📘 Cloud Computing Unit–2

RGPV One- Important Questions With Easy And Detailed Explaination

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1. Virtualization

Introduction

Virtualization cloud computing ka backbone hai. Isme ek physical machine ko multiple virtual machines me divide kiya jata hai.

Definition

Virtualization is the technique of creating virtual versions of hardware, operating systems, servers, storage or networks using software.

Why It Is Needed

Traditional system me ek server par mostly ek OS/application run hota tha. Isse hardware waste hota tha. Virtualization same hardware ko multiple systems ki tarah use karne deta hai.

Easy Explanation

Ek powerful computer ko software ke help se 3–4 अलग virtual computers me divide kar dena virtualization hai.

Step-by-Step Working

1. Physical hardware available hota hai.

2. Hypervisor install hota hai.
3. Hypervisor virtual machines create karta hai.
4. Har VM me separate OS install hota hai.
5. VMs independent systems ki tarah kaam karti hain.

Flow of Process

```
Physical Hardware
        ↓
Hypervisor
        ↓
Virtual Machines
        ↓
Applications
```

Diagram

```
+-----------------------------+
|        Applications         |
+-----------------------------+
| VM1 | VM2 | VM3 | VM4        |
+-----------------------------+
|        Hypervisor           |
+-----------------------------+
|      Physical Hardware      |
+-----------------------------+
```

Real-Life Analogy

Ek bada ghar multiple rooms me divide ho sakta hai. Har room alag person use kar sakta hai. Same way, one server multiple VMs me divide hota hai.

Advantages

- Better hardware utilization
- Cost saving
- Multiple OS support
- Easy backup and recovery
- Fast testing environment

Disadvantages

- Performance overhead
- Security risk if hypervisor compromised
- VM sprawl problem
- Requires skilled management

Applications

- Cloud data centers
- Server consolidation
- Software testing
- Disaster recovery
- Development environments

Important Keywords

Virtual Machine, Hypervisor, Resource Sharing, Server Consolidation, Isolation

Conclusion

Virtualization cloud computing ko efficient, scalable and cost-effective banata hai.

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2. Hypervisor

Introduction

Hypervisor virtualization ka main software layer hai. Ye virtual machines ko create aur manage karta hai.

Definition

Hypervisor is a software or firmware layer that creates, runs and manages multiple virtual machines on a single physical machine.

Why It Is Needed

Hypervisor ke bina virtualization possible nahi hai. Ye physical hardware resources ko VMs ke beech distribute karta hai.

Easy Explanation

Hypervisor ek manager jaisa hai jo decide karta hai ki kis VM ko kitna CPU, RAM, storage aur network milega.

Types of Hypervisor

Type	Meaning	Example
Type-1 / Bare Metal	Direct hardware par run hota hai	VMware ESXi, Hyper-V, Xen
Type-2 / Hosted	Host OS ke upar run hota hai	VirtualBox, VMware Workstation

Step-by-Step Working

1. Hypervisor physical hardware access karta hai.
2. Virtual machines create karta hai.
3. Resources allocate karta hai.
4. VMs ko isolate rakhta hai.
5. VM monitoring and control karta hai.

Flow

```
Hardware → Hypervisor → VM1 / VM2 / VM3
```

Diagram

```
Type-1:
Applications
VMs
Hypervisor
Hardware

Type-2:
Applications
VMs
Hypervisor
Host OS
Hardware
```

Real-Life Analogy

Hypervisor hotel manager jaisa hai. Hotel rooms = VMs, hotel building = physical hardware. Manager rooms allocate karta hai.

Advantages

- Multiple VMs on one server
- Resource management
- Isolation
- Better server utilization

Disadvantages

- Hypervisor attack risk
- Performance overhead
- Configuration complexity

Applications

- Cloud computing
- Data centers
- Virtual servers
- Testing labs

Important Keywords

Type-1 Hypervisor, Type-2 Hypervisor, VM Management, Bare Metal, Hosted Hypervisor

Conclusion

Hypervisor virtualization ka core component hai jo multiple virtual machines ko manage karta hai.

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3. Utility Computing

Introduction

Utility computing cloud ka pay-as-you-use model hai. User jitne resources use karta hai, utna hi payment karta hai.

Definition

Utility computing is a service model where computing resources are provided on demand and users pay according to actual usage.

Why It Is Needed

Organizations ko expensive hardware buy karne ki need nahi hoti. Cloud provider resources rent par deta hai.

Easy Explanation

Electricity bill jaisa model: jitni electricity use, utna bill. Cloud me jitna storage/server use, utna payment.

Step-by-Step Working

1. User resource request karta hai.
2. Cloud provider resource allocate karta hai.
3. User resource use karta hai.
4. Usage monitor hota hai.
5. Billing usage ke according hoti hai.

Flow

```
Request → Resource Allocation → Usage Monitoring → Billing
```

Diagram

```
User → Cloud Provider → CPU / Storage / Network
                    ↓
              Pay-as-you-use
```

Real-Life Analogy

Electricity, water aur gas bill utility model par kaam karte hain.

Advantages

- Cost saving
- No upfront hardware cost
- Flexible usage
- Easy scaling
- Efficient resource use

Disadvantages

- Internet dependency
- Monthly billing unpredictable ho sakta hai
- Security concerns
- Provider dependency

Applications

- Cloud storage
- Web hosting
- SaaS applications
- Data processing

Important Keywords

Pay-as-you-use, Metered Service, On-demand Resources, Resource Allocation

Conclusion

Utility computing cloud resources ko electricity jaise utility service ki tarah provide karta hai.

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4. Elastic Computing

Introduction

Elastic computing cloud ki ability hai jisme resources workload ke according automatically increase or decrease hote hain.

Definition

Elastic computing is the ability of cloud systems to dynamically scale computing resources up or down according to demand.

Why It Is Needed

Traffic kabhi high hota hai, kabhi low. Fixed resources lene se ya to shortage hoti hai ya wastage.

Easy Explanation

Sale time me website par traffic badh jaye to cloud extra servers add karega. Traffic kam hote hi servers remove karega.

Step-by-Step Working

1. System workload monitor karta hai.
2. Traffic/resources demand check hoti hai.
3. High load par resources increase hote hain.
4. Low load par resources decrease hote hain.
5. Cost and performance balance hota hai.

Flow

```
Monitor Load → Need More? → Add Resources
Monitor Load → Need Less? → Remove Resources
```

Diagram

```
Low Traffic  → 2 Servers
High Traffic → 10 Servers
Low Traffic  → 2 Servers
```

Real-Life Analogy

Restaurant me rush time extra staff bula liya jata hai, rush kam ho to staff reduce kar diya jata hai.

Advantages

- Better performance
- Cost optimization
- No resource wastage
- Handles sudden traffic
- Improves availability

Disadvantages

- Setup complex
- Monitoring required
- Wrong scaling rules problem create kar sakte hain

Applications

- E-commerce websites
- Streaming platforms
- Online exams
- Banking systems

Important Keywords

Auto-scaling, Elasticity, Dynamic Resources, Load Monitoring, Scalability

Conclusion

Elastic computing cloud systems ko demand ke according flexible and cost-efficient banata hai.

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5. Multitenancy

Introduction

Multitenancy cloud software architecture ka important concept hai. Isme ek application multiple customers ko serve karti hai.

Definition

Multitenancy is a software architecture where a single instance of an application serves multiple tenants while keeping their data logically separate.

Why It Is Needed

Har customer ke liye separate software install karna costly hota hai. Multitenancy cost reduce karti hai.

Easy Explanation

Ek apartment building me multiple families rehti hain, but har family ka flat separate hota hai. Same way ek cloud application multiple users ko serve karti hai.

Step-by-Step Working

1. Single application server run hota hai.
2. Multiple tenants login karte hain.
3. Application tenant identity check karta hai.
4. Har tenant ko uska separate data show hota hai.
5. Resources shared but data isolated hota hai.

Flow

```
Single Application
        ↓
Tenant A | Tenant B | Tenant C
        ↓
Separate Data Access
```

Diagram

```
+-----------------------+
|  Shared Application   |
+-----------------------+
| Tenant A | Tenant B   |
| Tenant C | Tenant D   |
+-----------------------+
| Shared Cloud Database |
+-----------------------+
```

Real-Life Analogy

Gmail ek hi application hai, but millions users ka data separate hota hai.

Advantages

- Cost saving
- Easy maintenance
- Centralized updates
- Better resource utilization
- Scalable SaaS model

Disadvantages

- Data security risk
- Performance sharing issue
- Customization limitation
- Tenant isolation important

Applications

- Gmail
- Salesforce
- Google Workspace
- SaaS applications

Important Keywords

Tenant, Shared Application, Data Isolation, SaaS, Resource Sharing

Conclusion

Multitenancy cloud software ko cost-effective and scalable banata hai.

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6. AJAX

Introduction

AJAX web applications ko fast and interactive banata hai. Isme full webpage reload nahi hota.

Definition

AJAX is a web development technique that allows web pages to update data asynchronously without reloading the entire page.

Why It Is Needed

Traditional webpage me har request par full page reload hota tha. AJAX partial update karta hai, jisse speed and user experience improve hota hai.

Easy Explanation

Google search suggestions AJAX ka best example hai. Aap type karte ho aur suggestions bina page reload ke aa jati hain.

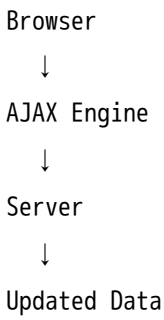
Step-by-Step Working

1. User webpage par action karta hai.
2. JavaScript background me server request bhejta hai.
3. Server response data bhejta hai.
4. Browser page ka required part update karta hai.
5. Full page reload nahi hota.

Flow

```
User Action → AJAX Request → Server → Data Response → Partial Update
```

Diagram



Real-Life Analogy

Restaurant me waiter kitchen se sirf required item laata hai, pura table replace nahi karta. AJAX bhi sirf page ka required part update karta hai.

Advantages

- Faster web applications
- Better user experience
- Less bandwidth usage
- Partial page update
- Rich interface

Disadvantages

- JavaScript dependency
- Debugging difficult
- Browser compatibility issues
- SEO issues in some cases

Applications

- Gmail
- Google Maps
- Search suggestions
- Live chat
- Social media feeds

Important Keywords

Asynchronous, JavaScript, Partial Page Update, Rich Interface, XMLHTTPRequest

Conclusion

AJAX web applications ko fast, interactive and user-friendly banata hai.

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7. Mashups

Introduction

Mashup ek web application hoti hai jo multiple sources ke data/services ko combine karti hai.

Definition

Mashup is a web application that combines data, services or functionalities from multiple sources into one integrated application.

Why It Is Needed

Alag-alag services ko combine karke powerful application banane ke liye mashups use hote hain.

Easy Explanation

Google Maps + hotel data + weather data = travel planning mashup.

Step-by-Step Working

1. Multiple services/data sources available hote hain.
2. API ke through data access hota hai.
3. Application data combine karti hai.
4. User ko single interface me result milta hai.

Flow

```
Service A + Service B + Service C → Mashup Application
```

Diagram

```
Google Maps API ──┐
Weather API       ├──── Travel App
Hotel API         ┘
```

Real-Life Analogy

Thali me dal, rice, roti, sabzi alag-alag sources hain; combined meal mashup jaisa hai.

Types

Type	Meaning
Data Mashup	Multiple data sources combine
Consumer Mashup	User-focused service
Business Mashup	Business tools/services combine

Type	Meaning
UI Mashup	Multiple interfaces combine

Advantages

- Faster development
- Better functionality
- Reusable services
- User-friendly application

Disadvantages

- API dependency
- Security risk
- Source service down ho to mashup fail
- Data consistency issue

Applications

- Travel apps
- Real estate maps
- Weather + location apps
- Social media dashboards

Important Keywords

API, Integration, Combined Services, User Interface, Data Mashup

Conclusion

Mashups multiple services ko combine karke useful and powerful cloud applications banate hain.

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8. Multi-schema Approach

Introduction

Multi-schema approach multitenant database design ka ek method hai.

Definition

Multi-schema approach is a multitenant database approach where each tenant has a separate schema inside a shared database.

Why It Is Needed

Multitenant software me multiple customers ka data store hota hai. Data isolation and security ke liye multi-schema approach useful hai.

Easy Explanation

Ek database building hai, uske andar har tenant ka separate room/schema hai.

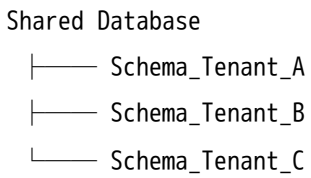
Step-by-Step Working

1. Single database server create hota hai.
2. Har tenant ke liye separate schema create hota hai.
3. Application tenant identify karti hai.
4. Tenant ka data uske schema se access hota hai.
5. Data isolation maintain hota hai.

Flow

```
Application → Tenant Identification → Tenant Schema → Data Access
```

Diagram



Real-Life Analogy

School me same building me different classrooms hote hain. Har class ka data/register separate hota hai.

Advantages

- Better data isolation
- Security improve
- Tenant-wise backup easy
- Customization possible

Disadvantages

- Schema management complex
- Large tenants hone par maintenance difficult
- Updates multiple schemas me apply karne padte hain

Applications

- SaaS applications
- Enterprise cloud software
- CRM systems

- ERP systems

Important Keywords

Tenant, Schema, Data Isolation, Shared Database, Multitenant Database

Conclusion

Multi-schema approach shared database me tenant-wise data isolation provide karta hai.

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9. Cloud Data Stores

Introduction

Cloud data stores cloud environment me data store and manage karne ke systems hain.

Definition

Cloud data stores are cloud-based storage systems used to store, manage and retrieve data for cloud applications.

Why It Is Needed

Cloud applications ko large, scalable and reliable storage chahiye hota hai.

Easy Explanation

Cloud data store online database/storage jaisa hai jahan application ka data safely store hota hai.

Types of Cloud Data Stores

Type	Meaning	Example
Relational Store	Table-based structured data	Amazon RDS

Type	Meaning	Example
NoSQL Store	Flexible large data	Bigtable, DynamoDB
Object Store	Files/objects store	Amazon S3
Distributed File Store	Large distributed files	GFS, HDFS

Step-by-Step Working

1. Application data generate karti hai.
2. Data cloud data store me send hota hai.
3. Storage system data replicate karta hai.
4. User/application query bhejta hai.
5. Data retrieve hota hai.

Flow

```
Application → Cloud Data Store → Storage / Replication → Query Result
```

Diagram

```
Cloud Application
        ↓
Cloud Data Store
  ├──── Tables
  ├──── Objects
  ├──── Files
  └──── NoSQL Data
```

Real-Life Analogy

Cloud data store digital warehouse jaisa hai jahan data boxes organized form me store hote hain.

Advantages

- High scalability
- Remote access
- Backup and replication
- High availability
- Large data handling

Disadvantages

- Security and privacy concerns
- Internet dependency
- Data migration difficulty
- Vendor lock-in

Applications

- E-commerce databases
- Big data systems
- Cloud apps
- Backup systems
- Social media platforms

Important Keywords

Cloud Storage, NoSQL, Replication, Scalability, Distributed Storage, Bigtable, HDFS

Conclusion

Cloud data stores cloud applications ko scalable and reliable data storage provide karte hain.

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10. Multi-Entity Support

Introduction

Multi-entity support ka matlab hai ek software system me multiple organizations, departments ya business units ko support karna.

Definition

Multi-entity support is the ability of a cloud application to support multiple organizations or business entities within the same system while maintaining separate data and settings.

Why It Is Needed

Large organizations me different branches/departments hote hain. Same software use karte hue unka data separate rakhna important hota hai.

Easy Explanation

Ek college management system me multiple departments ho sakte hain: CSE, IT, ME, CE. Same software, but each department ka data separate.

Step-by-Step Working

1. System me multiple entities create hoti hain.
2. Har entity ke separate roles/settings define hote hain.
3. Users apni entity ke under login karte hain.
4. Application entity-wise data show karti hai.
5. Admin overall management kar sakta hai.

Flow

```
Shared Application
        ↓
Entity A | Entity B | Entity C
        ↓
Separate Users + Data + Settings
```

Diagram

```
Cloud ERP System
  ├──── HR Department
  ├──── Finance Department
  ├──── Sales Department
  └──── Support Department
```

Real-Life Analogy

University ek system hai, uske under multiple colleges/departments alag identity ke saath work karte hain.

Advantages

- Centralized management
- Separate entity data
- Cost saving
- Easy reporting
- Better administration

Disadvantages

- Complex permission management
- Data isolation required

- Configuration complexity

Applications

- ERP systems
- CRM systems
- University portals
- Multi-branch businesses
- SaaS applications

Important Keywords

Entity, Multi-tenant, Separate Data, Role Management, Centralized System

Conclusion

Multi-entity support cloud software ko multiple organizations/departments ke liye useful and manageable banata hai.

🔥 Comparison Table: Utility Computing vs Elastic Computing

Basis	Utility Computing	Elastic Computing
Main Idea	Pay according to usage	Scale resources according to demand
Focus	Billing and service model	Resource scaling
Example	Pay for used storage	Add servers during high traffic
Benefit	Cost saving	Performance improvement
Related Term	Metered service	Auto-scaling

Which is Better?

Dono ka purpose different hai. Utility computing cost model hai, elastic computing resource management feature hai. Cloud me dono saath use hote hain.

🔥 Comparison Table: Virtualization vs Multitenancy

Basis	Virtualization	Multitenancy
Level	Infrastructure level	Application/software level
Main Idea	Multiple VMs on one hardware	Multiple tenants use one app
Isolation	VM isolation	Data/application isolation
Example	VMware	Gmail/Salesforce
Benefit	Hardware utilization	Software cost saving

🔥 Most Important 7-Mark Questions

1. Explain virtualization technology.
2. Explain hypervisor and its types.
3. Explain utility computing.
4. Explain elastic computing.
5. Explain multitenant software.
6. Explain AJAX with architecture.
7. Explain mashups with example.
8. Explain multi-schema approach.
9. Explain cloud data stores.
10. Explain multi-entity support.

⭐ Most Important 14-Mark Questions

1. Explain virtualization, hypervisor and applications in enterprises.

2. Explain multitenancy with multi-entity support and multi-schema approach.
3. Explain utility computing and elastic computing with examples.
4. Explain AJAX and mashups in cloud applications.
5. Explain cloud data stores and multi-tenancy using cloud data stores.

🎯 PYQ-Based Expected Questions

Very High Probability

✅ Virtualization
✅ Hypervisor
✅ Utility Computing
✅ Elastic Computing
✅ Multitenancy

High Probability

✅ AJAX
✅ Mashups
✅ Multi-schema approach

Medium Probability

✅ Cloud data stores
✅ Multi-entity support

⚡ One-Night Revision Notes

Topic	One-Line Revision
Virtualization	Physical resource ka virtual version
Hypervisor	VM manager

Topic	One-Line Revision
Utility Computing	Pay-as-you-use
Elastic Computing	Auto-scaling resources
Multitenancy	One app, many customers
AJAX	Page reload ke bina update
Mashup	Multiple services combine
Multi-schema	One DB, many schemas
Cloud Data Store	Cloud-based storage/database
Multi-entity	Multiple departments/orgs support

📌 Smart Study Plan

2-Hour Plan

Time	Topic
30 min	Virtualization + Hypervisor
20 min	Utility + Elastic Computing
20 min	Multitenancy
15 min	AJAX
15 min	Mashups
20 min	Multi-schema + Cloud Data Stores

5-Hour Plan

Time	Topic
1 hour	Virtualization + Hypervisor
1 hour	Utility + Elastic Computing
1 hour	Multitenancy + Multi-schema
1 hour	AJAX + Mashups
1 hour	Cloud Data Stores + PYQ Revision

🧠 Memory Tricks

Virtualization Flow

HVM

- H = Hardware
- V = Virtualization Layer
- M = Machines

Utility Computing

PUB

- P = Pay
- U = Usage
- B = Billing

Elastic Computing

MAS

- M = Monitor
- A = Add resources
- S = Shrink resources

Multitenancy

SDS

- S = Shared application
- D = Different tenants
- S = Separate data

🚀 Topper Answer Writing Tips

For **7 marks**, write:

```
Definition
↓
Need
↓
Working
↓
Diagram
↓
Advantages
↓
Applications
↓
Conclusion
```

For **14 marks**, write:

```
Introduction
↓
Definition
↓
Types / Components
↓
Step-by-step working
↓
Diagram
↓
Example
↓
Comparison table
↓
Advantages
```

↓

Disadvantages

↓

Applications

↓

Conclusion

Keywords to Underline

Virtualization, Hypervisor, Virtual Machine, Utility Computing, Elasticity, Auto-scaling, Multitenancy, Tenant, AJAX, Mashup, Multi-schema, Cloud Data Store

Final tip: Unit-2 me sabse pehle **Virtualization + Hypervisor + Utility Computing + Elastic Computing + Multitenancy** prepare करो.