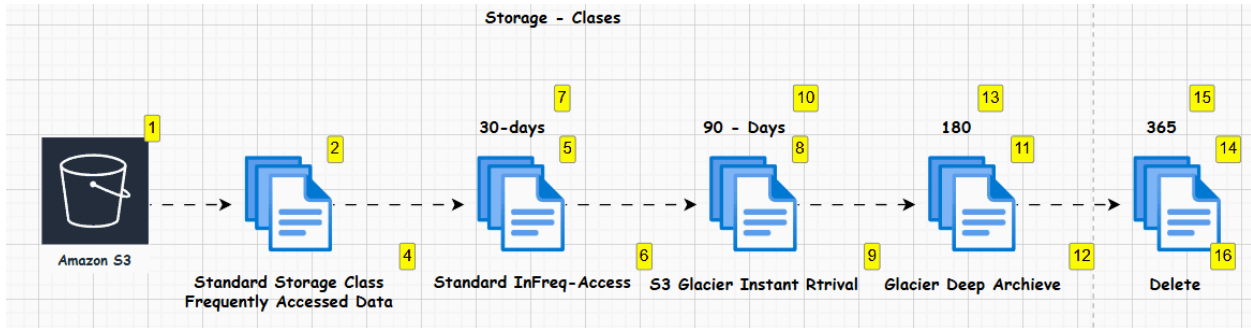

🎓 Amazon S3 Storage Classes –



📘 What Are S3 Storage Classes?

✅ Definition:

Amazon S3 Storage Classes are different **tiers of storage** designed to help you **optimize cost, durability, and performance** based on how frequently you access your data and how long you need to retain it.

Every object stored in S3 can belong to a specific storage class, and **each class serves a different use case** — from frequent access to deep archive.

🎯 Why It Matters:

- Reduce costs by placing data in the **right class** based on usage
- Avoid overpaying for infrequently accessed or archival data
- Improve scalability and compliance for long-term storage

📦 The 8 AWS S3 Storage Classes

Let's break down each class with:

- 📌 Use Case
 - 💰 Cost
 - ⚡ Performance
 - 🧠 Instructor Notes
-

1 S3 Standard

✓ Default Storage Class

Feature	Value
Durability	99.999999999% (11 9's)
Availability	99.99%
Retrieval Time	Immediate
Minimum Duration	None
Use Case	Frequently accessed data

📌 **Use Case:** Websites, real-time applications, user uploads, etc.

💰 **Cost:** Highest per GB, but ideal for hot data.

🧠 **Tip:** This is the default for all S3 uploads unless specified.

2 S3 Intelligent-Tiering

✓ Auto-cost optimization with performance retention

Feature	Value
Durability	99.999999999%
Availability	99.9%

Retrieval Time	Immediate
Minimum Duration	30 days (for some tiers)
Use Case	Unknown or changing access patterns

- 📌 **Use Case:** ML datasets, media files, unpredictable usage
 - 💰 **Cost:** Small monitoring fee + tier-based pricing
 - 🧠 **Tip:** Great for hands-off optimization without lifecycle rules.
-

3 S3 Standard-IA (Infrequent Access)

- ✅ **Lower cost for less frequent access**

Feature	Value
Durability	99.999999999%
Availability	99.9%
Retrieval Time	Immediate
Minimum Duration	30 days
Use Case	Monthly-access backups, reports

- 📌 **Use Case:** Log files, backups, financial records
 - 💰 **Cost:** Cheaper than Standard, but **retrieval costs apply**
 - 🧠 **Tip:** Lifecycle rules often move Standard objects here after 30 days.
-

4 S3 One Zone-IA

- ✅ **Cheapest IA option but lower resiliency**

Feature	Value
Durability	99.999999999% (1 AZ only)
Availability	99.5%

Retrieval Time	Immediate
Minimum Duration	30 days
Use Case	Re-creatable, redundant data

- 📌 **Use Case:** Re-generated thumbnails, cache backups
 - 💰 **Cost:** ~20% cheaper than Standard-IA
 - 🧠 **Tip:** Not multi-AZ—avoid for critical or compliance data.
-

5 S3 Glacier Instant Retrieval

✓ Fast access archival

Feature	Value
Durability	99.999999999%
Availability	99.9%
Retrieval Time	Milliseconds
Minimum Duration	90 days
Use Case	Archive but fast-read files

- 📌 **Use Case:** Compliance data, medical records
 - 💰 **Cost:** Lower storage price, retrieval fee applies
 - 🧠 **Tip:** Use when you **need archive durability + speed**
-

6 S3 Glacier Flexible Retrieval (Formerly Glacier)

✓ Low-cost deep archive with flexible retrieval

Feature	Value
Durability	99.999999999%
Availability	Varies by retrieval method

Retrieval Time	Minutes to hours
Minimum Duration	90 days
Use Case	Long-term backups

- 📌 **Use Case:** Audit logs, legal archives
 - 💰 **Cost:** Low storage, variable retrieval (expedited/standard/bulk)
 - 🧠 **Tip:** Not for data that needs fast or frequent access.
-

7 S3 Glacier Deep Archive

- ✅ **Lowest-cost storage for long-term compliance**

Feature	Value
Durability	99.999999999%
Retrieval Time	Up to 12 hours
Minimum Duration	180 days
Use Case	Legal/compliance data retention

- 📌 **Use Case:** Financial, government records for 7+ years
 - 💰 **Cost:** Cheapest of all classes
 - 🧠 **Tip:** Retrieval takes time—use only for **very cold data**
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8 S3 Reduced Redundancy Storage (Legacy)

- 🚫 **Deprecated/Not recommended for use**

Feature	Value
Durability	99.99%
Availability	99.99%
Retrieval Time	Immediate








Use Case Temporary/cached data

 **Use Case:** Formerly used for non-critical objects

 **Cost:** Not much lower than Standard

 **Tip:** AWS recommends **not using this anymore**

Quick Reference Table for Teaching

Class	Ideal For	Retrieval	Min Duration	Cost
Standard	Hot data	Instant	None	 High
Intelligent-Tiering	Unpredictable access	Instant	Some Tiers	 Medium
Standard-IA	Monthly-used backups	Instant	30 Days	 Medium
One Zone-IA	Re-creatable data	Instant	30 Days	 Low
Glacier Instant	Archived but fast-read	Instant	90 Days	 Very Low
Glacier Flexible	Rare access, flexible speeds	Minutes+	90 Days	 Very Low
Glacier Deep Archive	Compliance backups	Hours	180 Days	 Lowest

Classroom Discussion Prompts:

- What happens if you try to retrieve 1 TB of data from Glacier?
 - How do lifecycle policies move objects between these classes?
 - Why would a company use Deep Archive vs Glacier Instant?
 - What happens if you delete Glacier objects before minimum duration?
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✓ Hands-On Lab Suggestions (AWS Console):

1. Create a bucket
 2. Upload files
 3. Use lifecycle rules to transition:
 - Standard → Standard-IA after 30 days
 - Standard-IA → Glacier after 60 days
 4. Check object class metadata (manually or wait for transition)
 5. Discuss cost impact using AWS Pricing Calculator
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S3 Storage Classes: Comparison and Pricing Guide



Purpose of S3 Storage Classes

AWS offers multiple S3 storage classes to help you **balance cost, availability, and retrieval time** based on how often your data is accessed and how long you want to store it.



Comparison Table

Storage Class	Durability	Availability	Retrieval Time	Min Duration	Ideal Use Case	Storage Cost (per GB)	Retrieval Cost
S3 Standard	99.999999999%	99.99%	Immediate	None	Frequently accessed data	~\$0.023	\$0
S3 Intelligent-Tiering	99.999999999%	99.9%	Immediate	30/90 days	Unknown/variable access patterns	~\$0.023 + monitoring	Varies by tier
S3 Standard-IA	99.999999999%	99.9%	Immediate	30 days	Infrequently accessed data	~\$0.0125	~\$0.01/GB
S3 One Zone-IA	99.999999999%	99.5%	Immediate	30 days	Re-creatable, non-critical data	~\$0.01	~\$0.01/GB
S3 Glacier Instant Retrieval	99.999999999%	99.9%	Milliseconds	90 days	Archive w/ fast access needs	~\$0.004	~\$0.03/GB
S3 Glacier Flexible Retrieval	99.999999999%	Varies	Minutes to Hours	90 days	Low-cost long-term archive	~\$0.0036	\$0.01 – \$0.03/GB
S3 Glacier Deep Archive	99.999999999%	Varies	Up to 12 Hours	180 days	Regulatory/Compliance retention	~\$0.00099	~\$0.02 – \$0.03/GB

🧠 **Note:** Pricing is region-dependent. The values above are approximate (e.g., US East) and subject to change. Always check the [AWS S3 Pricing Page](#) for the latest.

Cost Breakdown (Estimated, US East 1)

Storage Cost (per GB/month):

Storage Class	Cost (USD)
S3 Standard	~\$0.023
Intelligent-Tiering (Frequent Tier)	~\$0.023 + \$0.0025 monitoring
Standard-IA	~\$0.0125

One Zone-IA	~\$0.01
Glacier Instant Retrieval	~\$0.004
Glacier Flexible Retrieval	~\$0.0036
Glacier Deep Archive	~\$0.00099

Retrieval Costs (per GB):

Storage Class	Retrieval Cost (USD)
S3 Standard	Free
Intelligent-Tiering (Frequent)	Free
Standard-IA	~\$0.01
One Zone-IA	~\$0.01
Glacier Instant Retrieval	~\$0.03
Glacier Flexible Retrieval	~\$0.01 – \$0.03
Glacier Deep Archive	~\$0.02 – \$0.03

When to Use Each Class – Real-World Use Cases

Storage Class	Common Scenarios
Standard	Web apps, dynamic content, user uploads
Intelligent-Tiering	Unpredictable access patterns (ML, IoT, backups)
Standard-IA	Log files, periodic reports, image archives
One Zone-IA	Non-critical re-creatable data (e.g., thumbnails)
Glacier Instant Retrieval	Archived financial data, compliance docs w/ fast reads
Glacier Flexible Retrieval	Backup snapshots, audit logs, media archives
Glacier Deep Archive	Legal archives, tape backups, cold storage

Training Tip – Pricing Lab Idea


Create a lab where students:

1. Upload files to a Standard bucket
2. Create lifecycle rules:
 - Standard → IA after 30 days
 - IA → Glacier after 60 days
3. Use AWS Calculator to estimate monthly cost over 12 months

Sample Scenario for Class Discussion

Company X stores 10TB of logs per month. They access only the last month's logs.
Which storage classes should they use?

- First month: **S3 Standard**
- After 30 days: **S3 Standard-IA**
- After 90 days: **S3 Glacier Flexible Retrieval**

 Expected savings over 1 year: 70–90% vs keeping all logs in S3 Standard
