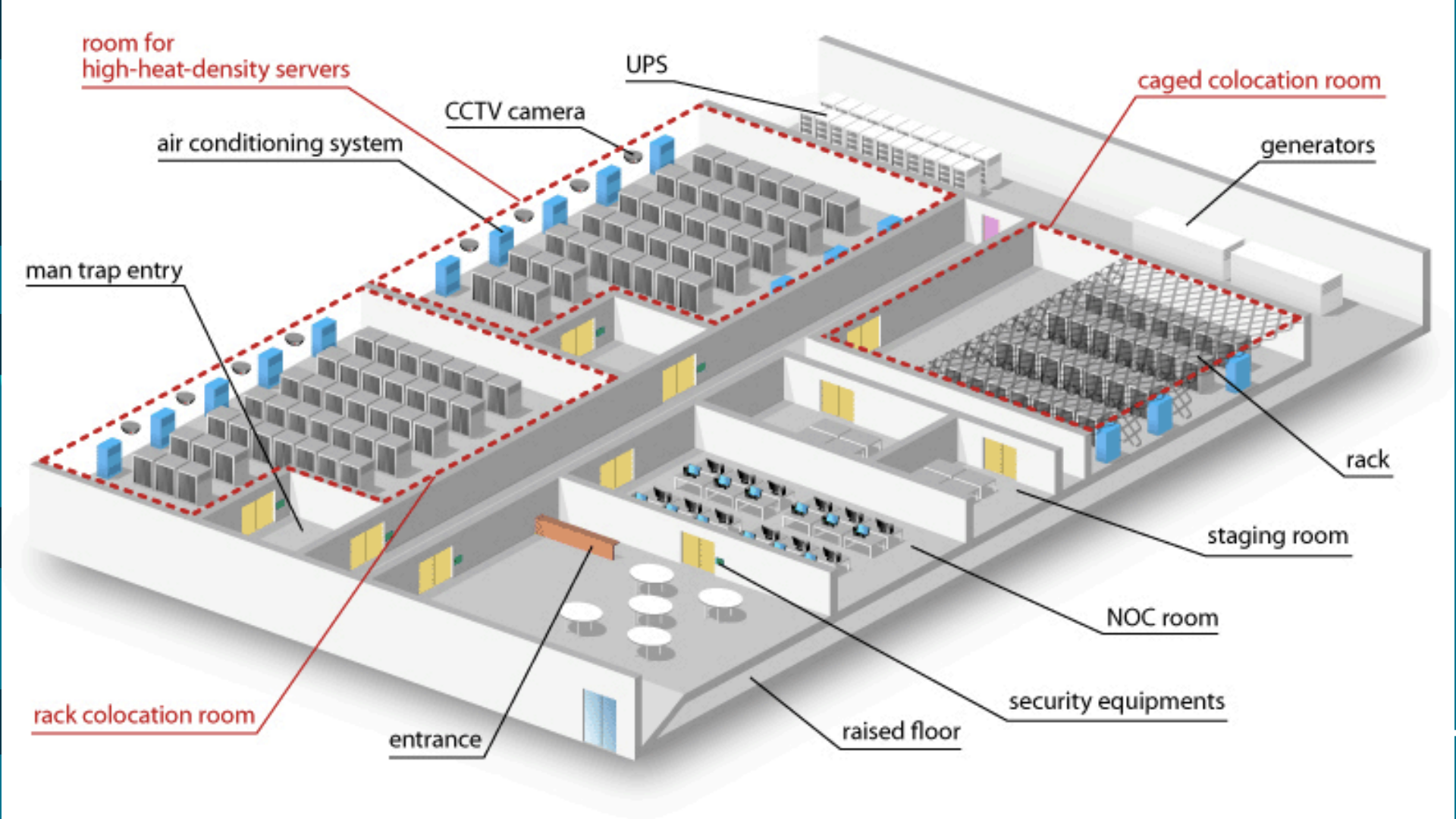
Components of Data Center

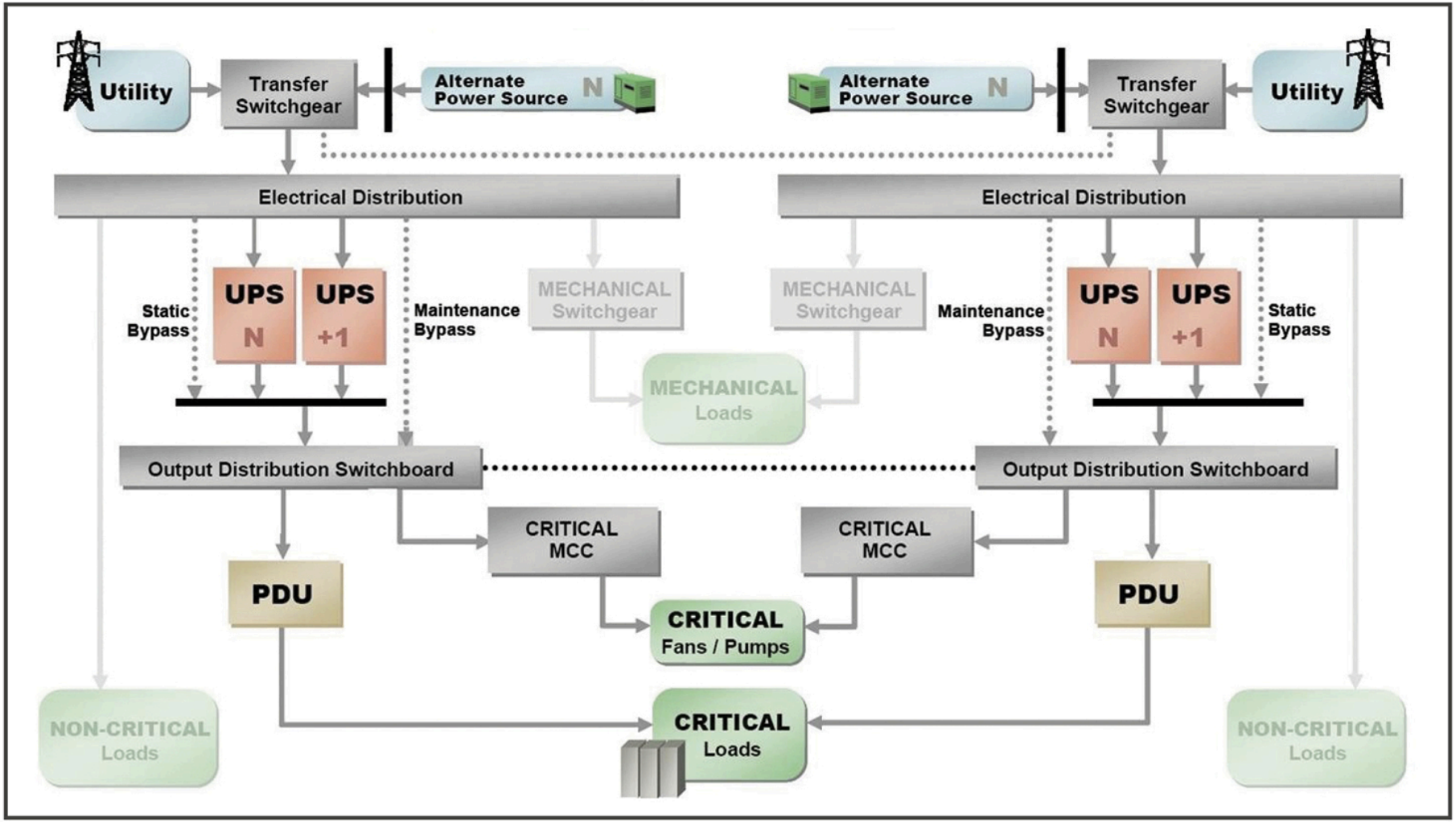


Components of Data Center

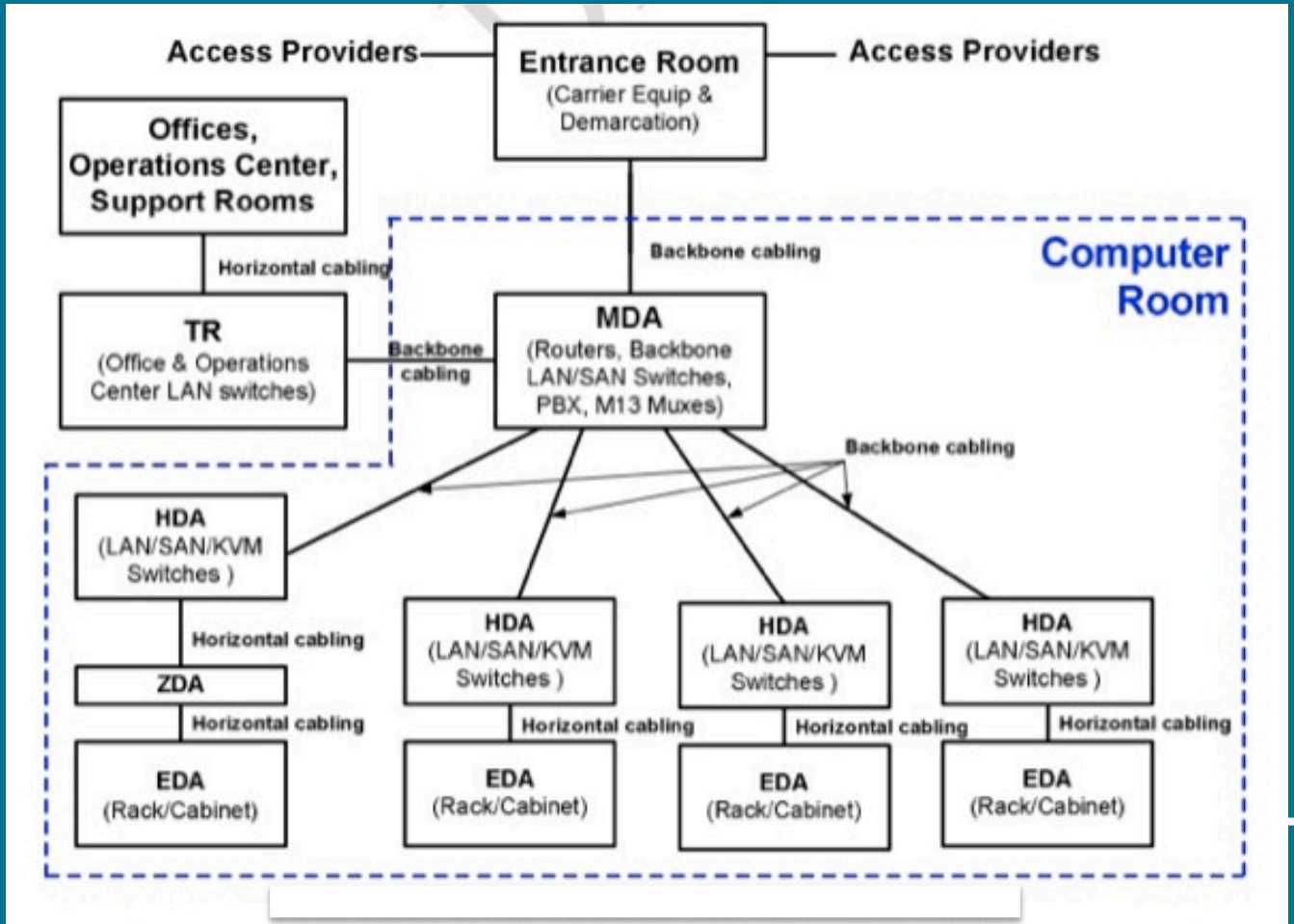
- Real Estate (Building, Floor)
- Facility
  - Power (Grid, Generator, UPS, Rectifier)
  - Cooling (PAC, CRAC, Chiller)
  - Controlled Environment (Humidity, Smoke Detection, Water Leakage etc.)
  - Physical Security (Access Control, CCTV)
- Passive Infrastructure
  - Cabling (Power, UTP, Fiber)
  - ODF
  - Patch Panel
  - Rack

- Active Infrastructure
  - Compute / Server
  - Network
  - Storage
  - Logical Security
- Application
  - ERP
  - CRM
  - SCM
  - Web

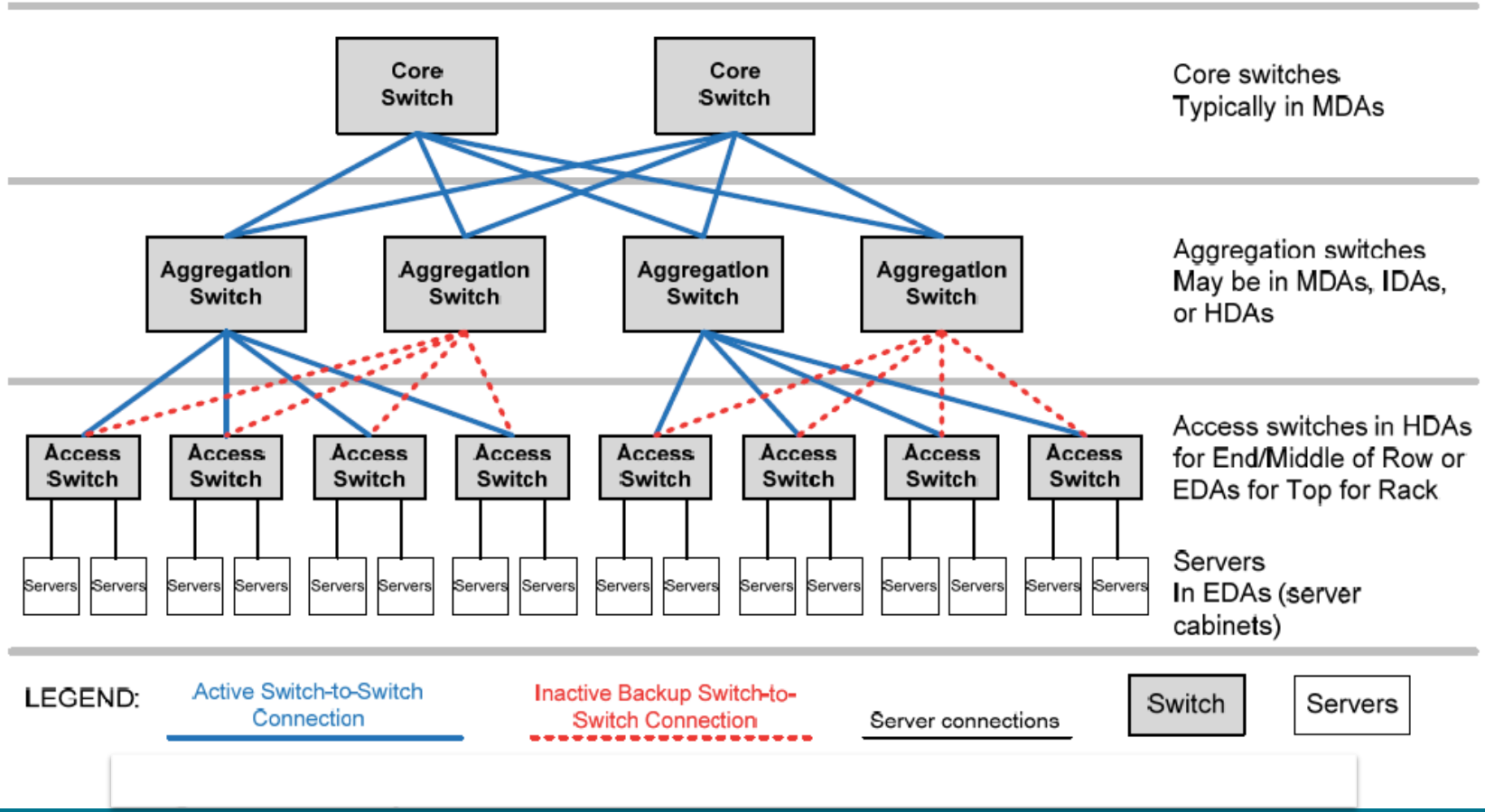

room for
high-heat-density servers
UPS
caged colocation room
CCTV camera
air conditioning system
generators
man trap entry
rack
staging room
NOC room
rack colocation room
security equipments
entrance
raised floor


Utility
Transfer Switchgear
Alternate Power Source N
Alternate Power Source N
Transfer Switchgear
Utility
Electrical Distribution
Electrical Distribution
Static Bypass
UPS N
UPS +1
Maintenance Bypass
MECHANICAL Switchgear
MECHANICAL Switchgear
Maintenance Bypass
UPS N
UPS +1
Static Bypass
MECHANICAL Loads
Output Distribution Switchboard
Output Distribution Switchboard
CRITICAL MCC
CRITICAL MCC
PDU
PDU
CRITICAL Fans / Pumps
NON-CRITICAL Loads
CRITICAL Loads
NON-CRITICAL Loads

Standards of Data Center – ANSI/TIA-942



Standards of Data Center – ANSI/TIA-942



Standards of Data Center – ANSI/TIA-942

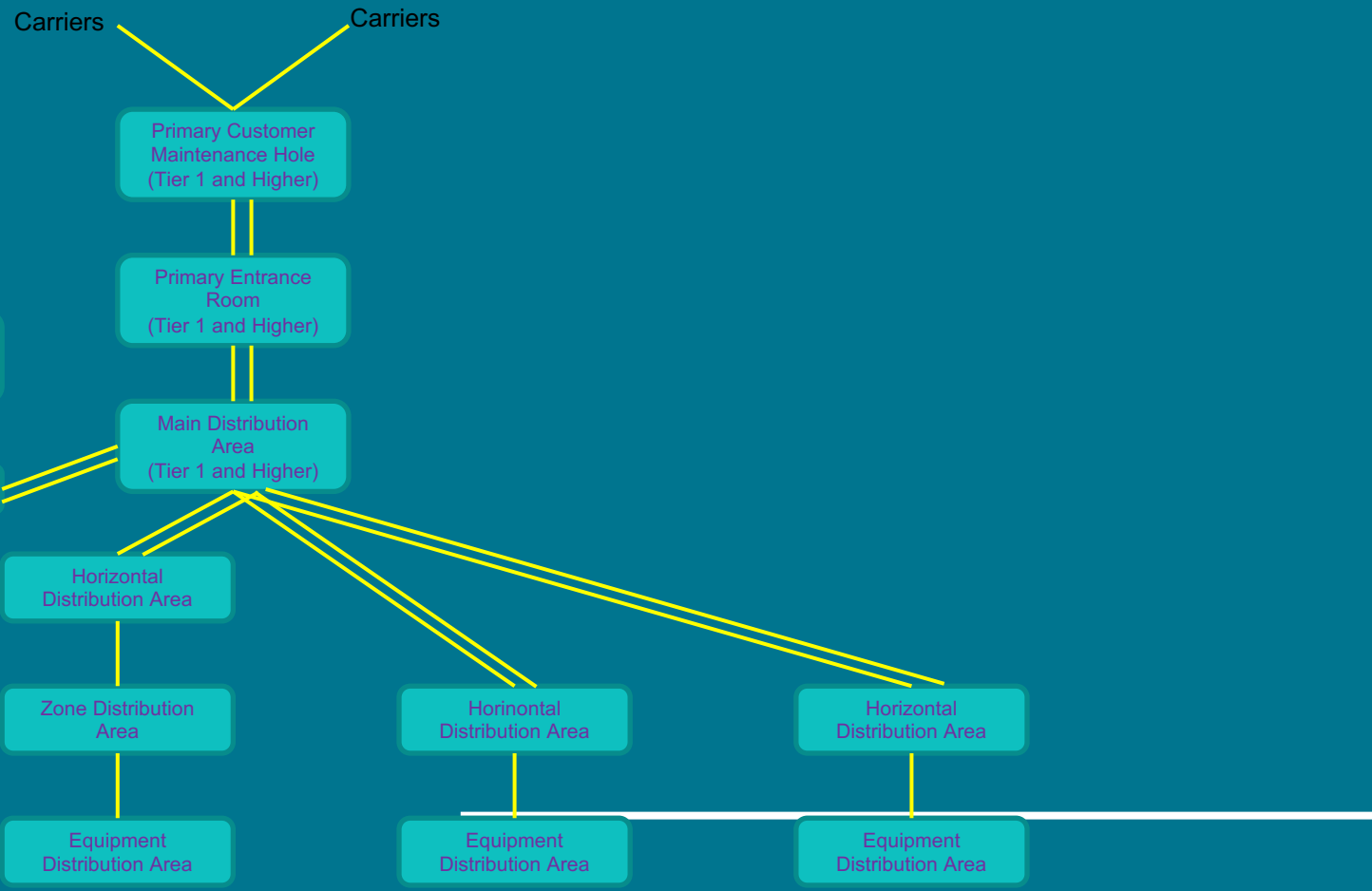
Tier 1: Basic site infrastructure. A Tier 1 data center offers limited protection against physical events. It has single-capacity components and a single, nonredundant distribution path.

Tier 2: Redundant-capacity component site infrastructure. This data center offers improved protection against physical events. It has redundant-capacity components and a single, nonredundant distribution path.

Tier 3: Concurrently maintainable site infrastructure. This data center protects against virtually all physical events, providing redundant-capacity components and multiple independent distribution paths. Each component can be removed or replaced without disrupting services to end users.

Tier 4: Fault-tolerant site infrastructure. This data center provides the highest levels of fault tolerance and redundancy. Redundant-capacity components and multiple independent distribution paths enable concurrent maintainability and one fault anywhere in the installation without causing downtime.

Standards of Data Center – ANSI/TIA-942



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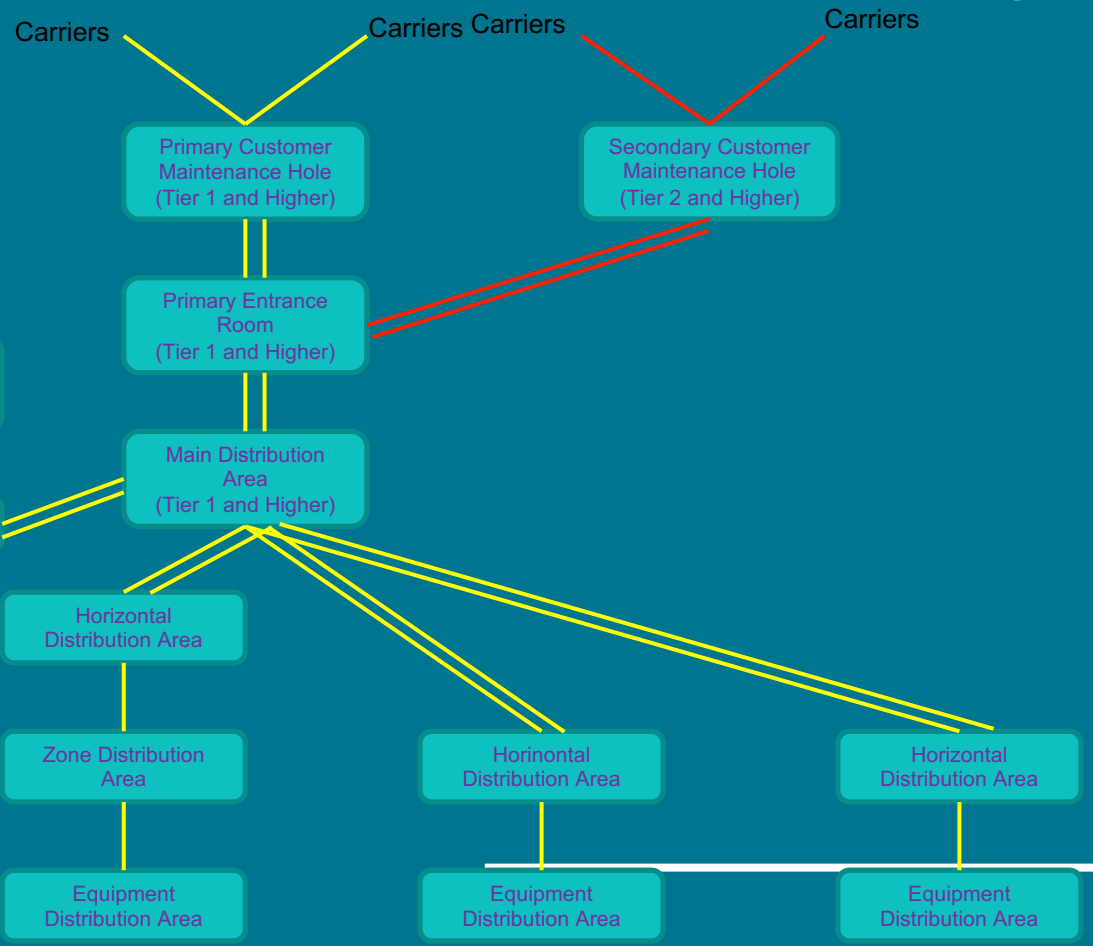

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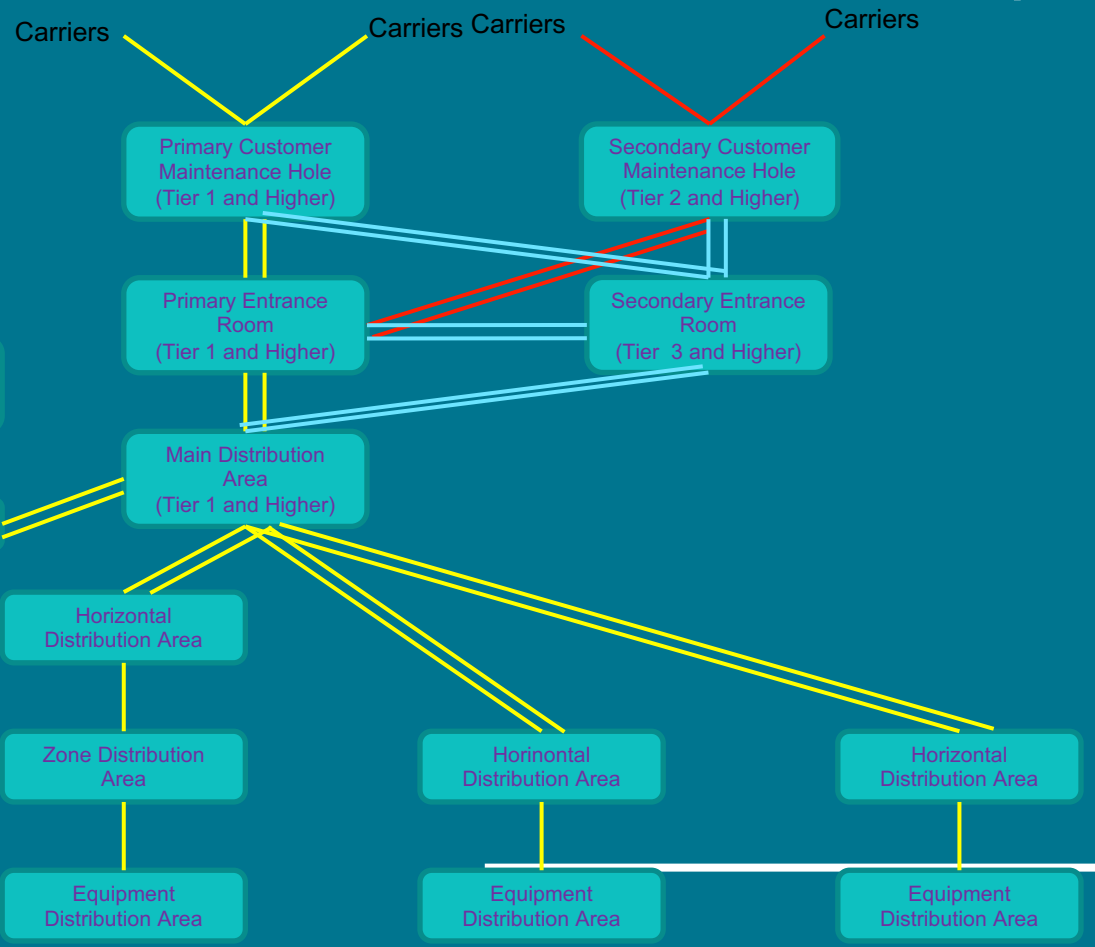

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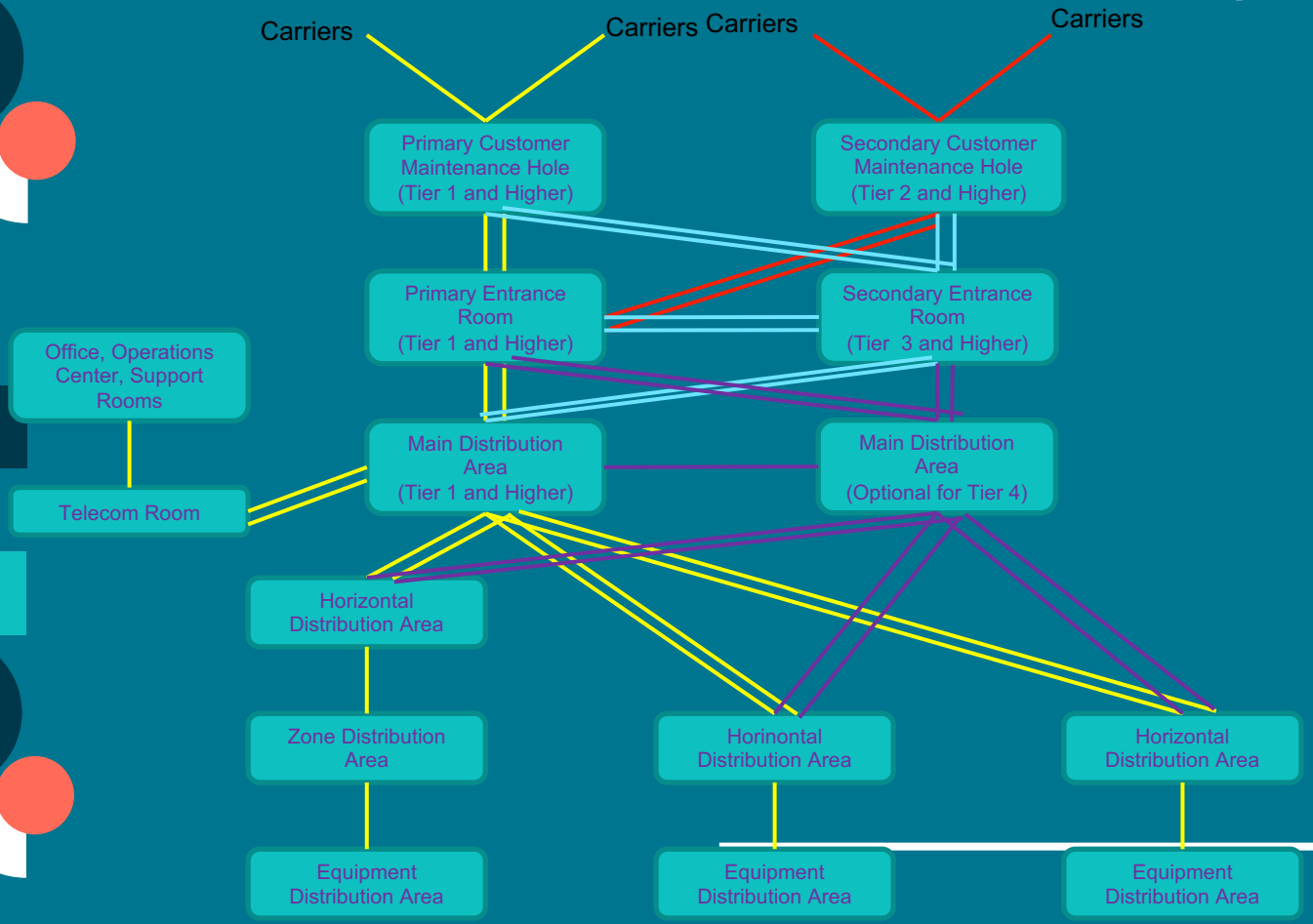
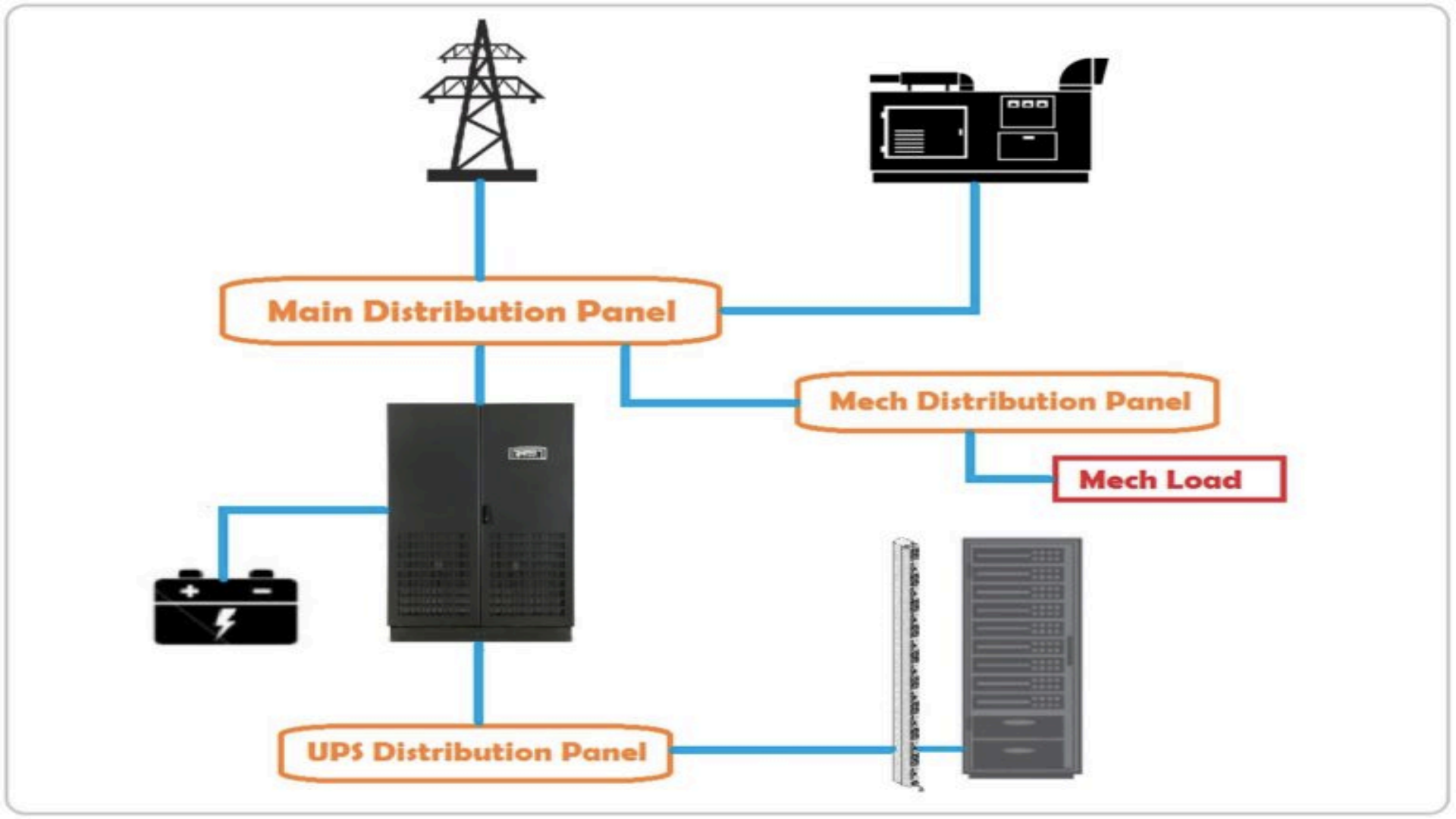
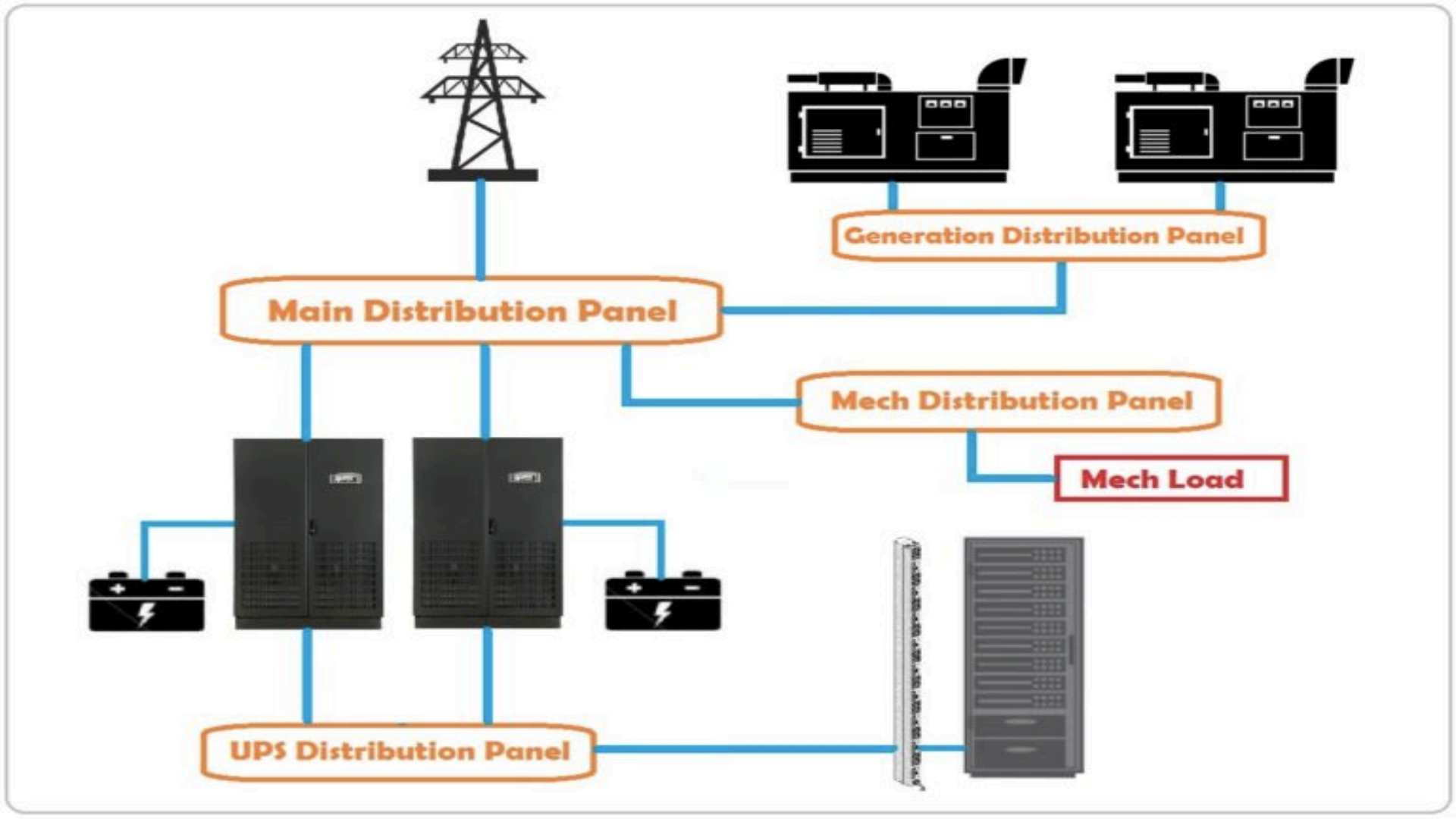
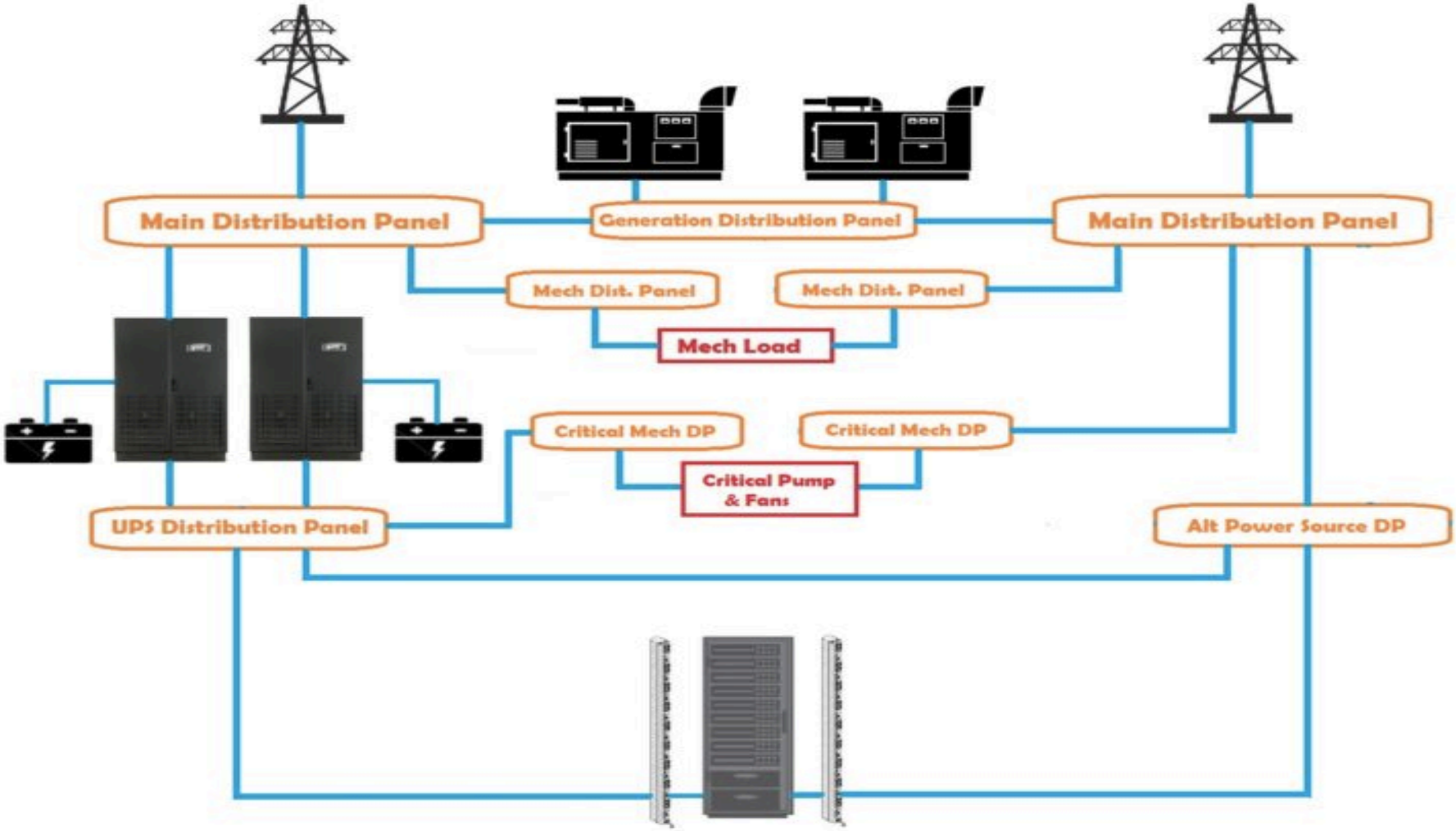


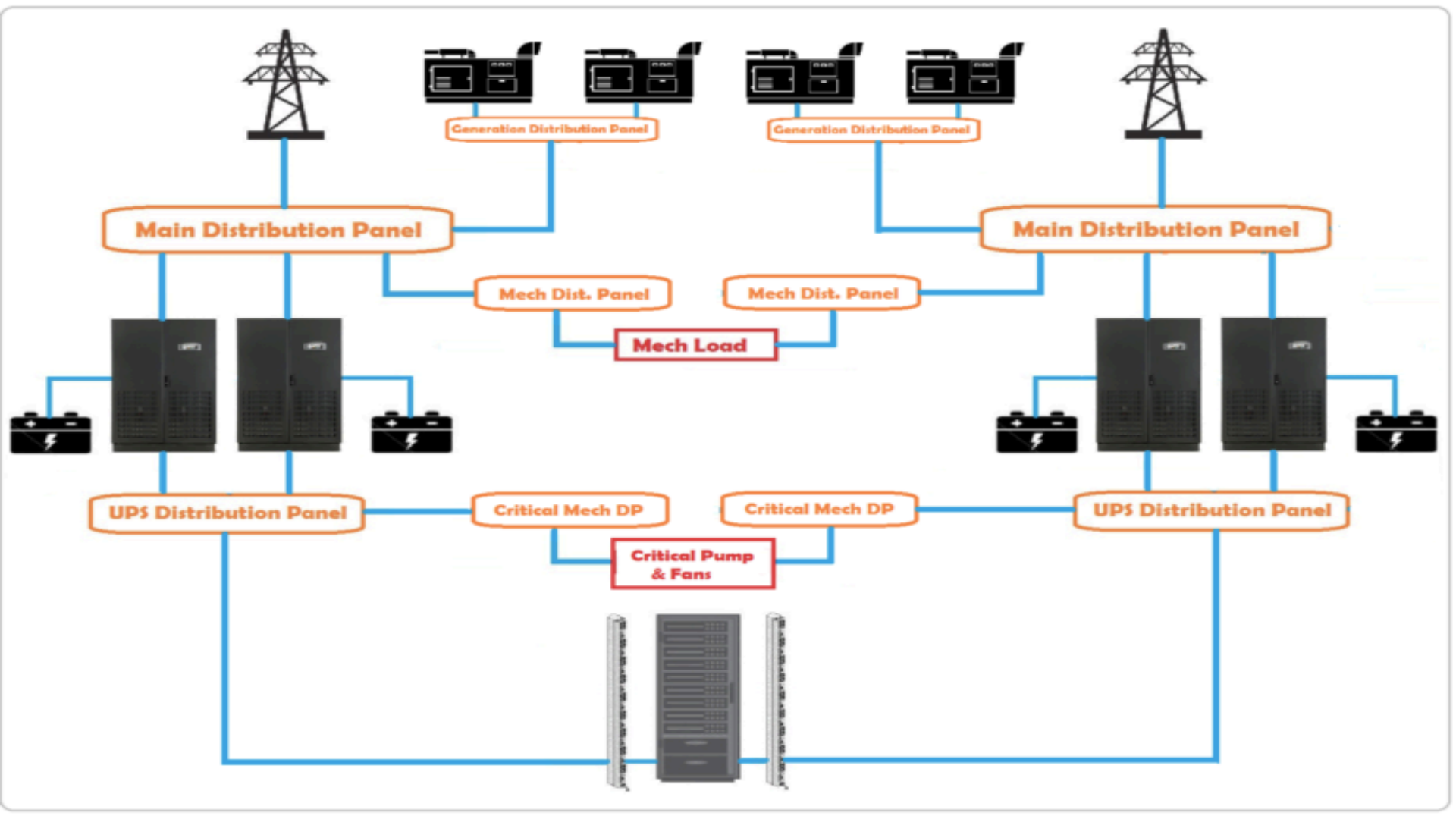
Standards of Data Center – ANSI/TIA-942

	Tier I	Tier II	Tier III	Tier IV
Active Capacity Components to Support the IT Load	N	N+1	N+1	N After any Failure
Distribution Paths	1	1	1 Active and 1 Alternate	2 Simultaneously Active
Concurrently Maintainable	No	No	Yes	Yes
Fault Tolerant	No	No	No	Yes
Compartmentalization	No	No	No	Yes
Continuous Cooling	No	No	No	Yes

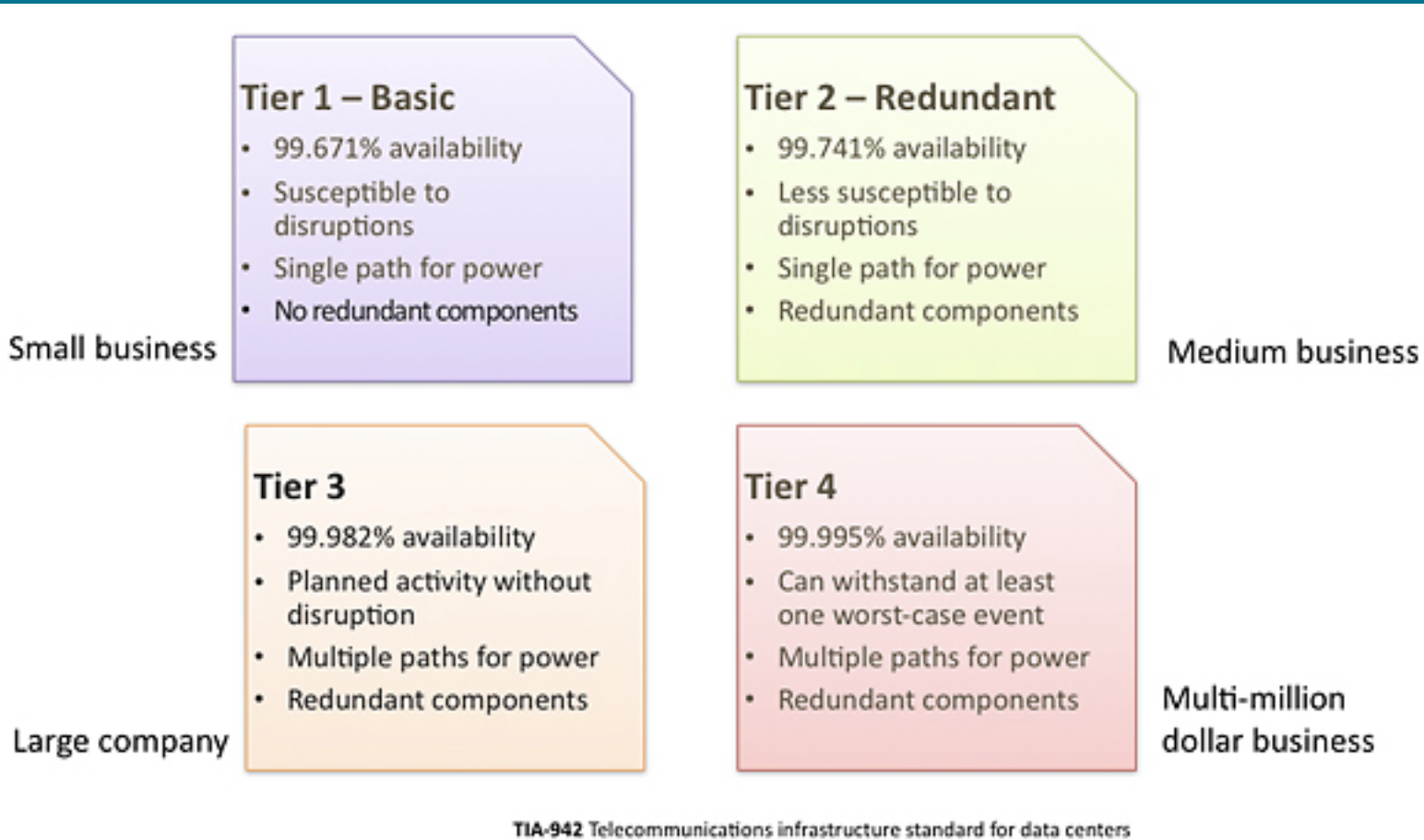

Main Distribution Panel
Mech Distribution Panel
Mech Load
UPS Distribution Panel


Generation Distribution Panel
Main Distribution Panel
Mech Distribution Panel
Mech Load
UPS Distribution Panel


Main Distribution Panel
Generation Distribution Panel
Main Distribution Panel
Mech Dist. Panel
Mech Dist. Panel
Mech Load
Critical Mech DP
Critical Mech DP
Critical Pump & Fans
UPS Distribution Panel
Alt Power Source DP


Generation Distribution Panel
Generation Distribution Panel
Main Distribution Panel
Main Distribution Panel
Mech Dist. Panel
Mech Dist. Panel
Mech Load
UPS Distribution Panel
Critical Mech DP
Critical Mech DP
UPS Distribution Panel
Critical Pump & Fans

Standards of Data Center – ANSI/TIA-942



Data Center Virtual Tour

https://www.youtube.com/watch?v=zHQpK3Aultg

Types of Data Center

Name	Description
Enterprise	Built, owned and operated by company
Managed services	The company leases the equipment and infrastructure owned and managed by third party
Colocation	Company rent space in a Data Center owned by third party.
Cloud	Virtual Data Center

Infrastructure Evolution

Computing infrastructure has experienced three macro waves of evolution over the last 65 years:

The first wave saw the shift from proprietary mainframes to x86-based servers, based on-premises and managed by internal IT teams.

A second wave saw widespread virtualization of the infrastructure that supported applications. This allowed for improved use of resources and mobility of workloads across pools of physical infrastructure.

The third wave finds us in the present, where we are seeing the move to cloud, hybrid cloud and cloud-native. The latter describes applications born in the cloud.

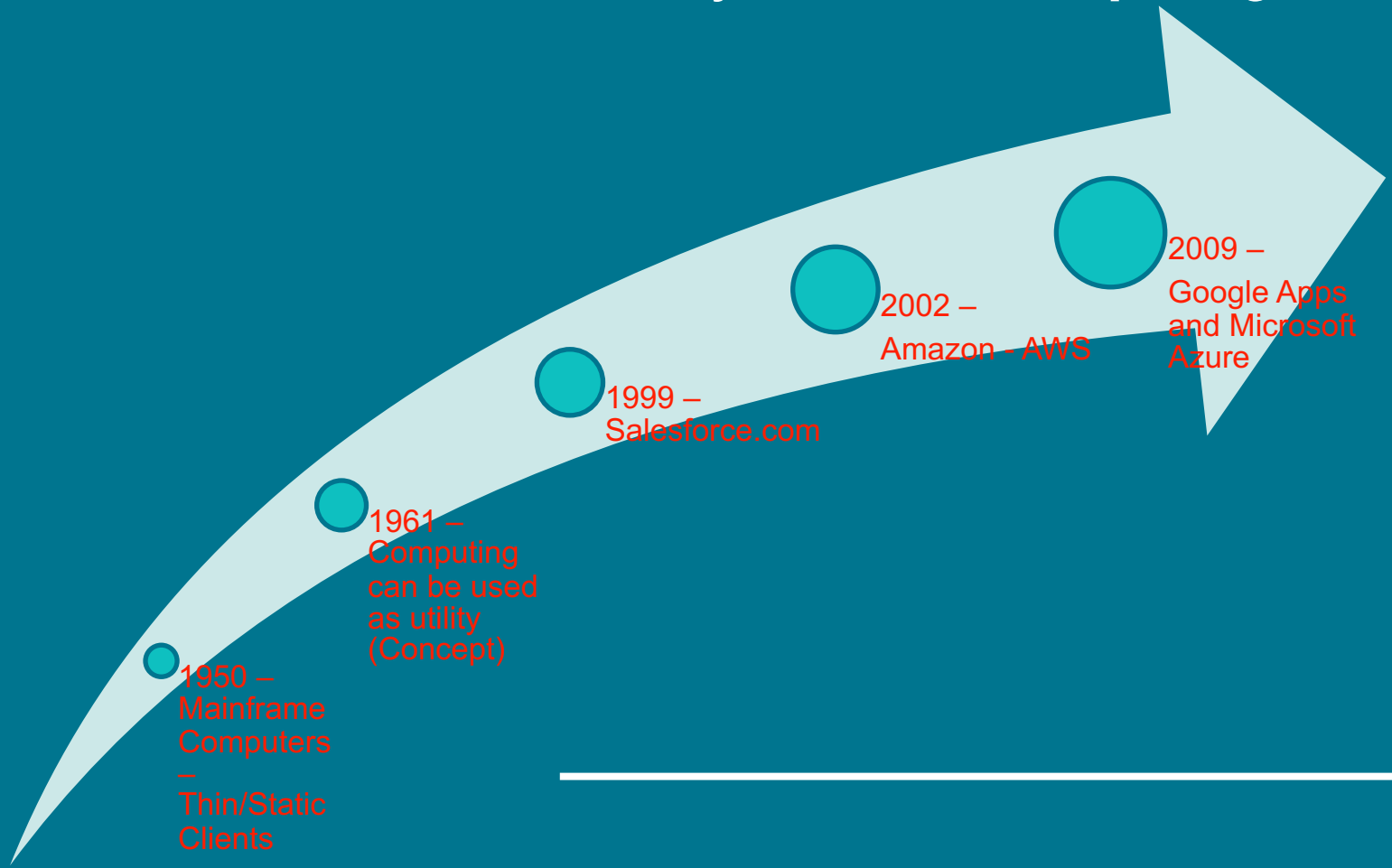
Introduction to Cloud Computing

Cloud computing is not a new technology, but an IT delivery model using existing technology. Its main purpose is to transform computing resources into a utility just like electricity or water, which can be easily accessible and charged according to its use.

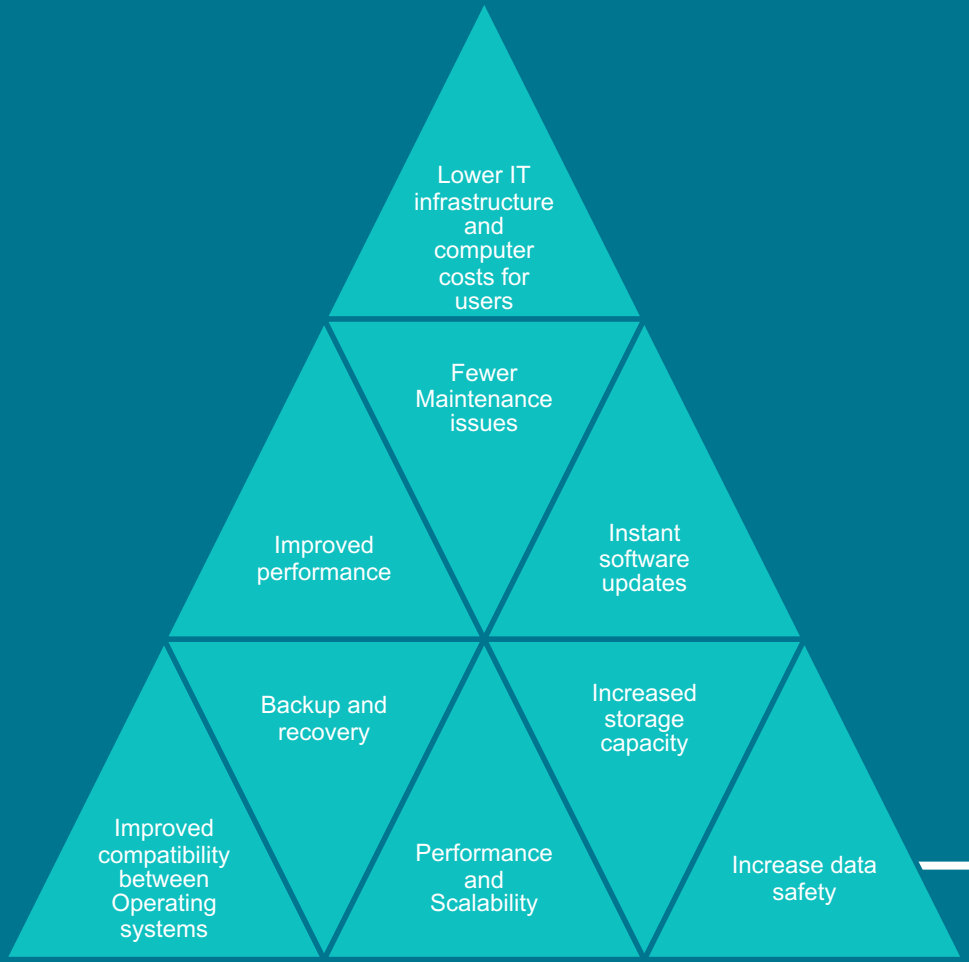
Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Cloud computing implementations provide an extra layer of abstraction (another one!) that hides the complexity of IT implementations and support from its consumers.

Journey of Cloud Computing



Benefits of Cloud Computing



Cloud Computing Applications

Storing File Online

Video Making and Editing Software

File Converter

Anti-Virus Applications

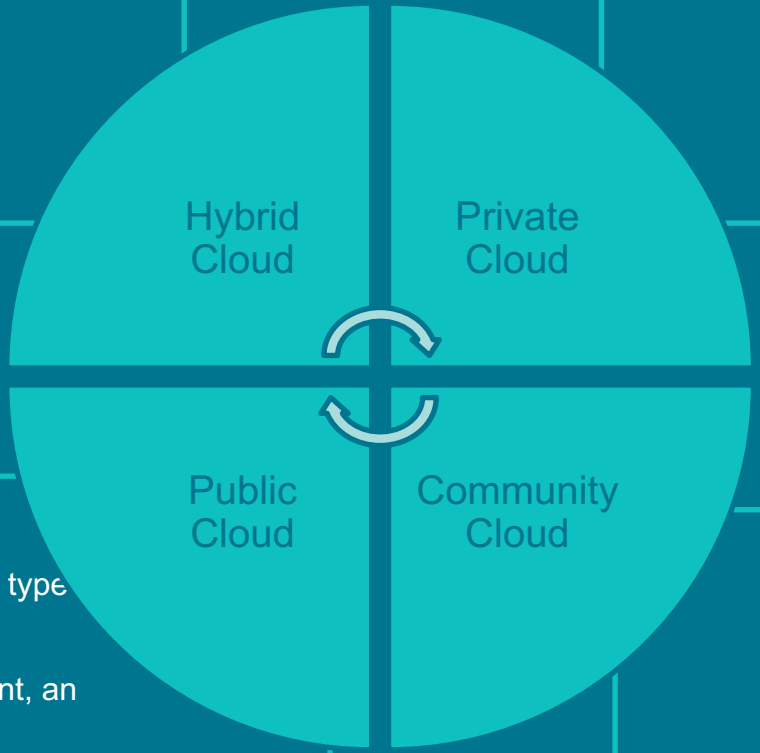
E-Commerce Applications

Business Process

Backup and Recovery

Types of Cloud Computing

- Business to Business or B2C Business to Consumer interaction
- bound together by different clouds

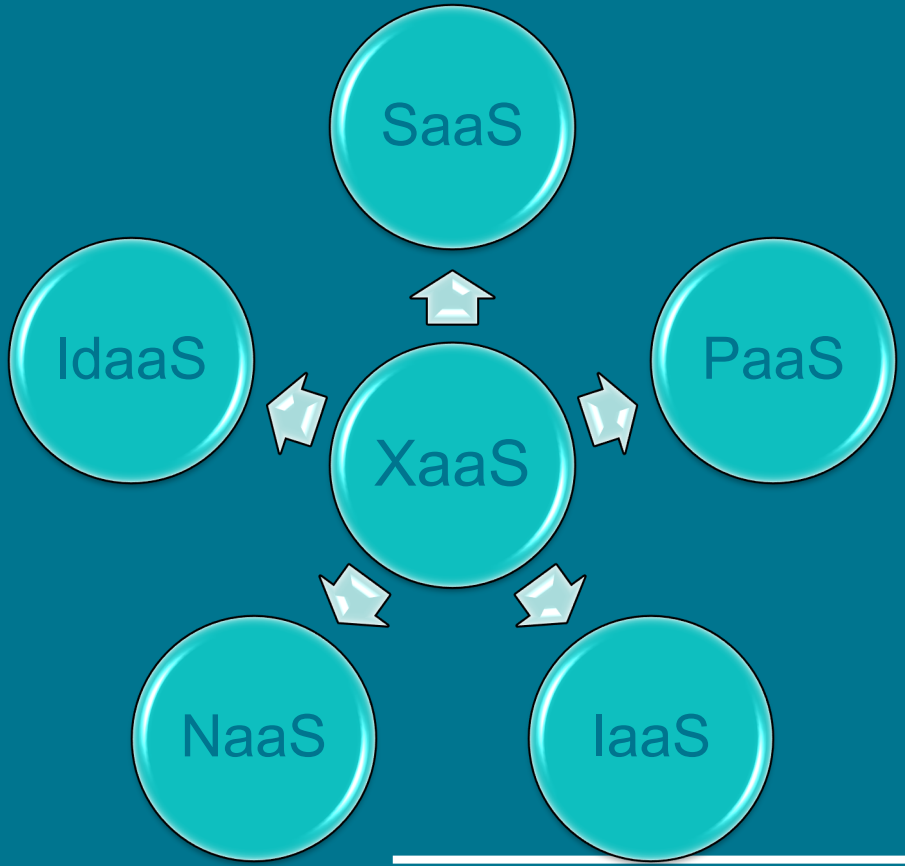


- one particular organization
- intra-business interactions
- governed, owned and operated by the same organization

- Business to Consumer type interactions
- owned, governed and operated by government, an academic or business organization

- Community and similar type of organizations

Services of Cloud Computing



Software as a Service (SaaS)

SaaS	• Also known as Hosted Software, On-Demand Software or Web-Based Software
Application	• Vendor develop and manage • Accessible through web browser or dedicated application
Benefits	• Scalable • Flexible • Up to Date • Ease of Access
Architecture	• Multitenancy • Virtualization
Varieties	• Vertical • Horizontal
Disadvantages	• Connectivity Demand • Performance • Management • Security • Limited variation

Platform as a Service (PaaS)

PaaS

- Allows customer to develop, run and manage the application

Usability

- Analytics and Business Intelligence
- Framework
- Workflow
- Directory
- Security
- Scheduling

Delivery Model

- Software installed at a public IaaS
- Operating System
- Database
- Backup

Advantages

- Reduced Coding Time
- Enhancement of Development Capabilities
- Availability of Multiple Platform
- Economical Tools
- Regular Management of Appliance Lifecycle

Infrastructure as a Service (IaaS)

IaaS

- Customer can create and manage the virtualized IT infrastructure (CPU, Memory, HDD and OS)

Working Model

- Service Provider Cloud
- Hardware
- Servers

Advantages

- Protection and Recovery
- Flexible in Every business Condition
- Scalable
- Rapid Innovation
- Integrated Business Concentration
- Better Compatibility

Examples

- Business Networks
- Cloud Hosting
- Virtual Data Center

Network as a Service (NaaS)

Features	•Direct Network Access •Network Virtualization
Service Model	•Bandwidth On-Demand •Virtual Private Network •Mobile Network Virtualization
Requirements	•High level natural programming Language •Use of commodity networking equipment •Multitenancy Isolation using tenant code
Architecture	•Single Device •Multiple Device
Benefits	•Plug and Play •Guaranteed Uptime •Traffic Engineering

Identity as a Service (IdaaS)

Addressed Problem

- Remember multiple username and associated password
- Backlog

Features

- Cloud-Based and Multitenant Architecture
- Security
- Single Sign On and Federation
- Analytics and Intelligence
- Governance, Risk and Compliance

Advantages

- Manage local and remote applications
- Removes multiple authentication
- Single Database
- Detailed access reporting

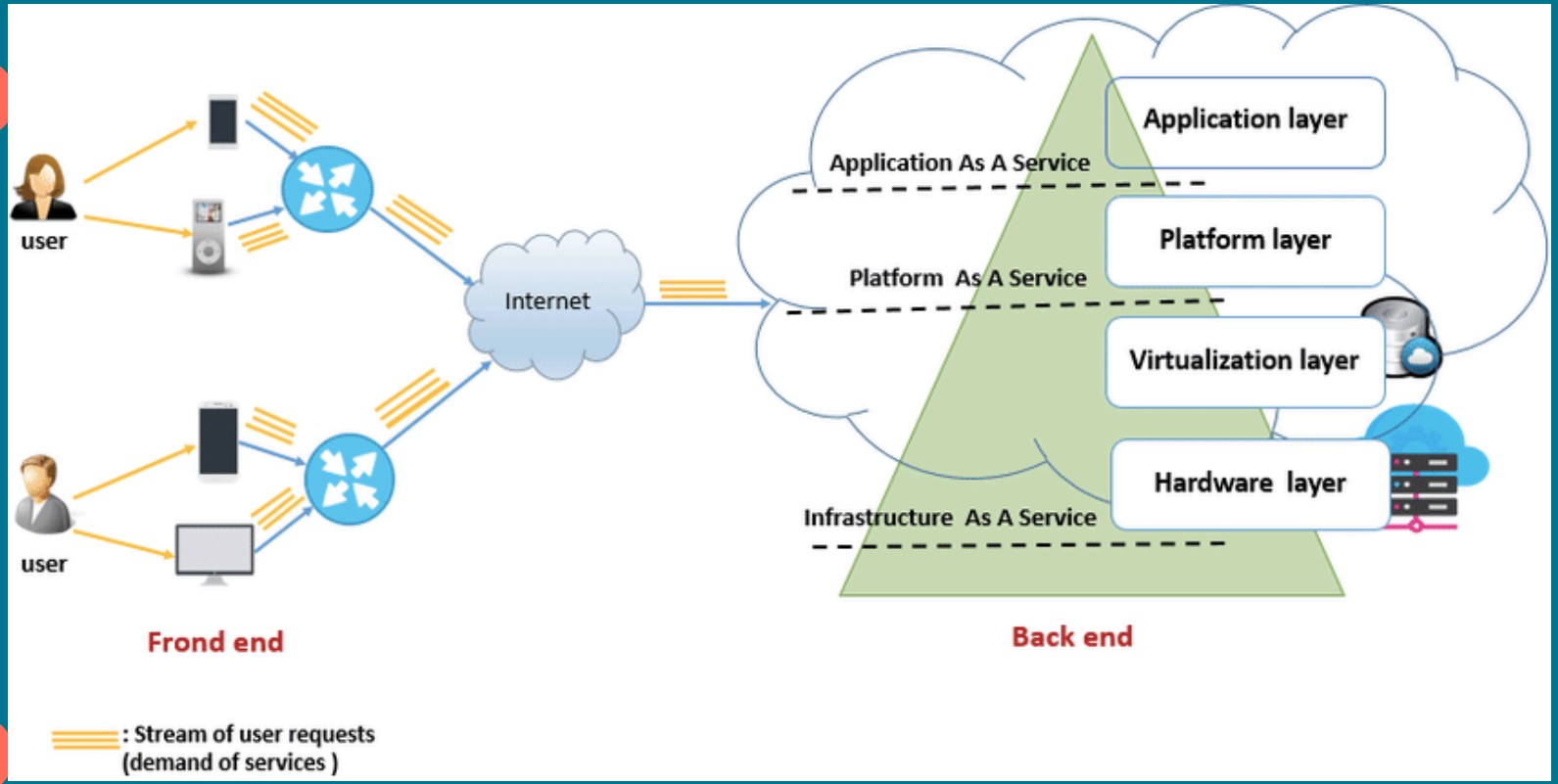
Anything as a Service (XaaS)

- Monitoring
- Content
- Object Storage
- Block Storage
- Collaboration
- Queue
- Communication
- Finance
- Database

Features of Cloud Computing

- Resource Pooling
- On Demand Self Service
- Easy Maintenance
- Large Network Access
- Availability
- Automatic System
- Economical
- Security
- Pay as you Go
- Measured Service

Cloud Computing Architecture

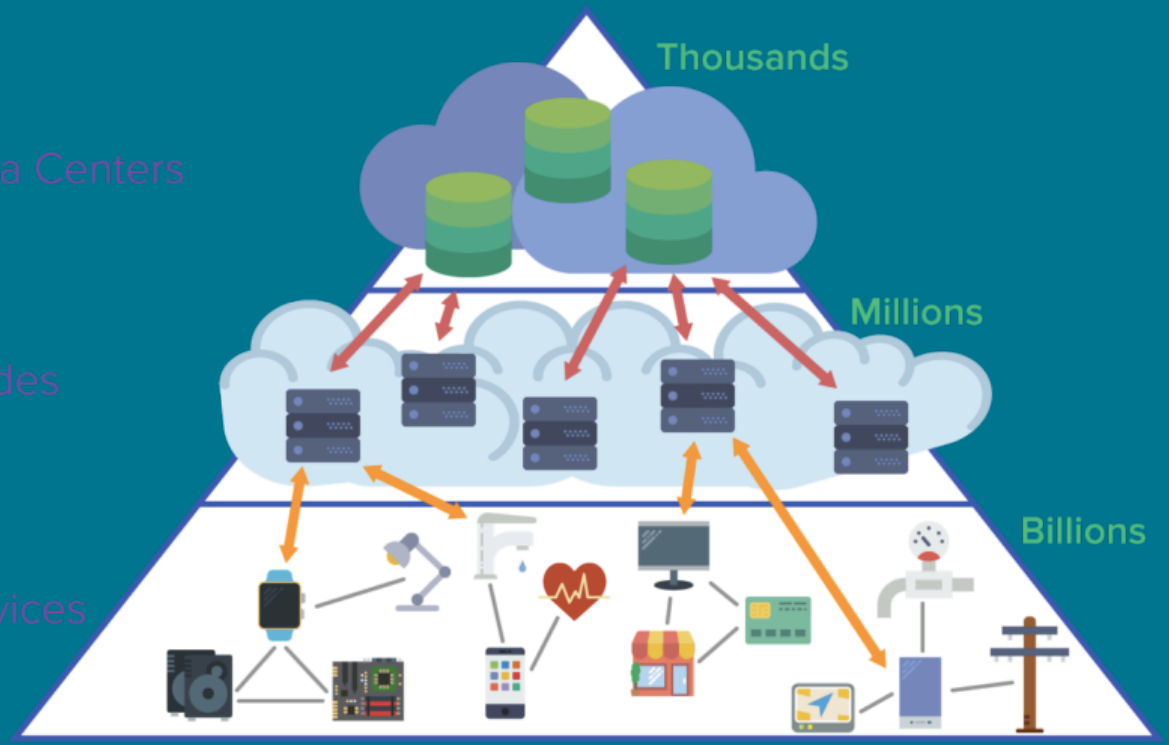


Fog Computing Architecture

CLOUD | Data Centers

FOG | Nodes

EDGE | Devices



Thank
You