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Advanced DevOps Assignment : 1

Q2.) Discuss BMW & Host Start case studies using AWS.

a.) The BMW Group, headquatered in Munich, Germany, is a global manufacturer of premium automobiles & motorcycles. To maintain its leadership in the automotive industry's digital transformation, the company heavily invested in data & predictive analytics. In 2015, BMW developed an on-premises data lake to collect & combine anonymized data from various sources. However, as data needs expanded, this system struggled to scale, hindering innovation & agility.

To overcome these challenges, BMW decided to to migrate its data lake to Amazon Web Services (AWS), creating a Cloud Data Hub (CDH). The CDH ingests & processes massive amounts of data from millions of connected BMW vehicles daily. This migration provided BMW the flexibility & agility needed to support a wide range of data use cases. AWS managed services such as Amazon Athena, Amazon S3, Amazon Kinesis Data Firehouse, & AWS Glue now power the CDH, allowing teams to manage their own DevOps processes autonomously. This makes data easily accessible.

By leveraging AWS services like Amazon Athena & Sagemaker, BMW now scales its operation with greater agility, supporting data engineers & analysts with a more efficient platform.

BMW has introduced a data providers & consumer model, allowing teams to work autonomously while sharing well-defined interfaces. Using GraphQL APIs, developers now have more flexibility to fetch data tailored to specific use cases, speeding up application development. The company plans to continue scaling its CDH, open-sourcing key components, & driving innovation in customer experiences & mobility services.

b) Hotstar :-

Hostar, one of India's largest video streaming platforms, serves millions of users, especially during peak events like cricket matches & live sports. The company needed a robust & scable infrastructure to manage high traffic spikes, optimize content delivery, & provide a seamless user experience.

With millions of concurrent users, the platform needed an infrastructure that could handle sudden traffic surges while maintaining low latency & high availability. They also needed to scale quickly to meet demand without over-provisioning resources during non-peak times. They leveraged AWS's elastic & scalable cloud infrastructure which enabled them to optimize for peak loads while minimizing operational costs.

Key services used included, Amazon CloudFront: It cached the video content at edge locations close to the viewers, improving streaming performance. Hotstar used DynamoDB for its user session & state management, which required fast, consistent response times to maintain a smooth viewing experience during live events.

Using AWS allowed Hotstar to scale effortlessly from millions to tens of millions of concurrent users, particularly during live events like the IPL. With AWS's pay-as-you-go model, Hotstar was able to optimize infrastructure costs by scaling up only during peak traffic events. The platform achieved high availability, minimized downtime, & reduced latency for its users, ensuring a superior viewing experience.

Q3.) What are Kubernetes & advantages & disadvantages of Kubernetes. Explain how adidas uses Kubernetes.

Kubernetes is an open-source platform used for automating the deployment, scaling, & management of containerized applications. It helps manage clusters of containers, typically Docker containers, across multiple hosts. Key features of Kubernetes include:

1) Auto Scaling: Kubernetes can scale applications up or down based on demand
2) Load Balancing: It ensures that network traffic is distributed across containers
3) Self Healing: It monitors health of containers & automatically replaces failed ones
4) Automated Rollouts: It automates rolling updates to apps without downtime.
5) Service Discovery: Kubernetes assigns a DNS to containers & can route traffic to them

Kubernetes allows you to mount storage systems such as local storage, cloud storage, or network storage for your containers. It is a widely used DevOps practice & its crucial for cloud-native application management & orchestration.

Advantages :-

1.) High Availability : With built in self healing mechanisms, Kubernetes ensures that if a container fails, it's automatically restarted.

2.) Portability : It is platform-agnostic i.e. kubernetes can run across environments including on premise data centers, public clouds like AWS, GCP

3.) Kubernetes Ecosystem : It has a vast ecosystem of tools & plugins. You can extend its functionality with custom features & integrations making suitable for many use cases

4.) Resource Management : Optimizes the use of hardware resources by distributing workloads across clusters, ensuring efficient utilization of CPU, memory & storage

Disadvantages :-

1.) Complexity : Kubernetes has a steep learning curve. Setting up, managing, & maintaining a kubernetes cluster requires a deep understanding of components

2.) Configuration Management : Kubernetes configuration like YAML files, can be verbose & complex, which might result in misconfigurations, making trouble shooting difficult.

3.) Overhead in Small Deployment : Kubernetes can add unnecessary overhead. Simpler container orchestration tools may be more appropriate for small scale deployments.

4.) Cost : Due to its complexity & resource demands, Kubernetes can increase operational costs, particularly when considering the infrastructure & specialized personnel required for its management.

Adidas uses Kubernetes to enhance the scalability, flexibility, & efficiency of their digital services & e-commerce operations.

1.) Scalability for E-Commerce: Adidas experiences heavy traffic during high demand events like new product launches or seasonal sales. Kubernets allows adidas to scale their applications up & down automatically ensuring that their website can handle massive spikes in traffic.

2.) Cloud-Native Architecture: Adidas migrated to a microservices-based architecture by help of Kubernetes. By containerizing their applications, Adidas can run them efficiently across different environments, including on-premise data centers & public cloud platforms.

3.) Agility in Innovation: Adidas uses Kubernetes to foster a more agile development environment. By containerizing different parts of their digital platform they can innovate faster experimenting with new tech features & tools without affecting the stability of the overall system.

4.) DevOps Culture: Adidas embraces a DevOps culture & Kubernetes plays a central role in this by allowing better collaboration between development & operations teams. Developer can focus on writing code & deploying features, while kubernetes handles the infrastructure & scaling automatically.

Q4.) What are Nagios & Explain Nagios usage in E-services

Nagios is an open-source monitoring tool designed to monitor the health & performance of IT infrastructure, including servers, networks devices services & apps. It provides alerts & reports when critical components experience issues or are at risk of failure, allowing administrators to address problems before they impact business operations. Key features

1.) Infrastructure Monitoring: Nagios monitors the availability & performance of IT systems such as servers, databases, applications & network devices It can track system metrics like CPU usage, memory consumption.

2.) Alert & Notifications: Nagios sends real-time alerts via email, SMS or custom scripts when critical thresholds are breached or when a failure occurs. It helps IT teams respond to issues quickly.

3.) Plugins: Nagios uses plugins to collect data from the systems it monitors. These plugins are customizable & can be written for specific use cases - There are hundreds of existing plugins for monitoring various services

4.) Web-Based Interface: Nagios provides a web interface that allows admins to visualize the status of their infrastructure, check detailed performance metrics & review logs of events or issues.

Nagios usage in E-service

1.) Service Level Agreements compliance: E-service providers often have SLAs that guarantee a certain level of uptime or performance. Nagios helps ensure compliance with these SLAs by monitoring uptime & generating reports on service availability. This can be used to demonstrate SLA compliance to customers or stakeholders

2.) Security Monitoring: Security is vital for E-services that deal with sensitive data, such as personal information or financial transactions. Nagios can be configured to monitor security-related metrics, such as abnormal login attempts, SSL certificate expirations or firewall status

3.) Trend Analysis: Nagios provides historical data on the usage of system resources, which is useful for capacity planning. It helps E-service providers predict future needs & scale their infrastructure accordingly

Q1.) Use S3 bucket & host video streaming

Step 1: Login to AWS console: Navigate the AWS Management Console.

Step 2: Go to S3 service. Click create Bucket & choose a globally unique bucketname. Select the AWS region closest to your audience. Configure settings like, Disable 'Block Public Access' (for public streaming), Enable Versioning

Step 3: After creating bucket, click on the upload button to add video files Set permissions, to make sure your videos are publicly accisible by setting them to public-read.

Step 3: Configure the Bucket policy by going to permissions tab in the bucket & add the following policy to allow public access to all files in the bucket

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow"
      "Principal": "*"
      "Action": "s3:GetObject",
      "Resource": "arn:aws:s3:::your-bucket-name/*"
    }
  ]
}
```

Step 4 Go to the permissions tab in your bucket & click on CORS Configuration (Cross-Origin Resource Sharing). Add the following configuration to allow access from different domains

```
[
    {
        "AllowedHeaders": ["*"],
        "AllowedMethods": ["GET"],
        "AllowedOrigins": ["*"],
        "ExposedHeaders": []
    }
]
```

Step5: To ensure smooth video streaming & low latency, Go to Cloud Front service in AWS.
Click Create Distribution, under origin settings, select the S3 bucket as the origin
Enable Web distribution, which is suitable for media streaming.
Set Cache behaviours to handle video content efficiently
Eg: enable HTTP/2 for faster & transfer.

Once the distribution is created, you will get a CloudFront URL paste it in a new tabs in your browser with the S3 bucket key to get the stream.