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SSZG527

Lecture 6

Cloud Computing

Objective



- **Demo on EC2**
- **AWS Storage Services**
 - Amazon S3
 - Amazon Glacier
 - Amazon EBS
 - AWS Import/Export
- **AWS Database Services**
 - Amazon RDS
 - Amazon DynamoDB
- **Amazon CloudFront**
- **Demo on S3**



Amazon Simple Storage Service (Amazon S3)

- Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers.
- It provides a simple web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the web.
- You can accomplish these tasks using the AWS Management Console , which is a simple and intuitive web interface
- Also called as Object storage
- S3 is independent of an instance:
 - for archival purposes: store it now and retrieve it at a later date



Organization of data in S3



Buckets, Objects and keys:

- Bucket is a logical container in S3
- Files are called as objects in S3
- Objects are referred to with keys
- Object size can be up to 5TB
- No limit on no: of objects in a bucket
- No: of buckets can be up to 100 for a account
- Bucket namespace is shared; so, it is not possible to create a bucket with a name that has already been used by another S3 user

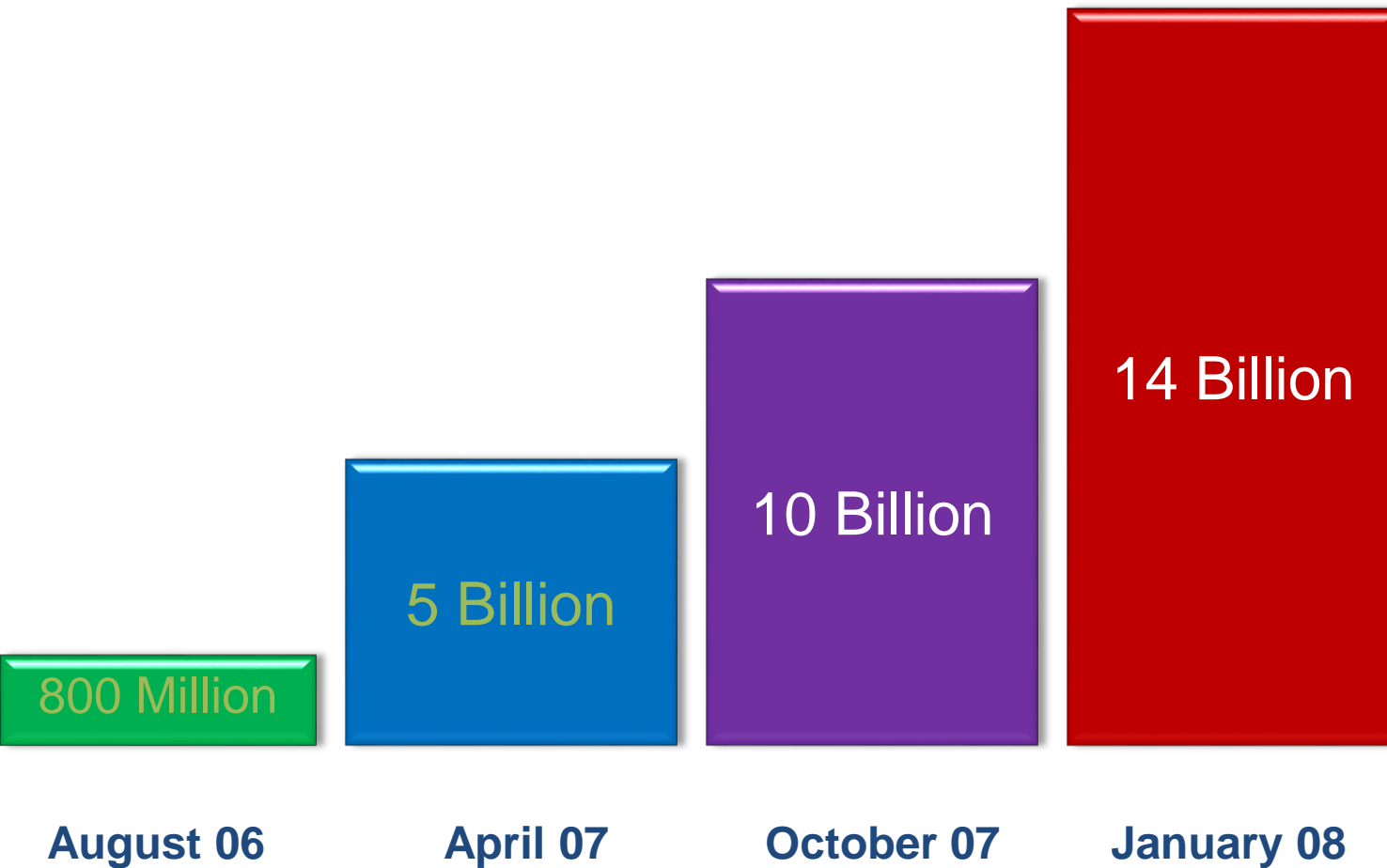
- S3 is not hierarchical file system
- If bucket name is **bits** and key is **hyd.doc** the object is accessed using
 - <http://s3.amazonaws.com/bits/hyd.doc>
 - <http://bits.s3.amazonaws.com/hyd.doc>

Amazon S3(contd..)

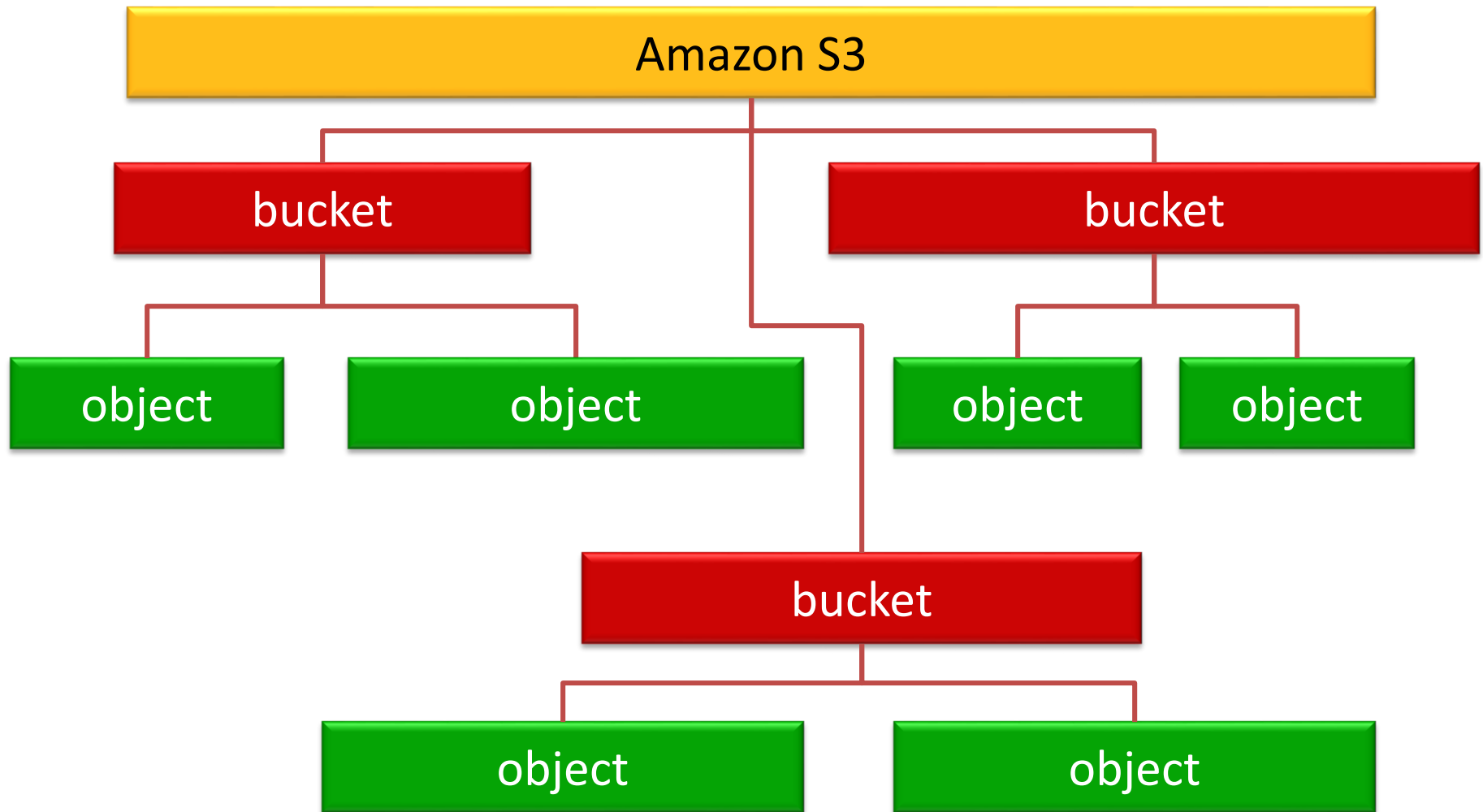
- Highly scalable data storage in-the-cloud
- Programmatic access via web services API
- Simple to get going, simple to use
- Highly available and durable
- Pay-as-you-go:
 - Storage: \$0.15 / GB / month
 - Data Transfer: starts at \$0.18 / GB



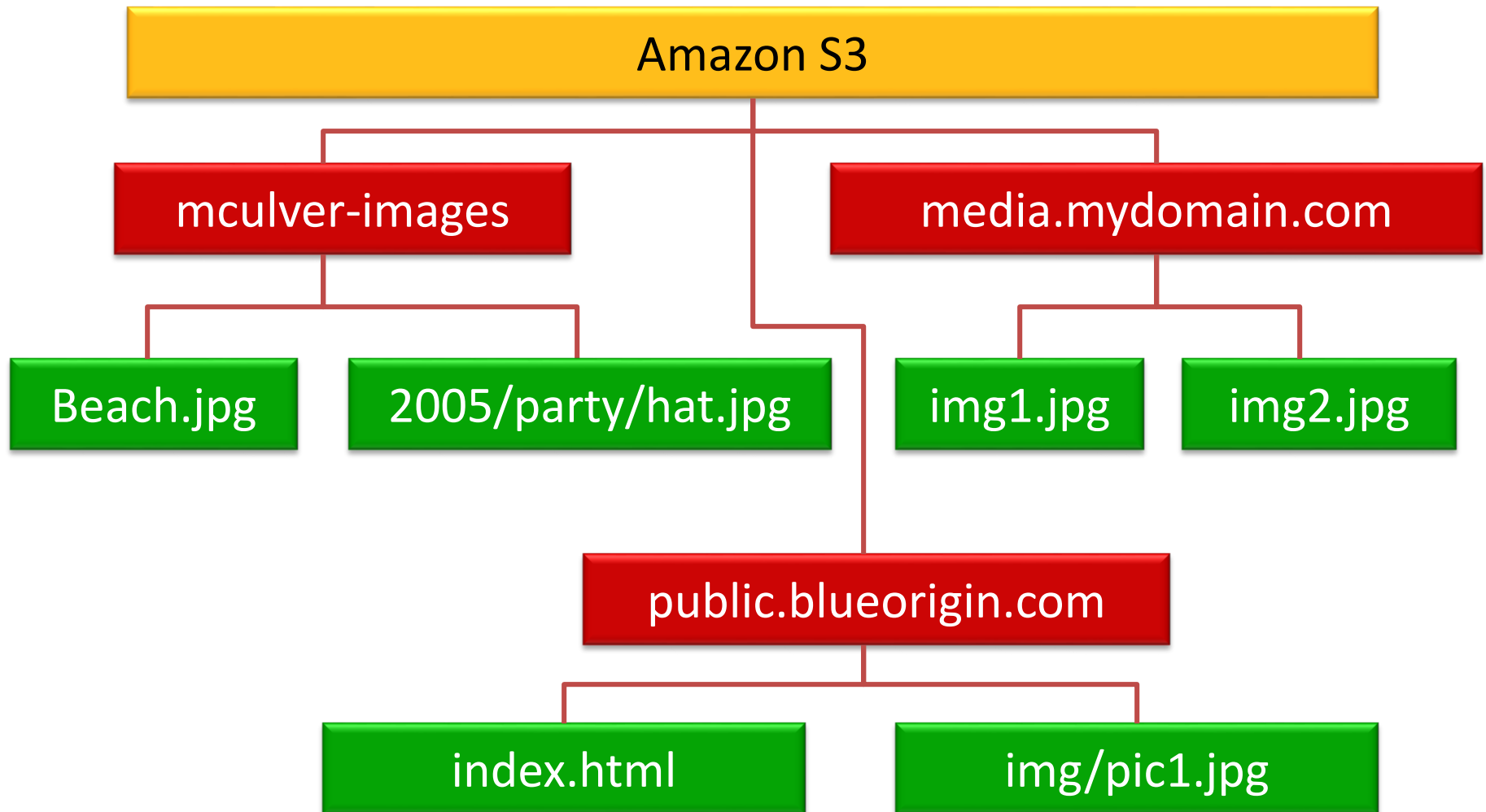
Billions of Objects Stored



Amazon S3 Namespace



Amazon S3 Namespace



Amazon S3 API

Amazon web services API support the ability to:

- Find buckets and objects
- Discover their meta data
- Create new buckets
- Upload new objects
- Delete existing buckets and objects
- When manipulating the buckets you can optionally specify where they should be stored.
- BitTorrent access to S3 is also available



EC2 Storage Resources

- Amazon S3: Highly available object store
- **Elastic Block Service (EBS): Permanent block storage**
- Instance Storage: Transient block storage

Block storage resources

- Used to configure resources that appear to be physical disks to the EC2 instance
- There are two types of block storage resources: Elastic Block Service, and instance storage

Amazon Elastic Block Store



- It provides block level storage volumes for Amazon EC2 instances.
- Amazon EBS volumes are network-attached, and persist independently from the life of an instance.
- After a volume is attached to an instance, you can use it like any other physical hard drive.
- Amazon EBS provides highly available, highly reliable, predictable storage volumes that can be attached to a running Amazon EC2 instance and exposed as a device within the instance.
- Amazon EBS is particularly suited for applications that require a database, file system, or access to raw block level storage

Amazon EBS (contd..)



- ✓ Amazon EBS allows you to create storage volumes from 1 GB to 1 TB that can be mounted as devices by Amazon EC2 instances.
- ✓ Multiple volumes can be mounted to the same instance.
- ✓ Amazon EBS enables you to provision a specific level of I/O performance if desired, by choosing a Provisioned IOPS volume. This allows you to predictably scale to thousands of IOPS per Amazon EC2 instance.
- ✓ Storage volumes behave like raw, unformatted block devices, with user supplied device names and a block device interface. You can create a file system on top of Amazon EBS volumes, or use them in any other way you would use a block device (like a hard drive).
- ✓ Amazon EBS volumes are placed in a specific Availability Zone, and can then be attached to instances also in that same Availability Zone.

Amazon EBS (contd..)



- ✓ Amazon EBS also provides the ability to create point-in-time snapshots of volumes, which are persisted to Amazon S3.
- ✓ These snapshots can be used as the starting point for new Amazon EBS volumes, and protect data for long-term durability.
- ✓ A snapshot can be used to instantiate as many volumes as you wish. These snapshots can be copied across AWS regions, making it easier to leverage multiple AWS regions for geographical expansion, data center migration and disaster recovery.

Instance Storage Vs EBS storage



| | Instance storage | EBS Storage |
|-------------|---|---|
| Creation | Created by default when an EC2 instance is created | Created independently of EC2 instances |
| Sharing | Remains with only EC2 instance with which it is created | Can be shared between EC2 instances |
| Attachment | Attached by default to S3-backed instances; can be attached to EBS-backed instances | Not attached by default to any instances |
| Persistence | Not persistent; vanished if instance is terminated | Persistent even if instance is terminated |
| S3 snapshot | Can be snapshotted to S3 | Can be snapshotted to S3 |

S3-backed Instances vs EBS-backed Instances

- ❖ EC2 compute and storage resources behave slightly differently depending upon whether the root AMI for the EC2 instance is stored in S3 or EBS
- ❖ These instances are referred to as S3-backed Instances and EBS-backed Instances respectively

| Characteristic | Amazon EBS-Backed Instances | Amazon S3-Backed Instances |
|--------------------|--|--|
| Root partition | The root device for an instance launched from the AMI is an Amazon EBS volume created from an Amazon EBS snapshot | The root device for an instance launched from the AMI is an instance store volume created from a template stored in Amazon S3 |
| Boot Time | Usually less than 1 minute | Usually less than 5 minutes |
| Size Limit | 1 TiB | 10 GiB |
| Root Device Volume | Amazon EBS volume | Instance store volume |
| Data Persistence | Data on Amazon EBS volumes persists after instance termination; you can also attach instance store volumes that don't persist after instance termination | Data on instance store volumes persists only during the life of the instance; you can also attach Amazon EBS volumes that persist after instance termination |
| Upgrading | The instance type, kernel, RAM disk, and user data can be changed while the instance is stopped. | Instance attributes are fixed for the whole life of an instance |
| Charges | Instance usage, Amazon EBS volume usage, and Amazon EBS snapshot charges for AMI storage | Instance usage and Amazon S3 charges for AMI storage |
| Stopped State | Can be placed in stopped state where instance is not running, but the instance is persisted in Amazon EBS | Cannot be in stopped state; instances are running or terminated |

Amazon Glacier



- It is an extremely low-cost storage service that provides secure and durable storage for data archiving and backup.
- With Amazon Glacier, customers can store their data cost effectively for months, years, or even decades.
- Amazon Glacier is a great storage choice when low storage cost is paramount, your data is rarely retrieved, and retrieval latency of several hours is acceptable.
- If your application requires fast or frequent access to your data, consider using Amazon S3

AWS Import/Export



- AWS Import/Export accelerates transferring large amounts of data between the AWS cloud and portable storage devices that you mail to Amazon
- AWS transfers data directly onto and off of your storage devices using Amazon's high-speed internal network
- Useful for large data sets
- AWS Import/Export supports:
 - Import to Amazon S3
 - Export from Amazon S3
 - Import to Amazon EBS
 - Import to Amazon Glacier

Amazon Relational Database Service (Amazon RDS)



- It makes it easy to set up, operate, and scale a relational database in the cloud.
- It provides cost-efficient and resizable capacity while managing time-consuming database administration tasks, freeing you up to focus on your applications and business
- It gives you access to the capabilities of a familiar MySQL, Oracle or SQL Server database
- It makes it easy to use replication to enhance availability and reliability for production databases and to scale out beyond the capacity of a single database

Amazon DynamoDB



- Rather than requiring consistency after every transaction, it is enough for the database to eventually be in a consistent state
- It is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability.
- Amazon DynamoDB is designed to address the core problems of database management, performance, scalability, and reliability.
- DynamoDB automatically spreads the data and traffic for the table over a sufficient number of servers to handle the request capacity specified by the customer and the amount of data stored, while maintaining consistent, fast performance.

An alternative to ACID is BASE:

Data Read and Consistency:

- When you receive an "operation successful" response to your write request, DynamoDB ensures that the write is durable on multiple servers. However, it **takes time for the update to propagate to all copies.**
- The data is eventually consistent, i.e., a read request immediately after a write operation might not show the latest change
- It supports both eventually consistent and strongly consistent read options.

Eventually Consistent Reads:

- When you read data, the response might not reflect the results of a recently completed write operation
- By default, the operations perform eventually consistent reads, but you can optionally request strongly consistent reads

Strongly Consistent Reads

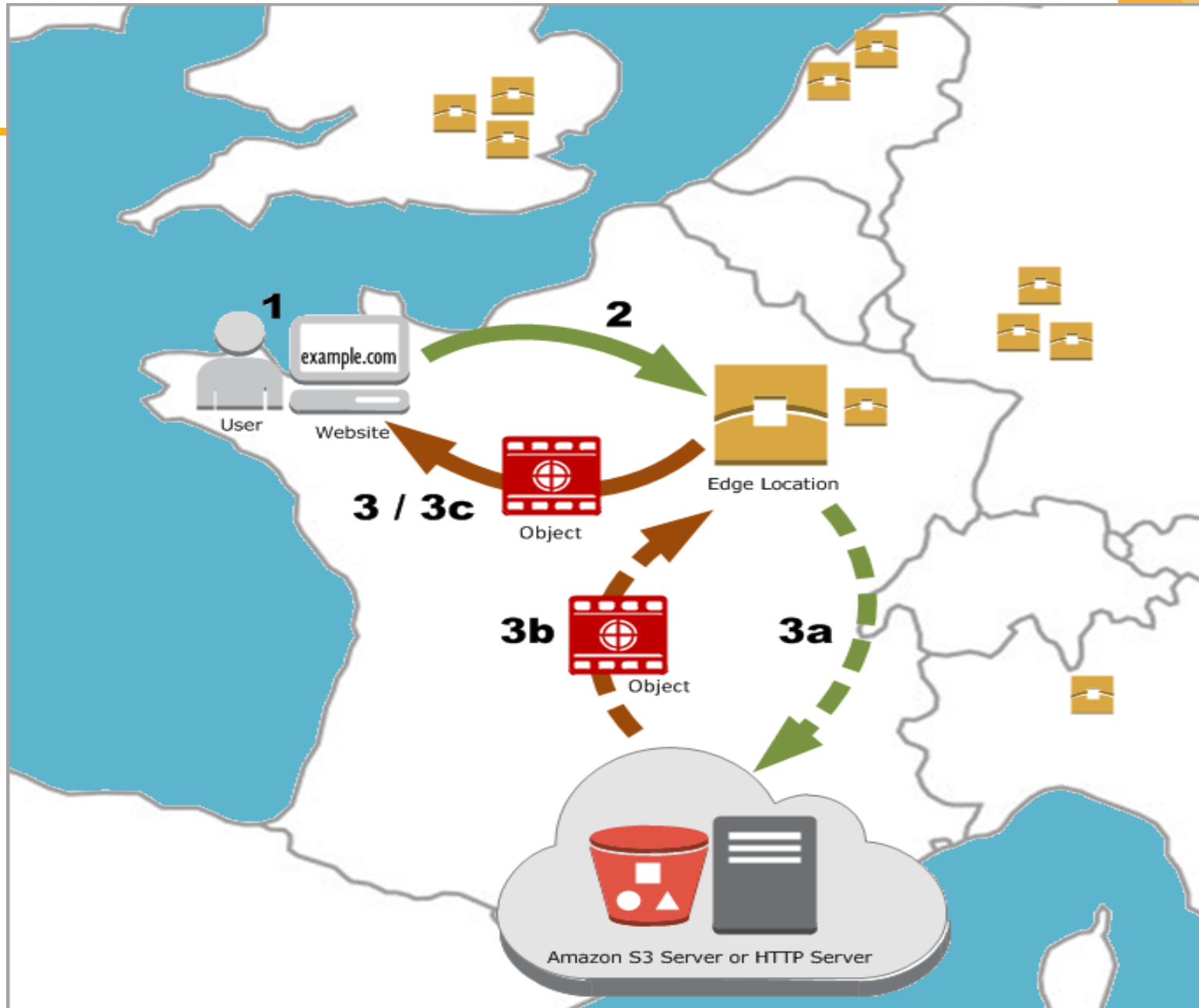
- DynamoDB returns a response with the **most up-to-date data that reflects updates by all prior related write operations** to which DynamoDB returned a successful response.
- A strongly consistent read might be less available in the case of a network delay or outage

Amazon CloudFront



- It is a web service for content delivery.
- It integrates with other AWS's to give developers and businesses an easy way to distribute content to end users with low latency, high data transfer speeds, and no commitments
- CloudFront delivers your content through a worldwide network of data centers called edge locations
- It can deliver your entire website, including dynamic, static and streaming content using a global network of edge locations.
- Requests for objects are automatically routed to the nearest edge location, so content is delivered with the best possible performance

How CloudFront Delivers Content



Summary



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