Nasuni Edge Appliance – Versioning and Snapshotting

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This document provides a detailed overview of how the Nasuni Edge Appliance performs versioning and snapshotting as part of its hybrid cloud file system architecture. It explains the design principles, workflow, components, and technical mechanisms that enable continuous protection, scalability, and global file synchronization across enterprise deployments.

1. Concept and Objectives

Nasuni's versioning and snapshotting system provides continuous file protection, near-instant recovery, and multi-site consistency. Each modification to a file is captured and preserved as a version, ensuring that enterprises can recover data to any point in time. Snapshots capture both data and metadata, making them essential for business continuity and ransomware resilience.

2. Key Components

1 **Edge Appliance:** Local on-prem or virtual appliance that caches active file data and stages writes to cloud storage.

2 **Copy-On-Write (COW) Snapshot Disk:** Temporary storage used to maintain write consistency during snapshot processing.

3 **Cloud Object Storage:** Acts as the immutable, scalable backend repository for deduplicated and encrypted file blocks.

4 **Nasuni UniFS (Global File System):** Metadata and versioning engine maintaining a global namespace across all sites.

5 **Orchestration Center:** Centralized management and snapshot coordination service for all volumes and edges.

3. Snapshot and Versioning Workflow

The snapshot and versioning process in Nasuni follows a multi-phase pipeline designed for efficiency and consistency across global sites:

1 **1. File Modification:** Users modify files over SMB/NFS. The Edge Appliance logs these changes locally.

2 **2. Snapshot Trigger:** A scheduler or policy event triggers snapshot creation, locking metadata for the volume.

3 **3. Data Phase:** Changed blocks are identified, deduplicated, compressed, encrypted, and uploaded to cloud storage.

4 **4. Metadata Phase:** The file system's structure, permissions, and pointers are updated and sent to UniFS.

5 **5. Snapshot Finalization:** Once data and metadata phases complete, the snapshot is sealed as an immutable version.

6 **6. Synchronization:** Other Edge Appliances automatically synchronize to the latest snapshot via UniFS coordination.

4. Underlying Mechanisms

Nasuni uses several data management techniques to optimize snapshot and versioning performance:

1. **Deduplication:** Identifies identical data blocks across files and versions, storing them once to minimize storage cost.

2. **Chunking:** Breaks files into variable-sized chunks, enabling efficient block-level updates rather than whole-file writes.

3. **Encryption:** Each block and metadata snapshot is encrypted before being sent to the cloud, ensuring data confidentiality.

4. **Copy-on-Write (COW):** Guarantees that active writes do not interfere with snapshot consistency by writing modified data to a temporary disk.

5. **Immutable Snapshots:** Once written to cloud object storage, snapshots cannot be modified, ensuring version integrity.

5. Version Retention and Recovery

Each snapshot represents a point-in-time version of the file system. Nasuni's retention policies allow organizations to keep versions indefinitely or prune them based on policy parameters. Restoration operations can be performed on:

1. • Entire volumes – rolling back the global state.

2. • Directories – restoring shared data sets to prior snapshots.

3. • Individual files – restoring the previous version from the cloud in seconds.

Because metadata catalogs every snapshot, restores are instantaneous and involve fetching relevant blocks from cloud storage. Deduplication ensures that rollback operations are efficient and non-destructive.

6. Multi-Site Synchronization

UniFS coordinates version propagation across Edge Appliances. When a new snapshot is created, UniFS updates metadata pointers globally. Each edge then synchronizes relevant changes on-demand, ensuring global data consistency without re-uploading entire datasets.

7. Security and Efficiency Considerations

- All snapshots are encrypted (AES-256) before cloud transmission. - Deduplication and compression drastically reduce bandwidth usage. - Copy-on-write ensures zero downtime during snapshots. - Immutable versions protect against ransomware and accidental deletion.

8. Summary and Key Takeaways

Nasuni's Edge Appliance seamlessly combines local performance with cloud-scale durability. Through a combination of **deduplication**, **copy-on-write**, **encryption**, and **UniFS global coordination**, it delivers continuous protection, versioning, and instant recovery. This architecture eliminates the need for traditional backup systems and ensures business continuity even in distributed environments.

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