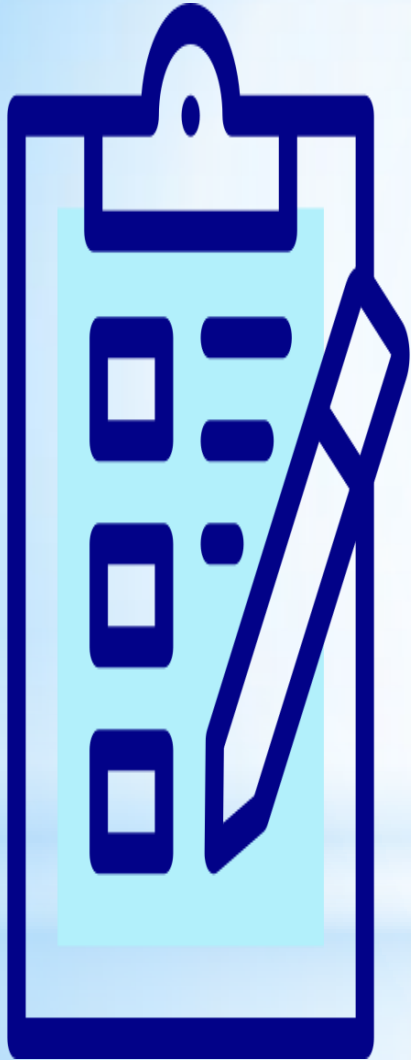# Google Data Centers:

Powering the Digital World

Agenda

- Introduction
- Evolution
- Purpose of data centers
- Security measures
- Cooling Systems
- Global network locations
- Conclusion

Introduction

What is Google Data Centers?

Google Data Centers are specialized facilities that house and manage computer systems, servers, networking equipment and storage systems.

Inside in Data Centers:

➤Servers

➤Networking equipment
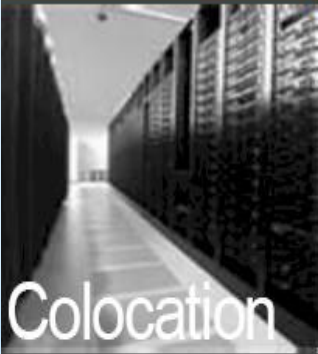
➤Storage systems

➤Cooling systems

Google data centers

Why Data Centers are Essential

➤ Highlight the need for data centers to store, process, and manage vast amounts of digital information.

➤ Emphasize the role of data centers in delivering reliable and efficient online services.

Evolution

1989-2005	2007	2009	2012	2015
Generation 1	**Generation 2**	**Generation 3**	**Generation 4**	**Generation 5**
2.0+ PUE	1.4 – 1.6 PUE	1.2 – 1.5 PUE	1.12 – 1.20 PUE	1.07 – 1.19 PUE
Colocation	Density	Containment	Modular	SW Defined
Server Capacity 20 year Technology	Rack Density & Deployment Minimized Resource Impact	Containers, PODs Scalability & Sustainability Air & Water Economization Differentiated SLAs	ITPACs & Colocations Reduced Carbon Right-Sized Faster Time-to-Market Outside Air Cooled	Fully Integrated Resilient Software Common Infrastructure Operational Simplicity Flexible & Scalable

Purpose for Data centers

what are stored in google data centers?

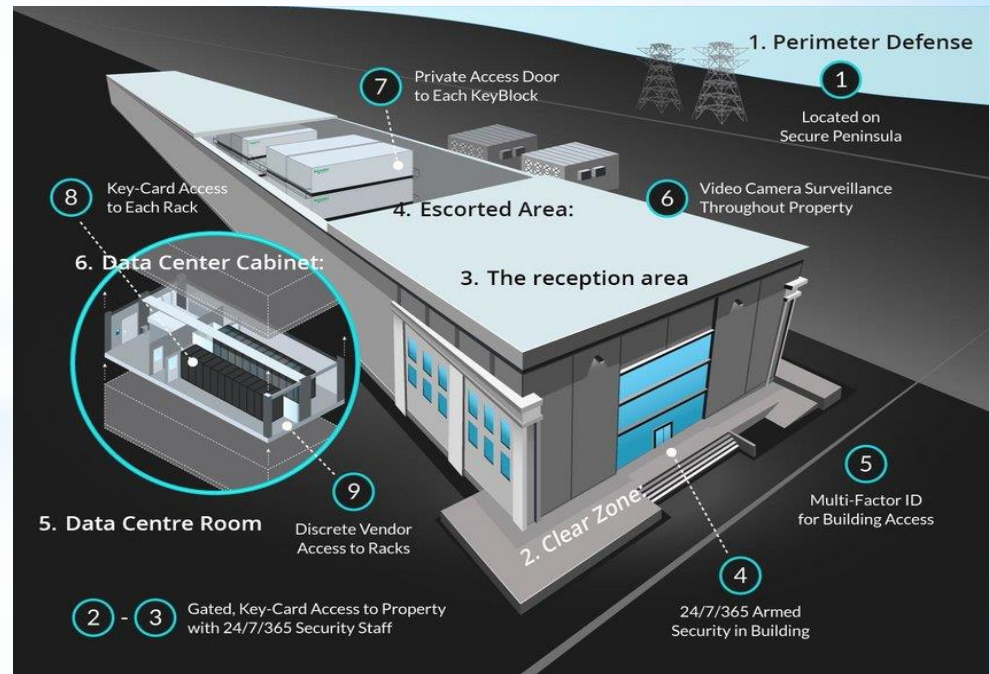   The web addresses, descriptions, and the order in which these web addresses are displayed is stored and structured in the data centers.

reliable storage

Security and Privacy measures

Benefits

keep the internet up and running 24/7

Scalability and Performance
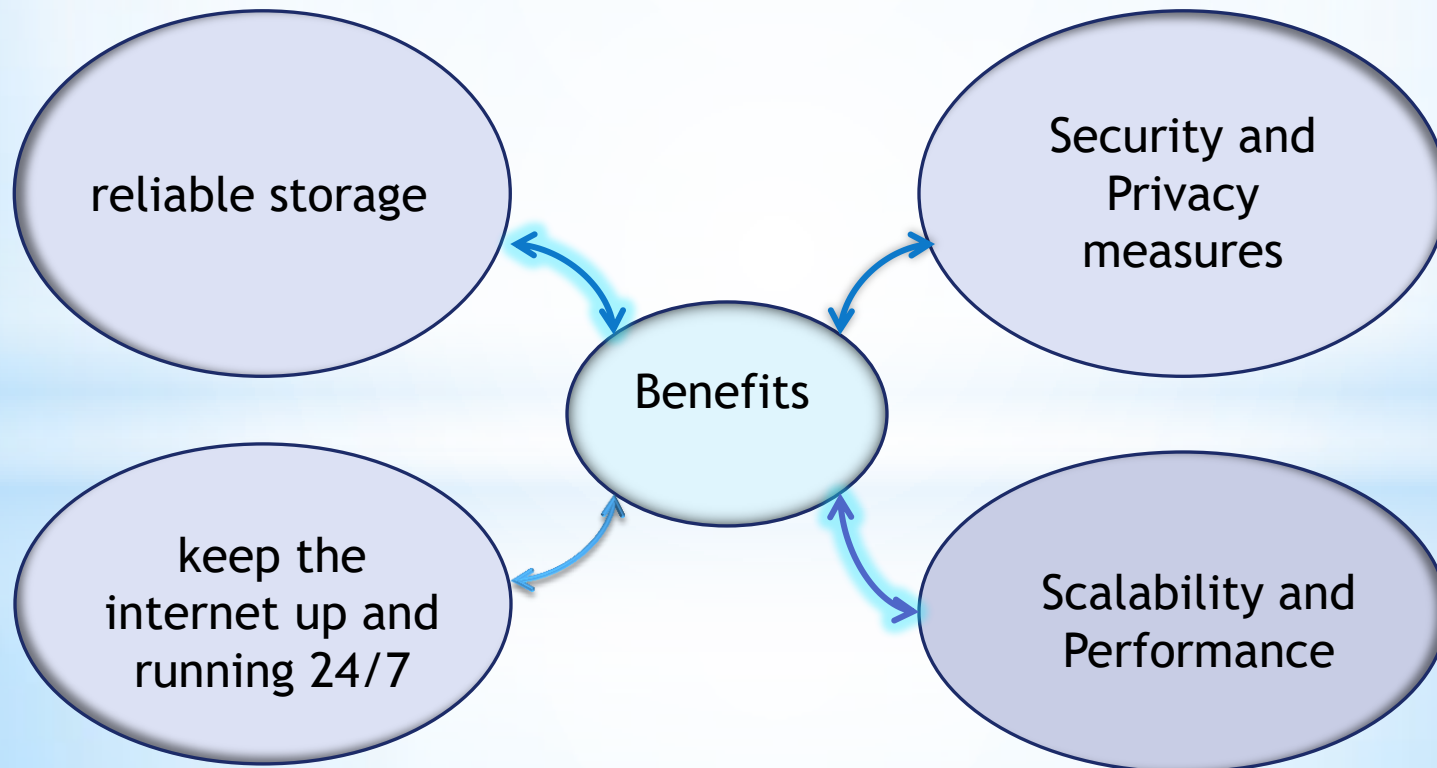
Security Measures

Physical Layer

Access Control

Network Security

Data Encryption

Security Monitoring

Incident Response and Recovery

1. Perimeter Defense
1 Located on Secure Peninsula

7 Private Access Door to Each KeyBlock

8 Key-Card Access to Each Rack

6 Video Camera Surveillance Throughout Property

4. Escorted Area:

6. Data Center Cabinet:

3. The reception area

5. Data Centre Room

9 Discrete Vendor Access to Racks

2. Clear Zone

5 Multi-Factor ID for Building Access

2 - 3 Gated, Key-Card Access to Property with 24/7/365 Security Staff

4 24/7/365 Armed Security in Building

Physical Security

➤ Perimeter security with fencing, barriers, and access controls.

➤ Biometric authentication and strict access control systems.

➤ Surveillance through CCTV cameras.

Access Control

➤ Strict access policies for personnel.
➤ Multi-factor authentication for authorized individuals.
➤ Limited access based on job roles and responsibilities.

Network Security:

- Firewalls to monitor and control incoming/outgoing network traffic.
- Intrusion detection and prevention systems.
- Secure communication protocols and encryption.

Data Encryption:

- Encryption of data both in transit and at rest.
- Use of advanced encryption algorithms to protect sensitive information.

Security Monitoring:

- Continuous monitoring of network activities.
- Security Information and Event Management (SIEM) systems to detect and respond to security incidents.
- Regular security audits and vulnerability assessments.

Incident Response and Recovery:

- Well-defined incident response plans to address security breaches.
- Regular drills and simulations to ensure preparedness.
- Data backup and recovery mechanisms to mitigate the impact of potential incidents.
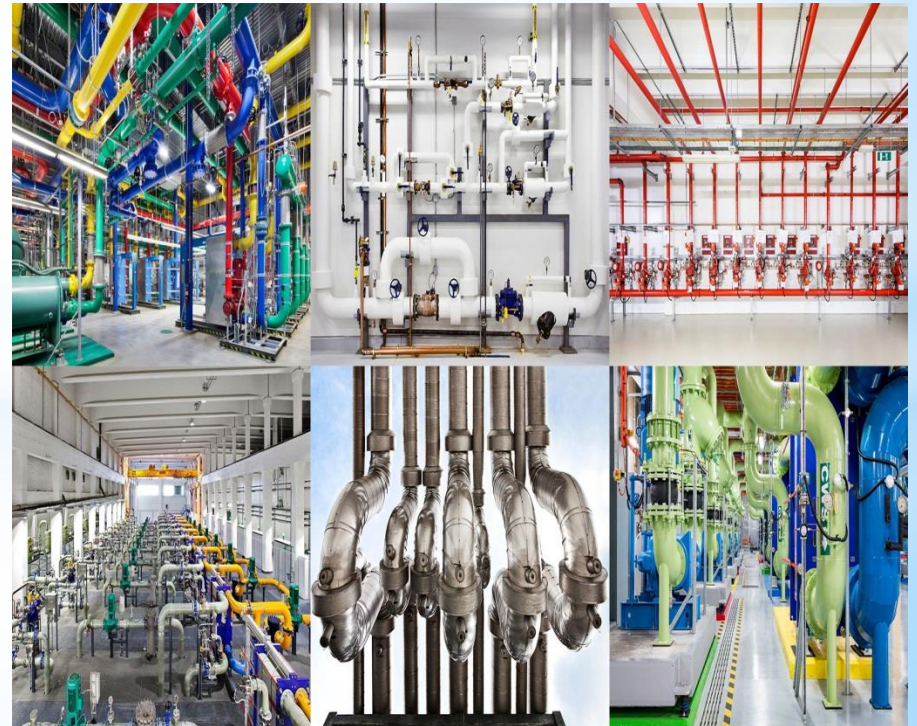
Cooling Systems

Why cooling systems are need for data centers?

Cooling systems are crucial for Google's data centers, as well as for any other data center, because they help manage the heat generated by the numerous servers and other IT equipment housed in these facilities.

Primary reason for cooling systems:

➢Prevention of Overheating

➢Heat Generation

➢Energy Efficiency

➢Performance and Reliability

➢Data Center Infrastructure Protection

Types of cooling systems

➢ **Liquid Cooling Solutions.**

Liquid cooling is a method of cooling computer components, such as processors and graphics cards, by using a liquid coolant instead of air.

➢ **Custom Cooling Equipment.**

Custom cooling refers to the design and implementation of a personalized or bespoke cooling solution for electronic components, such as CPUs, GPUs, or entire computer systems

➤ AI-Driven Cooling Optimization

AI-driven cooling optimization involves using artificial intelligence (AI) and machine learning (ML) algorithms to enhance the efficiency and effectiveness of cooling systems, particularly in data centers or other environments where managing heat is critical.

➤ Heat Recovery and Thermal Storage

Heat recovery and thermal storage are two strategies used in advanced energy management systems, especially in industrial processes and some data centers, to enhance efficiency and sustainability.

Locations

➢ 35 data centers around the world.

➢ Exodus data center in Santa Clara, Calif. in 1999.

➢ Google currently operates two Indian GCP cloud regions in Mumbai and Delhi. Mumbai opened in 2017.

Conclusion

➢ **Tech Powerhouse:** Google Data Centers are the silent heroes making our online world tick.

➢ **Innovative and Green:** Google's commitment to innovation and sustainability sets the standard for data center design.

➢ **Your Data's Guardian:** Multi-layered security keeps your information safe, reflecting Google's dedication to user privacy.

➢ **Shaping Tomorrow:** As we move forward, these centers will continue shaping the future of how we connect and experience the digital world.

➢ **Thanks for Joining:** A big thank you for joining us on this journey into the heart of Google's data infrastructure. Stay connected!