

Cloud Computing

Unit-4

Q-1. Explain Content Delivery Network and its function.

OR

A company has a website that is accessed by users all around the world. The website contains large images and videos, which can slow down the loading time for users who are far away from the company's servers. The company decides to use a CDN to improve the website's performance.

Ans:

A CDN can improve the website's performance for users who are far away from the company's servers by caching and distributing the website's content across a network of servers located in different geographic locations around the world. When a user requests content from the website, the CDN automatically delivers the content from the server that is closest to the user, reducing the distance that the content needs to travel and therefore improving the loading time for the user.

In the scenario described, the large images and videos on the website would be cached and distributed across the CDN's network of servers. When a user accesses the website, the CDN would automatically deliver the images and videos from the server that is closest to the user, reducing the latency and improving the user experience. The CDN would also be able to handle large amounts of traffic without overloading the company's servers, as the CDN would be responsible for delivering the content to the user.

Overall, using a CDN can help improve website performance for users who are far away from the company's servers by reducing latency and improving loading times, as well as reducing the load on the company's servers.

- A content delivery network (CDN) is a geographically distributed network of servers and data centers.
- The primary goal of a CDN is to improve web performance by reducing the time needed to send content and rich media to users.
- CDN architecture is also designed to reduce network latency caused by hauling traffic over long distances and across several networks.
- CDN servers are often referred to as "edge servers" since all CDN servers are located on the "edge network" — closer to end-users than a host server from which an application or a website originates.

Q.2. Explain how CDN functions?

- Caching: The CDN caches content from the origin server, creating copies of the content and storing them on multiple servers located in different geographic locations.
- DNS resolution: When a user requests content from a website that uses a CDN, the user's browser first resolves the domain name to an IP address via the CDN's DNS system.
- Routing: Once the browser has obtained the IP address, it sends a request to the closest server in the CDN network, based on the user's location. The CDN then routes the request to the server that has the cached copy of the content.
- Content delivery: The server delivers the cached content to the user's browser, which reduces latency and speeds up the delivery of the content.
- Load balancing: The CDN's load balancing technology ensures that traffic is distributed evenly across multiple servers, preventing any one server from becoming overloaded and slowing down the delivery of content.
- Dynamic content optimization: Some CDNs also offer dynamic content optimization, which involves automatically optimizing the content for different devices and network conditions to ensure the best possible user experience.
- AWS CloudFront is one of popular content delivery services used by AWS business application users.

Overall, CDNs function by caching content, routing user requests to the closest server, delivering content quickly and reliably, load balancing traffic across multiple servers, and optimizing content for different devices and network conditions. This results in improved website performance, faster content delivery, and a better user experience for end-users.

Q.3. A large e-commerce website with customers located all around the world has been experiencing performance issues due to high traffic and slow loading times. The website currently uses a single CDN to deliver content, but the company is considering switching to a multi-CDN approach to improve performance. How can a multi-CDN approach improve website performance for a large e-commerce website with customers located all around the world?

OR

What is Multi-CDN and its features.

Ans:

- A multi-CDN is the combination of multiple CDNs (content delivery networks) from different providers into a single network.
- The need for a multi-CDN strategy arises when an organization's traffic load increases beyond their current capacity limitations on one CDN provider or if they are looking to distribute their content geographically across providers strategically.
- This is because of the many advantages to hosting content from different CDN providers – geographical redundancy, security, increased performance, and cost savings (multi-CDN

can help reduce bandwidth costs by balancing out loads) and taking advantage of the pricing differences between different CDN vendors for different situations, time-slots, etc.

- A multi-CDN strategy can help you reduce latency, improve performance and save costs.

A multi-CDN approach can improve website performance for a large e-commerce website with customers located all around the world by providing greater flexibility, redundancy, and scalability. Here are some ways in which a multi-CDN approach can help improve website performance:

- **Greater flexibility:** With a multi-CDN approach, the e-commerce website can use multiple CDNs to deliver content to users around the world. This provides greater flexibility to choose the best CDN for each region based on performance, cost, and other factors.
- **Redundancy:** By using multiple CDNs, the e-commerce website can ensure that content is always available to users, even if one CDN experiences an outage or performance issue. This helps improve website uptime and reduce the risk of revenue loss due to downtime.
- **Scalability:** A multi-CDN approach can also help improve website scalability by allowing the e-commerce website to distribute traffic across multiple CDNs, reducing the load on any one CDN and ensuring that content is delivered quickly and reliably to users around the world, even during peak traffic periods.
- **Performance optimization:** By using multiple CDNs, the e-commerce website can also optimize content delivery for different regions, devices, and network conditions. This can help improve website performance, reduce latency, and improve the overall user experience for customers around the world.

Q.4. Explain Multi-CDN Architecture.

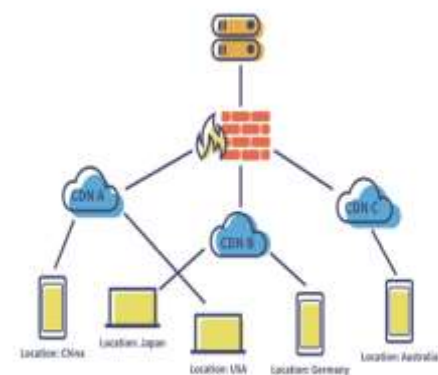
Ans:

Multi-CDN architecture is a setup that combines the infrastructure of different CDN providers, such as Akamai, Cloudflare, Edgio, and others.

It consolidates the resources of individual CDN providers and makes them accessible to broadcasters. A multi-CDN takes the benefits of a traditional CDN to greater heights by improving its reach and reliability.

The implementation of multi-CDN architecture require you to identify different CDN providers and configure each network with your website. You even need to define various switching mechanisms, such as:

- DNS-based switching
- HTTP redirect-based switching



- Client-side midstream switching
- Manifest rewrite on-the-fly

Q.5. Explain Meta-CDN?

OR

A large media streaming company has a global audience and wants to improve the performance of its website and app by using a meta-CDN. The company is considering using a meta-CDN to optimize content delivery across multiple CDNs, but wants to know how it works and what benefits it can provide. How can a meta-CDN improve content delivery for a large media streaming company with a global audience, and what benefits does it offer over a single CDN or multi-CDN approach?

Ans:

A meta-CDN can improve content delivery for a large media streaming company with a global audience by optimizing content delivery across multiple CDNs. A meta-CDN is essentially a layer of intelligence that sits on top of multiple CDNs and selects the best CDN for each user request based on real-time network conditions, content popularity, and other factors. Here are some benefits that a meta-CDN can offer over a single CDN or multi-CDN approach:

- Improved performance: By selecting the best CDN for each user request, a meta-CDN can help improve website and app performance, reduce latency, and improve the overall user experience.
- Greater scalability: A meta-CDN can also help improve website and app scalability by allowing the media streaming company to distribute traffic across multiple CDNs and handle peak traffic periods more effectively.
- Redundancy: A meta-CDN can also provide greater redundancy by ensuring that content is always available to users, even if one CDN experiences an outage or performance issue.
- Flexibility: A meta-CDN can provide greater flexibility than a single CDN or multi-CDN approach, allowing the media streaming company to add or remove CDNs as needed, and to select the best CDN for each region and use case.
- Cost-effectiveness: A meta-CDN can also help reduce costs by optimizing content delivery across multiple CDNs and reducing the need for expensive bandwidth and infrastructure.

Overall, a meta-CDN can help improve content delivery performance, scalability, redundancy, flexibility, and cost-effectiveness for a large media streaming company with a global audience. By selecting the best CDN for each user request based on real-time network conditions and other factors, a meta-CDN can help ensure that content is delivered quickly and reliably to users around the world, while also providing greater flexibility and cost savings.

Q.6. Explain Mobile Cloud Computing and its features.

Ans:

Mobile cloud computing (MCC) is a model of cloud computing that enables mobile devices, such as smartphones and tablets, to access cloud-based applications and services over the internet. MCC allows users to perform complex computing tasks, store and manage data, and access cloud-based applications on their mobile devices without requiring high-end hardware or processing power.

Here are some features of mobile cloud computing:

- Ubiquitous access: MCC provides ubiquitous access to cloud-based applications and services from anywhere, anytime using a mobile device with internet connectivity. Users can access data, applications, and computing resources on the go, without being tied to a particular location.
- Resource sharing: MCC enables resource sharing between multiple mobile devices and cloud-based applications. By sharing resources like processing power, storage, and bandwidth, MCC reduces the load on individual devices and enables more efficient use of resources.
- Scalability: MCC is highly scalable, meaning that it can easily accommodate changes in demand for computing resources. By using cloud-based resources, mobile applications can easily scale up or down based on demand, without requiring additional hardware or infrastructure.
- Cost-effectiveness: MCC can be a cost-effective option for mobile users, as it eliminates the need for expensive hardware and software licenses. Users can access cloud-based applications and services on a pay-as-you-go basis, and only pay for the resources they use.
- Security: MCC provides robust security features to protect user data and applications. Mobile cloud providers typically use secure data centers, encryption, and other security measures to ensure the confidentiality, integrity, and availability of data.
- Collaboration: MCC enables collaboration between multiple users by providing access to shared data, applications, and resources. This allows users to collaborate on projects and share information in real-time, regardless of their location.

Overall, mobile cloud computing provides mobile users with a powerful set of features and capabilities that enable them to access cloud-based applications and services from anywhere, anytime, while also reducing the need for expensive hardware and software licenses.

Q.7. Explain Intercloud and its issues.

Intercloud refers to a concept of connecting multiple cloud computing environments together to form a global cloud. It involves linking private clouds, public clouds, and hybrid clouds across different organizations and geographic locations to create a network of interconnected clouds

that work together seamlessly. The goal of intercloud is to provide users with a scalable, secure, and efficient cloud computing environment that can meet the demands of modern businesses. However, there are several issues associated with intercloud, including:

1. **Interoperability:** One of the main challenges with intercloud is ensuring interoperability between different cloud environments. Different cloud providers may use different technologies, protocols, and standards, which can create compatibility issues and make it difficult to integrate different clouds.
2. **Security:** Intercloud raises several security concerns, as data and applications may be transferred between different cloud environments. This can increase the risk of data breaches, data loss, and other security threats, especially if the cloud environments have different security policies and protocols.
3. **Data privacy:** Intercloud can also raise concerns about data privacy, as data may be stored in multiple locations and transferred across different cloud environments. This can make it difficult to ensure compliance with data protection laws and regulations, especially if the cloud environments are located in different jurisdictions.
4. **Performance:** Intercloud can also affect performance, as data may need to be transferred between different cloud environments, which can increase latency and reduce application performance. This can be especially problematic for applications that require low latency and high bandwidth.
5. **Management and governance:** Intercloud can also create management and governance challenges, as different cloud environments may have different management and governance models. This can make it difficult to manage and monitor cloud resources, ensure compliance with policies and regulations, and optimize cloud usage.

Q.8. Explain Cost Management Framework in Cloud Economics.

OR

A company is looking to migrate its existing IT infrastructure to the cloud, but it's concerned about the potential costs associated with the move. The company wants to adopt a cost management framework to ensure that it can manage its cloud costs effectively. What are some steps the company can take to implement a cost management framework in cloud economics?

Ans:

1. **Cost Inspection:** This refers to the process of monitoring and analyzing cloud costs, typically using tools or services provided by the cloud provider or third-party cost management tools. Cost inspection allows organizations to identify areas where costs can be reduced, such as unused or underutilized resources.
2. **Cost Analysis Report:** This is a report that provides a breakdown of the costs associated with cloud usage, typically organized by service, resource, or user. These reports allow organizations to gain insights into cost trends, identify cost-saving opportunities, and optimize cloud usage.

3. **Role-Based Access:** This refers to a security model that restricts access to cloud resources based on predefined roles or permissions. Role-based access ensures that users only have access to the resources they need, reducing the risk of unauthorized access or misuse of resources.
4. **Consumption Alerting:** This is a feature that allows organizations to set up alerts for specific usage thresholds or cost thresholds. These alerts can help organizations proactively monitor usage and costs, identify potential issues, and take action to optimize cloud usage and reduce costs.
5. **Pricing Calculator:** This is a tool that allows organizations to estimate the cost of using cloud resources based on factors such as usage, region, and instance type. Pricing calculators can help organizations plan for cloud costs and compare pricing across cloud providers.
6. **Budgeting and Auditing:** This refers to the process of establishing a budget for cloud usage and regularly reviewing usage and costs to ensure that they are within the budget. Auditing involves reviewing cloud usage and costs to ensure that they align with organizational policies and compliance requirements.
7. **Governance:** This refers to the process of establishing policies, procedures, and controls to ensure that cloud usage aligns with organizational goals, compliance requirements, and best practices. Governance can include processes such as resource allocation, security management, and cost management.

Q.9. Write the laws of Cloudnomics.

Ans:

1. **Utility Services cost less even though they cost more:**
Although utilities cost more when they are used, they cost nothing when they are not. Consequently, customers save money by replacing fixed infrastructure with Clouds when workloads are spiky, specifically when the peak-to-average ratio is greater than the utility premium.
2. **On-demand trumps forecasting:**
Forecasting is often wrong, the ability to up and down scale to meet unpredictable demand spikes allows for revenue and cost optimality.
3. **The peak of the sum is never greater than the sum of the peaks.**
Enterprises deploy capacity to handle their peak demands. Under this strategy, the total capacity deployed is the sum of these individual peaks. However, since clouds can reallocate resources across many enterprises with different peak periods, a cloud needs to deploy less capacity.
4. **Aggregate demand is smoother than individual.**
Aggregating demand from multiple customers tends to smooth out variation. Therefore, Clouds get higher utilization, enabling better economics.
5. **Average unit costs are reduced.**

They are reduced by distributing fixed costs over more units of output. Larger cloud providers can therefore achieve economies of scale.

6. Superiority in numbers.

Superiority in numbers is the most important factor in the result of a combat. Service providers have the scale to fight rogue attacks.

7. Space-time is a continuum.

Organizations derive competitive advantage from responding to changing business conditions faster than the competition. With Cloud scalability, for the same cost, a business can accelerate its information processing and decision-making.

8. Dispersion is the inverse square of latency.

Reduced latency is increasingly essential to modern applications. A Cloud Computing provider is able to provide more nodes, and hence reduced latency, than an enterprise would want to deploy.

9. Don't put all your eggs in one basket.

A data center is a very large object. Private data centers tend to remain in locations for reasons such as being where the company was founded, or where they got a good deal on property or a lease. A Cloud service provider can locate greenfield sites optimally and without such limits of legacy logic.

10. An object at rest tends to stay at rest.

Reduced latency is increasingly essential to modern applications. A Cloud Computing provider is able to provide more nodes, and hence reduced latency, than an enterprise would want to deploy.

Q.10. Explain Pricing Strategy of Cloud Computing.

Ans:

Cloud computing pricing strategies typically revolve around the pay-as-you-go model, which allows customers to pay only for the resources they use. Here are some common pricing strategies used in cloud computing:

- On-Demand: Customers pay for computing resources by the hour or by the minute, with no upfront fees or long-term commitments.
- Reserved Instances: Customers can commit to a certain amount of resources for a period of one or three years, receiving a discount in exchange for the commitment.
- Spot Instances: Customers can bid on unused cloud computing resources, with prices varying based on supply and demand.
- Hybrid Pricing: Customers can mix and match pricing models based on their specific needs, using on-demand, reserved, and spot instances as needed.
- Tiered Pricing: Cloud providers offer different pricing tiers based on usage volume, with discounts for higher levels of usage.

- Freemium: Cloud providers offer a free tier with limited resources, with customers paying for additional resources as needed.
- Bundled Pricing: Cloud providers offer pre-configured bundles of computing resources, with pricing based on the specific bundle chosen.

