



Batch: A-4 Roll No.: 16010122151

Experiment No. 01

Grade: AA / AB / BB / BC / CC / CD /DD

Title: Study of Cloud Computing & Architecture

Objective:

Expected Outcome of Experiment:

CO	Outcome

Books/ Journals/ Websites referred:

Related Theory: -**Types of Computing**

1. **Personal Computing**
 - Computing done on personal devices (PCs, laptops, smartphones).
 - Users own and control both the hardware and software.
2. **Grid Computing**
 - Connecting multiple computers to perform a single task collaboratively.
 - Used in scientific research and solving complex computational problems.
3. **Cluster Computing**
 - A group of linked computers working as a single system.
 - Often used for high-performance computing (HPC).
4. **Cloud Computing**
 - On-demand delivery of IT resources and services over the Internet.
 - Elastic and scalable, users pay for what they use.

NIST 3-4-5 Definition of Cloud Computing

The National Institute of Standards and Technology (NIST) defines cloud computing based on **3 service models**, **4 deployment models**, and **5 essential characteristics**:

3 Service Models

1. **Infrastructure as a Service (IaaS):**
 - Basic IT infrastructure (e.g., servers, storage, networking) provided on a pay-as-you-go basis.
 - Examples: AWS EC2, Microsoft Azure Virtual Machines, Google Compute Engine.
2. **Platform as a Service (PaaS):**
 - A platform for developers to build, deploy, and manage applications without managing underlying hardware.
 - Examples: AWS Elastic Beanstalk, Google App Engine, Heroku.
3. **Software as a Service (SaaS):**
 - Software accessed via the internet without managing the underlying platform or infrastructure.
 - Examples: Google Workspace, Salesforce, Dropbox.

4 Deployment Models

1. **Private Cloud:**
 - Dedicated to a single organization; offers greater control and security.
 - Hosted on-premises or by a third party.
 - Examples: VMware vCloud, AWS Outposts.
2. **Public Cloud:**

- Hosted by third-party providers; shared resources accessed by multiple organizations.
- Examples: AWS, Microsoft Azure, Google Cloud.
- 3. **Hybrid Cloud:**
 - Combines private and public clouds, enabling flexibility in workload deployment.
 - Examples: AWS Outposts + AWS Public Cloud.
- 4. **Community Cloud:**
 - Shared by multiple organizations with similar requirements.
 - Example: Governmental or educational institutions pooling resources.

5 Essential Characteristics

1. **On-Demand Self-Service:**
 - Users can provision computing resources as needed without manual intervention.
2. **Broad Network Access:**
 - Access via standard devices (laptops, smartphones) and interfaces.
3. **Resource Pooling:**
 - Resources pooled across multiple customers with multi-tenancy models.
4. **Rapid Elasticity:**
 - Scalability to meet variable demands quickly.
5. **Measured Service:**
 - Resource usage is monitored and billed based on usage metrics.

Evolution of Cloud Computing

1. **1960s (Conceptual Origins):**
 - J.C.R. Licklider proposed the idea of a globally interconnected network (predecessor to the internet).
 - Time-sharing systems laid the foundation for cloud computing.
 2. **1990s (Virtualization):**
 - VMware introduced virtual machines, enabling multiple operating systems to run on a single machine.
 - ASPs (Application Service Providers) emerged as precursors to SaaS.
 3. **2000s (Modern Cloud Platforms):**
 - Launch of Amazon Web Services (AWS) in 2006 marked the rise of modern cloud computing.
 - Google and Microsoft joined the competition, expanding the ecosystem.
 4. **2010s-Present (Cloud Everywhere):**
 - Hybrid and multi-cloud solutions emerged.
 - Edge computing and serverless architectures became prominent.
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File Storage and Synchronization Providers

Cloud Storage Providers offer solutions for storing, synchronizing, and sharing files across devices:

1. **Dropbox:**
 - Offers file synchronization, sharing, and collaboration tools.
2. **Google Drive:**
 - Integrated with Google Workspace, supports collaborative editing and unlimited storage plans.
3. **OneDrive:**
 - Integrated with Microsoft Office, offers both personal and enterprise solutions.
4. **Amazon S3 (Simple Storage Service):**
 - Enterprise-grade storage with high scalability and durability.
5. **Box:**
 - Business-oriented file sharing and storage solution with compliance and security features.
6. **iCloud:**
 - Apple's solution for personal cloud storage and device synchronization.
7. **pCloud:**
 - Focuses on privacy and security with client-side encryption.
8. **Sync.com:**
 - Known for zero-knowledge encryption for secure file storage.

Common Features of Desktop-as-a-Service (DaaS)

1. **Virtual Desktop Infrastructure (VDI):**
 - Allows users to access virtual desktops hosted on cloud servers.
2. **Centralized Management:**
 - IT administrators can manage desktops, applications, and updates centrally.
3. **Scalability:**
 - Easily add or remove users and compute resources as needed.
4. **Device Independence:**
 - Access from various devices (PCs, laptops, tablets, smartphones) and operating systems.
5. **Pay-as-You-Go Pricing:**
 - Subscription-based models tailored to usage.
6. **Security:**
 - End-to-end encryption, multi-factor authentication, and data isolation to protect sensitive information.
7. **Remote Access:**
 - Seamless remote work capabilities with consistent desktop experiences.
8. **Application Integration:**
 - Ability to integrate custom or business-critical applications.

1) CloudMe

CloudMe is a European cloud storage service that offers file synchronization, storage, and sharing solutions for both individuals and businesses. It enables users to store files in the cloud, access them from various devices, and share them with others.

Price:

Business-

☒ Monthly ☐ Yearly

☐ Consumer ☒ Business (VAT excluded)

Start a 30-day free trial of any of our business plans, cancel at any time before the end of the period to avoid any charge.

All business accounts comes with a central Cloud File Server and includes additional accounts for each employee. Included user accounts provides an additional 100 GB private space for each user and access to shared space.

Team Plan 1 TB + 5 users with 100 GB	Business Plan 2 TB + 15 users with 100 GB	Enterprise Plan 5 TB + 50 users with 100 GB
€ 149 / month	€ 279 / month	€ 759 / month
A secure shared workspace for your team or project. Store company data in one place.	Small office collaboration, backup and sharing. Access file server through any device.	A large cloud-based file server for enterprises with user management and scalability.
Try Plan	Try Plan	Try Plan

Invoice is available for companies within the European Union

Included user accounts are managed by the company administrator. All plans have a maximum file size of 2 GB. All prices are excluding VAT. Plans may be changed at any time.

Consumer-

☒ Monthly ☐ Yearly

☒ Consumer ☐ Business (VAT excluded)

Starter Plan 25 GB	Small Plan 100 GB	Standard Plan 200 GB	Large Plan 500 GB
€ 4 / month	€ 8 / month	€ 14 / month	€ 30 / month
Backup your camera roll, share files, publish photo albums and sync folders on your computer. Perfect for trying out the service.	Sync multiple folders with CloudMe. You'll have enough space to backup your important folders or have some of your photos, music and videos with you anywhere.	Have all your documents, photos, music and video backed up and with you always. Collaborate in projects with friends and co-workers. Invite people to send you files.	Perfect for a team or family that need a shared storage space in the cloud. Share storage with friends and family, and keep a cloud copy of your media library.
Try Plan	Try Plan	Try Plan	Try Plan

Try CloudMe for free before selecting your premium plan. Our free account is limited to 3 GB of storage and a maximum file size of 150 MB. [Free Plan](#)



Mobile App Availability:

CloudMe offers mobile applications for both Android and iOS platforms, allowing users to access and manage their files on the go.

User Interface (UI):

CloudMe is designed to be user-friendly, featuring a blue folder that synchronizes across all connected devices, ensuring consistent access to files. The service also offers a web interface for easy file management.

Sharing Capabilities via Social Media/Mail:

Users can share files and folders through email, text messaging, Facebook, and Google, facilitating collaboration and sharing with both CloudMe users and non-users.

Chat Facility:

As of the latest available information, CloudMe does not offer an integrated chat facility within its service.

2) Amazon WorkSpaces (AWS)

Amazon Web Services (AWS) offers a wide range of cloud computing services, including storage solutions like **Amazon S3 (Simple Storage Service)** and **Amazon Drive**.

Price:

How do you pay for AWS?



Pay-as-you-go

Pay-as-you-go allows you to easily adapt to changing business needs without overcommitting budgets and improving your responsiveness to changes. With a pay-as-you-go model, you can adapt your business depending on need and not on forecasts, reducing the risk of overprovisioning or missing capacity.

[Read more »](#)



Save when you commit

For AWS Compute and AWS Machine Learning, Savings Plans offer savings over On-Demand in exchange for a commitment to use a specific amount (measured in \$/hour) of an AWS service or a category of services, for a one- or three-year period.

[Read more »](#)



Pay less by using more

With AWS, you can get volume based discounts and realize important savings as your usage increases. For services such as S3, pricing is tiered, meaning the more you use, the less you pay per GB. AWS also gives you options to acquire services that help you address your business needs.

[Read more »](#)

Mobile App Availability:

- AWS offers mobile apps for specific services:
 - The **AWS Console Mobile App** allows administrators to monitor cloud resources but does not directly manage files.
 - For file storage, **Amazon Drive** used to have mobile apps for Android and iOS, but these are now unavailable since its discontinuation.
 - File access via **Amazon S3** can be managed through third-party apps or APIs integrated with custom solutions.

Storage Space:

- **Amazon S3:** Virtually unlimited storage, suitable for small personal projects to large-scale enterprise solutions. Storage options include:
 - **S3 Standard:** High performance for frequently accessed data.
 - **S3 Glacier:** For long-term archival storage.
- **Amazon Drive:** Previously offered storage tiers for personal use (e.g., 100 GB to 1 TB) but has been phased out.

User Interface (UI):

- The **AWS Management Console** provides a comprehensive web-based UI for managing all AWS services, including Amazon S3. However, it may appear complex for beginners due to the vast number of features.
- **Amazon S3** has a straightforward interface for uploading, managing, and configuring bucket settings.
- CLI (Command Line Interface) and SDKs (Software Development Kits) are available for advanced users.

Sharing Capabilities via Social Media/Mail:

- **Amazon S3** allows sharing of files through public URLs or pre-signed URLs that provide temporary access.
- It does not have direct integration with social media platforms like Facebook or email clients, but you can manually share URLs.
- Sharing requires configuring **bucket policies** or **Access Control Lists (ACLs)**.

Chat Facility:

- AWS does not include a native chat feature for its storage services. However:
 - AWS provides customer support through live chat, email, and phone for account management and technical issues.
 - Real-time collaboration or communication features need to be implemented by integrating AWS services like **Amazon Chime** (a communication service).

3) Microsoft Azure

Microsoft Azure offers a comprehensive suite of cloud storage solutions tailored for both individuals and enterprises.

Price:

Pay as you go or try Azure free for up to 30 days. There's no upfront commitment—cancel anytime.

Azure free account

Best for proof of concept and exploring capabilities

- ✓ Available only to new Azure customers
- ✓ Free monthly amounts of 20+ popular services for 12 months (new Azure customers only)
- ✓ Free monthly amounts of 65+ always-free services
- ✓ Access to full catalog of services up to free amounts and USD 200 credit
- ✓ Spending protection—credit card won't be charged²
- ✓ No upfront commitment—cancel anytime
- ✓ Move to pay-as-you-go pricing to continue beyond 30 days or after credit is used up

USD 200 credit

to use on Azure services within 30 days

[Sign up](#)

Pay as you go

Best for customers ready to start building workloads.

- ✓ Free monthly amounts of 20+ popular services for 12 months (new Azure customers only)
- ✓ Free monthly amounts of 65+ always-free services
- ✓ Access to full catalog of services with no cap on service usage
- ✓ Technical support options available
- ✓ No upfront commitment—cancel anytime
- ✓ No action required to continue beyond 30 days

Pay only for what you use

beyond free monthly amounts

[Sign up](#)

Mobile App Availability:

While Azure doesn't offer a dedicated mobile app specifically for file storage management, the **Microsoft Azure** mobile app is available for both Android and iOS platforms. This app enables users to monitor and manage Azure resources, including storage accounts. However, direct file access or manipulation via the app is limited. For accessing Azure Files on mobile devices, users can utilize third-party applications or configure network drives compatible with mobile operating

Storage Space:

- **Azure Blob Storage:** Offers virtually unlimited storage capacity, accommodating a wide range of data types and sizes.
- **Azure Files:** Provides fully managed file shares in the cloud, supporting standard protocols like SMB and NFS, with storage limits that can scale up to 100 TiB per share.

User Interface (UI):

Azure's primary management interface is the **Azure Portal**, a web-based platform that offers:

- **Comprehensive Management:** Access to all Azure services, including storage accounts, with detailed configuration options.
- **User Experience:** While feature-rich, the portal may present a learning curve for newcomers due to its extensive capabilities.
- **Additional Tools:** For advanced management, Azure provides tools like the **Azure CLI** and **Azure PowerShell**, catering to users who prefer command-line interactions.

Sharing Capabilities via Social Media/Mail:

Azure storage services, such as Azure Blob Storage and Azure Files, facilitate data sharing through:

- **Shared Access Signatures (SAS):** Generate secure, time-bound URLs granting specific access permissions to storage resources.
- **Integration:** While Azure doesn't offer direct sharing to social media or email platforms, users can distribute SAS URLs via their preferred communication channels, enabling controlled access to the shared data

Chat Facility:

Azure doesn't include a native chat feature within its storage services. However, developers can implement real-time communication functionalities using **Azure Communication Services**, which provides APIs and SDKs to integrate chat, voice, and video capabilities into applications.

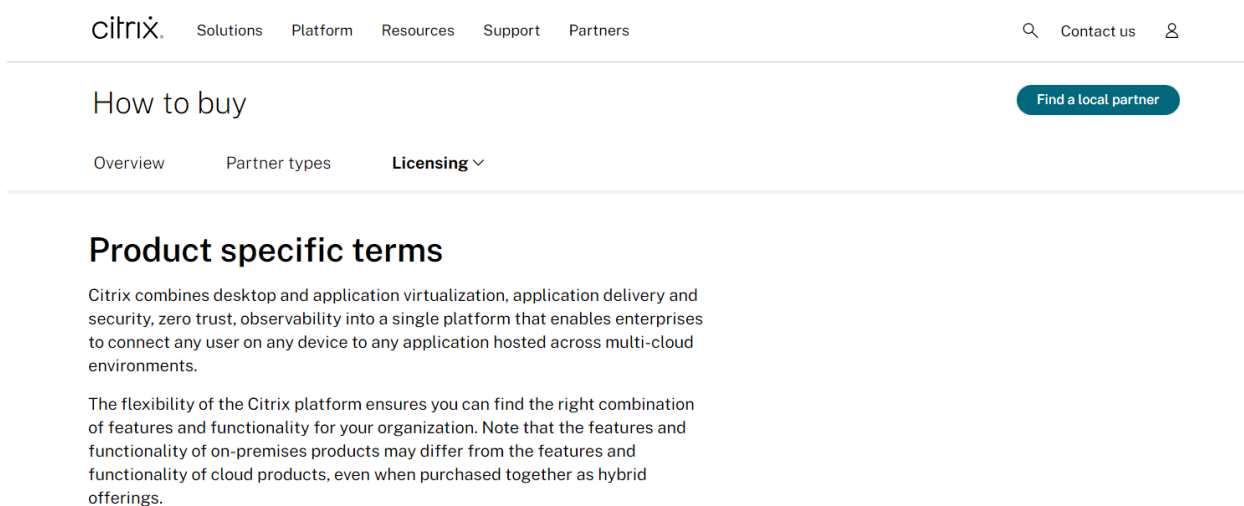
4) Citrix DaaS

Citrix DaaS (Desktop as a Service) is a cloud-based solution that enables organizations to deliver secure virtual applications and desktops to any device, facilitating remote work and enhancing flexibility.

Price:

Citrix DaaS offers several pricing tiers to accommodate different organizational needs:

- **Standard:** \$10 per user per month.
- **Advanced Plus:** \$13 per user per month.
- **Premium:** \$20 per user per month.
- **Premium Plus:** \$23 per user per month.
-



The screenshot shows the Citrix website's 'How to buy' section. The navigation bar includes 'Solutions', 'Platform', 'Resources', 'Support', and 'Partners'. The 'How to buy' section has tabs for 'Overview', 'Partner types', and 'Licensing'. A 'Find a local partner' button is visible. The 'Product specific terms' section describes Citrix DaaS as a cloud-based solution for secure virtual applications and desktops, highlighting its flexibility and multi-cloud support.

Mobile App Availability:

Citrix offers the **Citrix Workspace app**, a free application available for various platforms, including iOS and Android. This app allows users to access their virtual applications and desktops seamlessly from mobile devices, ensuring productivity on the go.

Storage Space:

Citrix DaaS itself does not provide direct file storage. Instead, it facilitates access to virtual desktops and applications where users can interact with files stored on network drives, cloud storage solutions, or other integrated storage services. The storage capacity and management depend on the underlying infrastructure and storage solutions employed by the organization.

User Interface (UI):

The **Citrix Workspace app** offers a user-friendly interface that aggregates all virtual applications and desktops into a single, accessible dashboard. This design simplifies navigation and enhances the user experience by providing a centralized point of access. Administrators benefit from intuitive management consoles that streamline the deployment and oversight of virtual environments.

Sharing Capabilities via Social Media/Mail:

Citrix DaaS focuses on secure access to virtual desktops and applications rather than direct file-sharing features. Users can share documents and collaborate through applications within their virtual desktops, utilizing email clients or other collaboration tools installed in the virtual environment. Direct integration with social media platforms for sharing purposes is not a primary feature of Citrix DaaS.

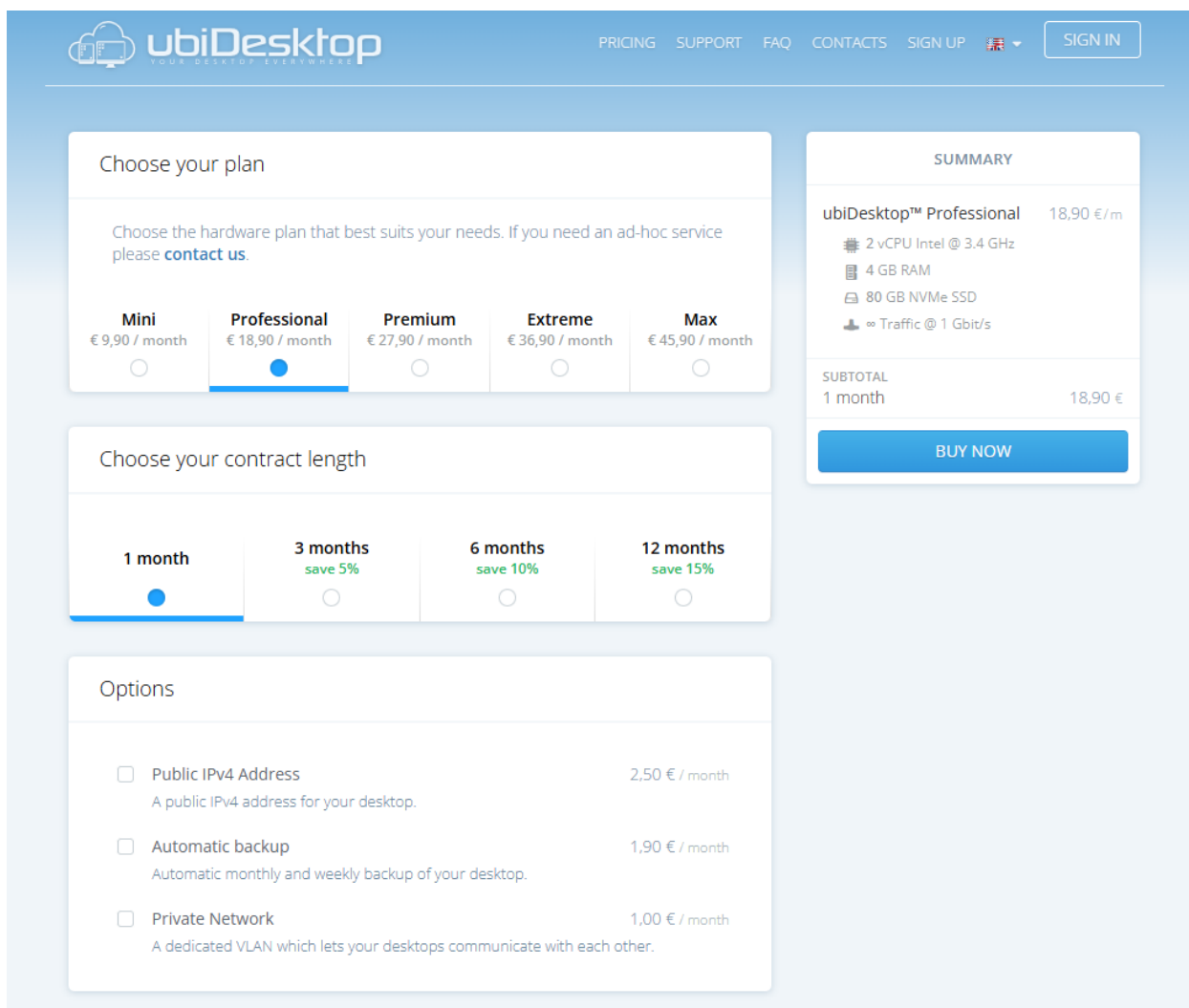
Chat Facility:

While Citrix DaaS does not include a built-in chat feature, it supports the use of communication and collaboration tools within the virtual desktop environment. Users can install and use applications like Microsoft Teams, Slack, or other messaging platforms to facilitate real-time communication and collaboration within their virtual workspace.

5) ubiDesktop:

ubiDesktop is a cloud-based Desktop as a Service (DaaS) solution that enables users to access their virtual desktops from any device, providing flexibility and mobility for both personal and professional use.

Price:



The screenshot shows the ubiDesktop pricing page. It features a navigation bar with links for PRICING, SUPPORT, FAQ, CONTACTS, SIGN UP, and SIGN IN. The main content area is divided into three sections: 'Choose your plan', 'Choose your contract length', and 'Options'. The 'Choose your plan' section offers five plans: Mini (€ 9,90 / month), Professional (€ 18,90 / month, selected), Premium (€ 27,90 / month), Extreme (€ 36,90 / month), and Max (€ 45,90 / month). The 'Choose your contract length' section offers four options: 1 month (selected), 3 months (save 5%), 6 months (save 10%), and 12 months (save 15%). The 'Options' section includes three checkboxes: Public IPv4 Address (2,50 € / month), Automatic backup (1,90 € / month), and Private Network (1,00 € / month). A 'SUMMARY' box on the right shows the selected Professional plan at 18,90 €/m with specifications: 2 vCPU Intel @ 3.4 GHz, 4 GB RAM, 80 GB NVMe SSD, and unlimited traffic at 1 Gbit/s. The subtotal for 1 month is 18,90 €, and a 'BUY NOW' button is provided.



Mobile App Availability:

While ubiDesktop doesn't provide a dedicated mobile application, users can access their virtual desktops from any device, including smartphones and tablets, using Remote Desktop Protocol (RDP) or NX clients compatible with their operating systems

Storage Space:

Each subscription plan includes a specified amount of NVMe SSD storage, ranging from 40 GB in the Mini plan to 160 GB in the Extreme plan. This storage is dedicated to the user's virtual desktop environment.

User Interface (UI):

ubiDesktop provides a virtual desktop environment that mirrors a traditional desktop experience, allowing users to install their preferred operating systems, such as Linux Mint, Ubuntu, Windows 7, or Windows 10. This familiarity ensures a seamless transition to the cloud environment.

Sharing Capabilities via Social Media/Mail:

The service focuses on providing virtual desktop environments and does not inherently include features for sharing content directly via social media or email. However, users can utilize applications within their virtual desktops to share files and information as they would on a physical computer.

Chat Facility:

ubiDesktop does not offer an integrated chat facility within its platform. Users requiring communication tools can install and use their preferred chat applications within the virtual desktop environment.

Comparative analysis table with respect to Price, Mobile App Availability, Storage Space, UI, Sharing capabilities via Social media/Mail, Chat facility

Feature	CloudMe	AWS	Azure	Citrix Daas	ubiDesktop
Price	Free 3GB plan; Paid plans starting at €1/month for 10GB.	Pay-as-you-go model; S3 starts at \$0.023/GB/month	Pay-as-you-go; Blob storage starts at \$0.0125/GB (Hot Tier).	Starts at \$10/user/month for Standard plans.	Plans from \$10.90/month (Mini) to \$40.90/month (Extreme).
Mobile App Availability	Apps for iOS and Android.	AWS Console app for monitoring; no direct storage management app.	Azure mobile app for monitoring; no direct storage management app.	Citrix Workspace app for iOS and Android to access virtual desktops.	No dedicated app; access virtual desktops via RDP or NX clients.
Storage Space	Free: 3GB; Paid: Up to 5TB.	Virtually unlimited via Amazon S3.	Virtually unlimited with Azure Blob Storage.	Depends on the underlying infrastructure used for the virtual desktops.	NVMe SSD storage: 40GB to 160GB based on the selected plan.
User Interface (UI)	Simple, user-friendly UI for managing files and folders.	AWS Management Console: Powerful but complex; CLI and SDK options for advanced users.	Intuitive yet feature-rich console; CLI and SDK available for developers.	User-friendly interface for accessing virtual apps and desktops.	Virtual desktop environments mirroring traditional OS (e.g., Windows, Linux).
Sharing Capabilities	File sharing via social media, email, and	File sharing via public or pre-signed URLs (no social	Manual sharing via public/private access settings.	Sharing functionality depends on applications installed	No native sharing; users can install apps for sharing

	public links.	media/email integration)		within the virtual environment.	within their desktop environment.
Chat Facility	No integrated chat feature	No chat; separate AWS services like Chime are available for communication.	No chat; Azure Communication Services available for integration.	No chat; users can install communication tools like Microsoft Teams within virtual desktops.	No chat; users can install and use their preferred chat tools (e.g., Slack, Teams, Skype).

Conclusion:-

Explored various DaaS platforms