

Buffalo TeraStation 71210RH Series Network Storage

Applications in iSCSI Storage and Diverse Server Environments

An In-depth Analysis of NAS Functionality in Virtual Machine Storage, Media Streaming, Backup Solutions, and Database Management.

This white paper provides an in-depth evaluation of the Buffalo TeraStation 71210RH Series NAS, focusing on its performance under specific conditions, versatility across various applications, and its reliability and speed. The primary objective of this testing was to determine the efficacy and operational capacity of the NAS in a simulated production environment, particularly when used as an iSCSI target with both Proxmox VE and Ubuntu Server.

Our evaluation aimed to assess its suitability for production storage in database and virtual machine environments. We extended our testing beyond conventional uses, exploring the functionality of the NAS as a:

- Media streamer
- Backup solution target
- Ability to handle multiple concurrent system accesses

This white paper details the testing methodology, analysis of performance data, and the implications of NAS deployment in varied operational contexts, providing a comprehensive guide for integrating this technology into enterprise environments.

Buffalo's TS71210RH is a powerful 12-bay rackmount network-attached storage (NAS) product that marks an evolution in enterprise-level data storage solutions. It features an Intel® Xeon® quad-core processor, enterprise-grade CMR hard drives (up to 240TB total capacity) included, and 4 native 10GbE ports to enable high throughput and outstanding server performance that allow the NAS to act as storage for active data scenarios, such as large-scale data storage and backup, mission-critical file server, and more.







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vmware READY STORAGE

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OVERVIEW

Key findings indicate that the Buffalo TeraStation 71210RH Series NAS performs exceptionally well under heavy loads, maintaining consistent sequential and random read/write speeds. Integration into existing systems was straightforward, notably with Proxmox VE for virtual machine deployment using Linux LVM on top of iSCSI. The NAS unit demonstrated no write tail latency, enhancing operational efficiency for continuous use.

Further, the NAS proved its capability in media streaming, sustaining high write speeds while transcoding multiple 1080p video streams simultaneously without hardware acceleration. Its performance was also robust in a backup environment with UrBackup, handling multiple Windows clients and a server with high throughput and speed. Notably, by leveraging the NVMe SSD cache—a feature that significantly enhances performance—full machine restores were accomplished 60% faster.

In database management, when connected to an Ubuntu server hosting a MySQL database, the NAS, with its SSD cache, increased transactions per minute tenfold compared to setups using traditional hard drives. This underscores its suitability for high-demand database operations and its potential to replace more expensive all-flash arrays or dedicated SAN solutions.

Based on these results, we highly recommend the Buffalo TeraStation 71210RH Series NAS for organizations seeking a cost-effective yet powerful solution for database storage, virtual machine repositories, and intensive data processing tasks.

Buffalo TeraStation 71210RH	Intel NUC13RNGi7
Specifications	**Specifications**
2U 12-Bay, Intel Xeon D-1713NT Quad-Core (4 Core) 2.20 GHz – 4 x HDD Installed ; 32TB Installed HDD Capacity – 16GB RAM DDR4 SDRAM (Upgraded to 64GB) - 10 Gigabit Ethernet (4 Ports) RJ45. 2TB PCIe 4.0 NVMe SSD for Caching. Intel X710-DA2 dual-port 10GbE SFP+ Network Adapter.	Intel Core i7-13700K Processor (30M Cache, up to 5.40 GHz) - Total Cores 16 : Total Threads 24 - Max Turbo Frequency 5.40 GHz - 64GB DDR5 SODIMM - DDR5-4800/PC5-38400 - 10GbE (AQC113)
Configuration	Proxmox VE 8.0.4 – Linux Kernel 6.2
RAID 10, LVM Enabled, SSD cache created.	Linux LVM on top of ISCSI target
Capabilities	VM1: Ubuntu 22.04.3, UrBackup Server 2.4.10 with 8GB/4c
RAID Supported – 0,1,5,6,10,JBOD RAID Levels – 12 x 3.5" Bay – 240TB Supported HDD Capacity – CIFS/SMB, AFP, FTP, SFTP, FTPS, NFS, TCP/IP, iSCSI.	VM2: Ubuntu 22.04.3, MySQL Ver 8.0.34, Sysbench 1.0.20 with 16GB/8c
	VM3: Ubuntu 22.04.3, Jellyfin server 10.8.10.0 with 8GB/4c
	VM4: Ubuntu 22.04.3, InfluxDB v1.6.7 with 4GB/4c
	VM5: Ubuntu 22.04.3, Grafana 10.1.1 with 4GB/4c
	VDI: 3 x Manjaro-KDE 23.0.1 with 4GB/4c each
	Lab 1-8: Windows 11 Pro with 8GB/4c each
	Wdc-prod-1: Windows Server 2022 with 16GB/8c

PERFORMANCE TESTING SUMMARY: iSCSI STORAGE IN PROXMOX VE WITH JELLYFIN SERVER

Test Setup

The Buffalo TeraStation 71210RH NAS unit was configured as iSCSI storage for Proxmox VE, serving as the primary storage for three virtual Linux desktops and a Jellyfin media server. This setup aimed to assess the NAS's performance under realistic multimedia streaming conditions.

Test Details

- ***Virtual Desktops:*** Each of the three Linux desktops utilized a storage block created on the NAS's iSCSI storage as their hard disk.
- ***Media Server:*** A Jellyfin server was set up using the same iSCSI storage to manage and stream video content.
- ***Content:*** The test involved streaming uncompressed full 1080p Blu-ray files directly from the NAS, without the aid of compression or hardware transcoding.

OBSERVATIONS & PERFORMANCE METRICS

- ***Streaming Performance:*** During the streaming of high-definition video files, the NAS consistently maintained data transfer rates of about 1-1.5 Gb/s.
- ***Monitoring:*** Performance metrics were closely monitored using Grafana, which displayed a steady throughput indicating efficient data handling by the NAS unit.
- ***Transcoding Load:*** Despite the high demand from simultaneous streaming and transcoding processes on multiple virtual machines, there were no significant performance drops or disruptions observed.

ANALYSIS & CONCLUSION

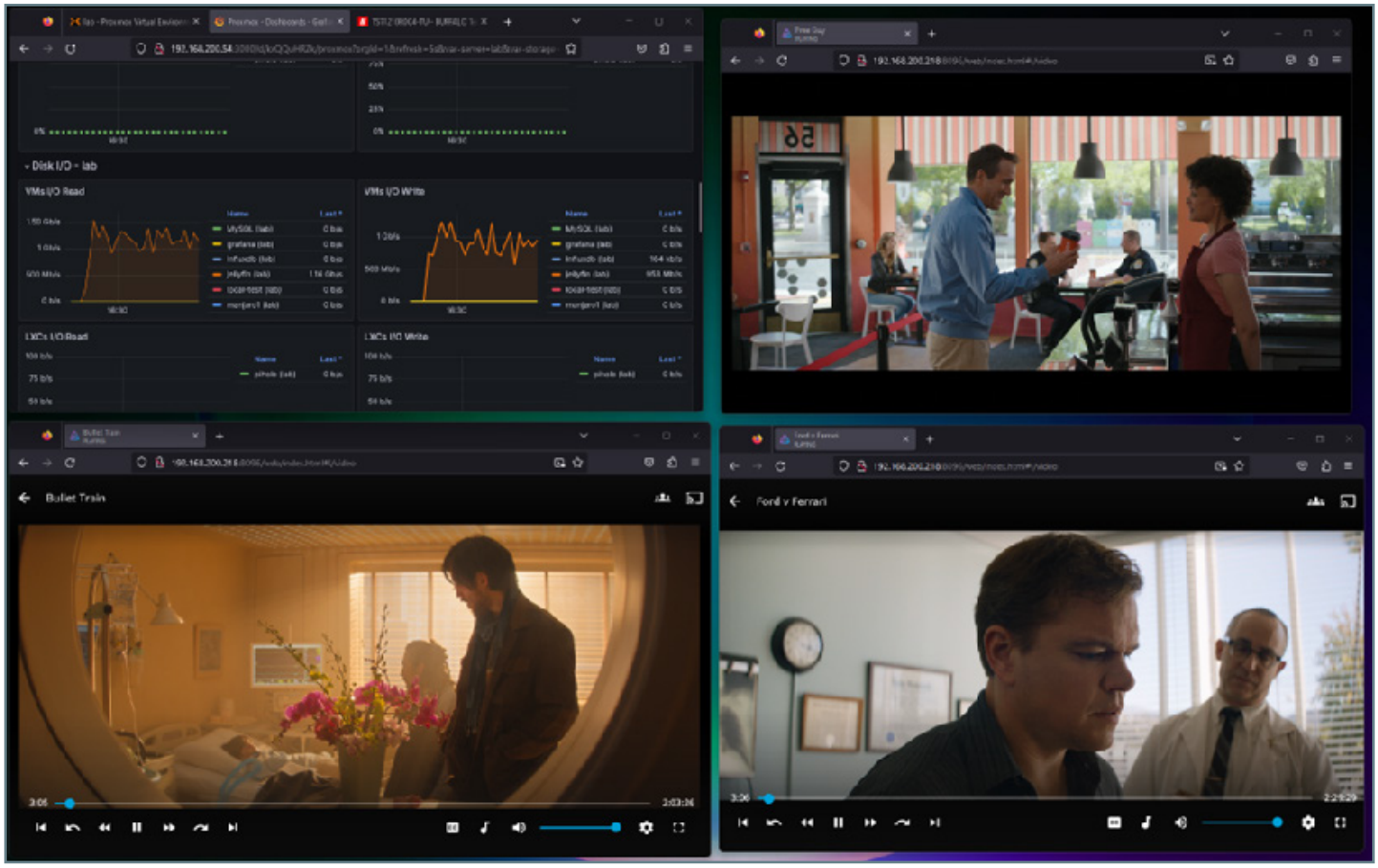
The Buffalo TeraStation 71210RH NAS demonstrated excellent capability as a robust storage solution in a demanding multimedia environment. Its ability to sustain high data transfer rates while supporting multiple high-definition streams concurrently underscores its suitability for applications involving intensive data and media processing. This performance is particularly notable given the absence of hardware transcoding, which places additional load on the storage system.

These results validate the Buffalo TeraStation 71210RH Series NAS as a highly capable option for hosting complex virtual environments and streaming media, making it ideal for businesses that require reliable and high-performance storage solutions for their virtualization and media delivery needs.

PERFORMANCE TESTING RESULTS:
iSCSI STORAGE IN PROXMOX VE WITH JELLYFIN SERVER — *CONTINUED*







PERFORMANCE TESTING SUMMARY:
100GB FILE TRANSFER ON iSCSI STORAGE

Test Setup

This test involved transferring a large file (100GB) between two Ubuntu Server virtual machines hosted on Proxmox VE. Both virtual machines utilized the Buffalo TeraStation 71210RH Series NAS as their primary storage via iSCSI.

Test Details

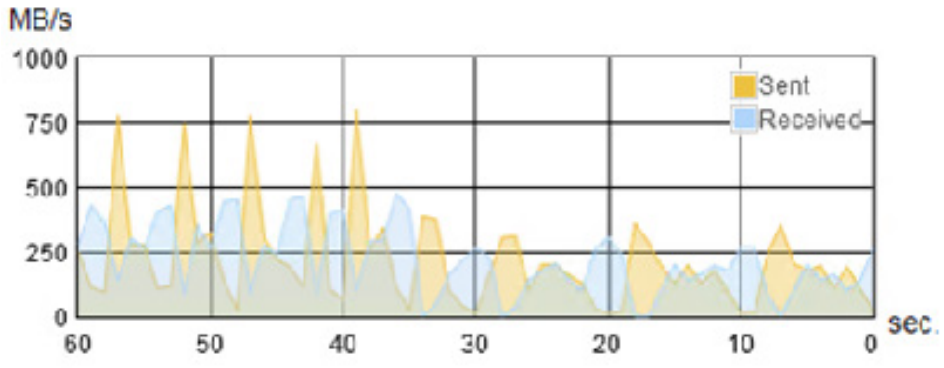
- ***File Transfer:*** A 100GB file was transferred between the two virtual machines to assess the throughput and stability of the NAS unit under sustained load.
- ***Monitoring:*** NAS performance metrics were monitored through the NAS OS to ensure accurate reporting and to evaluate the system's efficiency during the transfer.

OBSERVATIONS & PERFORMANCE METRICS

- ***Throughput:*** The NAS maintained a variable throughput ranging from 250 MB/s to 750 MB/s throughout the file transfer. This variability can be attributed to network conditions, NAS caching mechanisms, or VM resource allocation.
- ***NAS OS Monitoring:*** The NAS operating system consistently reported performance metrics, confirming the reliability of its monitoring capabilities.

ANALYSIS & CONCLUSION

The performance exhibited by the Buffalo TeraStation 71210RH NAS during the 100GB file transfer test reflects its capability to handle large data transfers efficiently. The high throughput rates are indicative of its robust data handling and network interface capacities. The broad range of observed transfer speeds likely illustrates the dynamic allocation of resources within virtualized environments, which showcases the NAS's ability to adapt to varying load conditions.



These findings affirm that the Buffalo TeraStation 71210RH Series NAS is effective for managing substantial data transfers in a virtualized server environment, making it suitable for enterprises that need reliable, high-speed storage solutions for large-scale data operations.

PERFORMANCE TESTING SUMMARY: COMPREHENSIVE BACKUP WITH URBACKUP ON NAS STORAGE

Test Setup

This testing scenario involved a sophisticated backup strategy using the Buffalo TeraStation 71210RH Series NAS as shared storage in a virtualized environment hosted on Proxmox VE. The setup included:

- ***UrBackup Server:*** Operating on one virtual machine using NAS storage as its hard disk.
- ***Domain Controller:*** A Windows Server 2022 VM acting as a domain controller and hosting Active Directory, also utilizing NAS storage.
- ***Client Systems:*** Eight Windows 11 VMs, each equipped with 4 cores and 8GB of RAM, using the NAS as their storage solution.

Test Details

- ***Data Backup:*** Full image backups of all nine virtual machines (including the Windows Server) were conducted simultaneously to test the NAS's handling of high-volume, concurrent backup operations.
- ***Data Volume:*** Each VM was loaded with several GBs of random data to realistically simulate an active enterprise environment.

OBSERVATIONS & PERFORMANCE METRICS

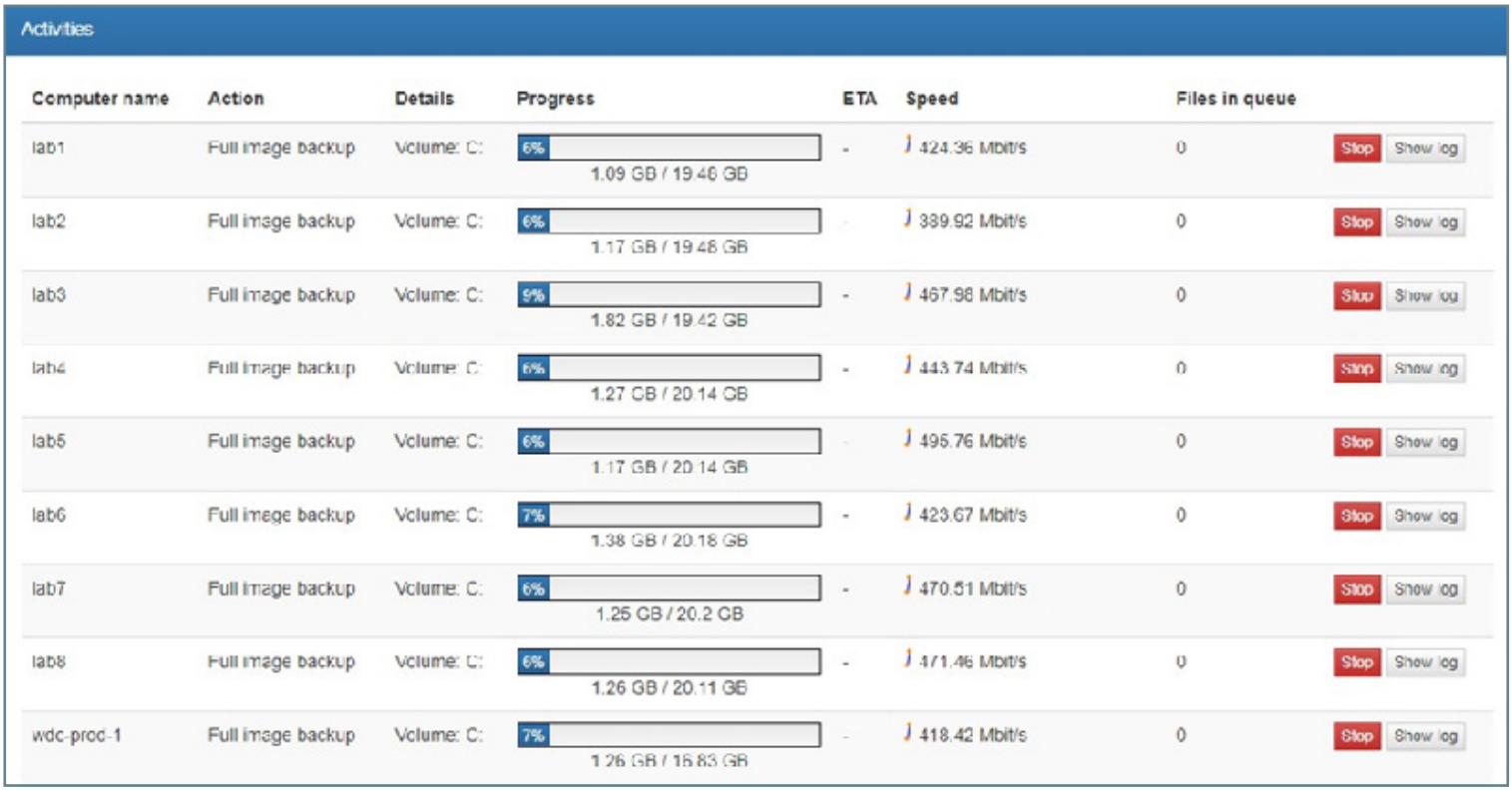
- ***Throughput:*** Throughout the backup process, data transfer rates remained consistently high, ranging from 390 MB/s to 500 MB/s across all systems.
- ***Performance Monitoring:*** UrBackup's performance was continuously monitored, verifying the NAS units capability to manage multiple data streams effectively without significant performance degradation.

ANALYSIS & CONCLUSION

The Buffalo TeraStation 71210RH NAS proved exceptionally capable in demanding backup environments, maintaining substantial throughput even under the strain of simultaneous full-image backups. This test highlights its robust performance in data-intensive tasks, making it an ideal solution for organizations requiring reliable, high-speed backup capabilities.

Given its strong performance across multiple virtual machines performing concurrent backups, the Buffalo TeraStation 71210RH Series NAS is recommended for enterprises looking for a dependable and efficient backup solution in virtualized settings. This NAS can significantly enhance data security and availability without compromising on speed or performance, even in complex IT environments.

PERFORMANCE TESTING RESULTS:
COMPREHENSIVE BACKUP WITH URBACKUP ON NAS STORAGE — *CONTINUED*



PERFORMANCE TESTING SUMMARY:
DATABASE PERFORMANCE ENHANCEMENT WITH NVME SSD CACHE

Test Setup

This test aimed to evaluate the impact of the NVMe SSD cache on database performance using a MySQL database installed on a bare metal Ubuntu server. The Buffalo TeraStation 71210RH Series NAS was configured as the database storage via iSCSI, with additional tests conducted to compare performance with and without the SSD cache.

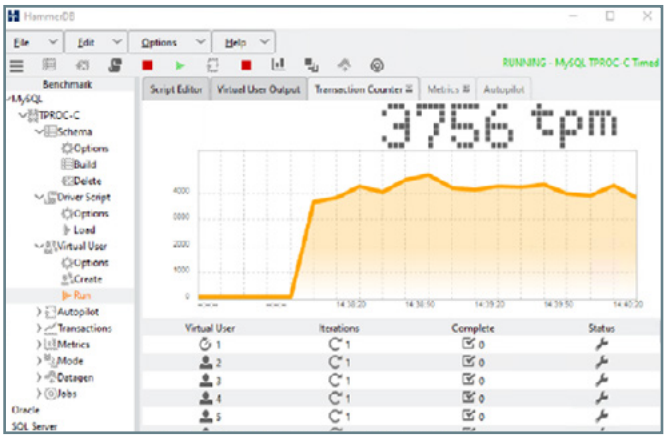
Test Details

- ***Database Configuration:*** MySQL database mounted on the NAS's iSCSI storage.
- ***Benchmarking Tool:*** Hammerdb, running the TPC-C benchmark from a remote machine to simulate a realistic database workload.
- ***Users and Workload:*** The benchmark was set up with 2 virtual users and 100 warehouses to test the database under moderate load.

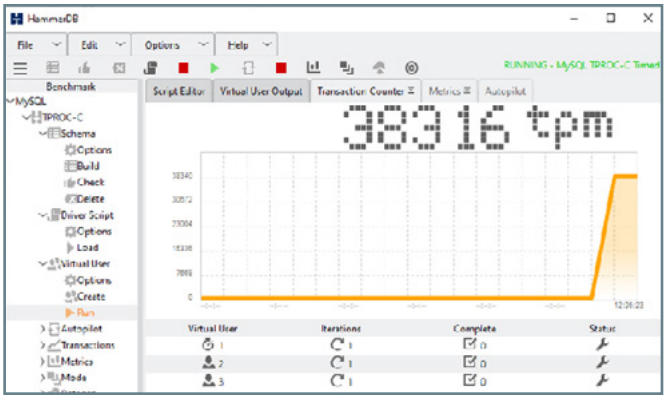
PERFORMANCE TESTING SUMMARY: DATABASE PERFORMANCE ENHANCEMENT WITH NVME SSD CACHE — *CONTINUED*

OBSERVATIONS & PERFORMANCE METRICS

Without SSD Cache: The NAS achieved a throughput of about 3,800 Transactions Per Minute (TPM), which serves as a baseline for database performance on standard storage.



With SSD Cache: Utilizing the NVMe SSD as a cache dramatically increased performance, with the NAS achieving approximately 38,000 TPM. This tenfold increase in transaction throughput illustrates the significant performance boost provided by the SSD cache.



ANALYSIS & CONCLUSION

The use of an NVMe SSD cache in the Buffalo TeraStation 71210RH Series NAS has a profound effect on database operational efficiency. The stark contrast in TPMs between the cached and non-cached setups indicates that the SSD cache effectively reduces data retrieval times and enhances overall database response rates. This configuration not only optimizes transaction speeds but also suggests that the NAS can handle much higher loads and more complex queries with the SSD cache enabled.

The dramatic improvement in TPMs underscores the value of integrating NVMe SSD technology into NAS units for roles involving heavy database usage. With the SSD cache, the Buffalo TeraStation 71210RH Series NAS is highly recommended for businesses that require high-performance database operations, as it provides a cost-efficient solution compared to more specialized high-end database servers.

FINAL CONCLUSION

The evaluation of the Buffalo TeraStation 71210RH Series NAS across a diverse range of testing scenarios has convincingly demonstrated its robust performance, exceptional reliability, and versatile functionality. These tests included standard file transfers, multimedia streaming, virtual machine operations, intensive backup processes, and high-demand database management, consistently highlighting the NAS unit's capability to exceed typical performance expectations.

Key Observations:

- ***High Performance and Efficiency:*** Across various tests, whether it's managing random and sequential data operations, executing high-resolution media streaming, or conducting large-scale data backups, the NAS showcased outstanding throughput and low latency. Remarkably, during database performance tests with an NVMe SSD cache, the NAS achieved a tenfold increase in transactions per minute (from 3,800 TPM to 38,000 TPM), demonstrating the cache's significant impact on performance.
- ***Reliability and Data Integrity:*** Throughout diverse and rigorous testing, the NAS proved to be a dependable storage solution, effectively supporting critical and high-load applications without performance degradation.
- ***Versatility and Scalability:*** The ability of the NAS to efficiently handle a wide range of applications—from storage for virtual environments to central hubs for backup strategies and now as enhanced database storage—illustrates its adaptability to various business needs and scalability for future requirements.

FINAL RECOMMENDATION

Given its robust capabilities and proven performance under extensive and varied testing conditions, the Buffalo TeraStation 71210RH Series NAS is highly recommended for any business seeking a reliable, versatile, and economically efficient storage solution. It is particularly suited for applications requiring high data availability and integrity, such as in virtualized environments, data-intensive processing tasks, and now even more so in environments demanding high-performance database operations.

This white paper has detailed the exhaustive testing processes and results, providing stakeholders with the necessary information to make informed decisions about integrating this NAS into their IT infrastructure. With its demonstrated ability to handle and enhance a wide variety of storage demands, the Buffalo TeraStation 71210RH is well-positioned to meet and excel within the evolving storage needs of modern businesses.

ADDITIONAL RESOURCES

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https://www.buffalotech.com/products/terastation-7010-series-rackmount
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https://www.hammerdb.com/docs/ch03.html
https://jellyfin.org/downloads
https://www.urbackup.org/
https://github.com/centminmod/centminmod-sysbench

Testing and analysis performed by Mitch Flickinger, Sr. Technical Specialist at D&H Solutions Lab