## **R&S®SpycerNode2**

## The evolution of storage



Product Brochure Version 01.00

### ROHDE&SCHWARZ

Make ideas real



## **ROHDE & SCHWARZ STORAGE SOLUTIONS**

Rohde & Schwarz has been innovating in the media storage market for nearly two decades, creating and deploying the most advanced storage systems for media workflows.

### Changes in the media and entertainment market

We have seen major changes in the quality and quantity of media assets. New resolutions and quality have led to new standards such as 4K, UHD, HDR and IFR. At the same time, there has been a real format proliferation in response to the demand for internet content. Finally (and perhaps even more important): The quantity of generated content has multiplied. All of these factors have resulted in increasing requirements for video data management tools and storage.

We have experienced a general consolidation between dedicated video and "standard" IT technologies. Many workflows based on dedicated video hardware, using specific interfaces and protocols, are now migrating to IT hardware. Moreover, workflows are migrating from purpose-built hardware platforms to software solutions based on discrete hardware or virtual machines.

### **Changing financial requirements**

The financial prerequisites in the fast-paced media markets are changing too, making forecasting and financial planning difficult. To partly alleviate this uncertainty, system flexibility is becoming a critical factor. The market is moving from planned investment models to on-demand investments, requiring vendors to develop agile systems that are highly scalable and offer pay-as-you-grow models, as a way of maximizing the return on investment.

Rohde & Schwarz is leading this changing market and is already supporting the new standards and trends of tomorrow's media and entertainment technologies with innovative and state-of-the-art software-defined and cloud based turnkey solutions, such as the world's first totally virtualized playout system.

## **R&S®SpycerNode2**

R&S<sup>®</sup>SpycerNode2 is a hybrid HDD and SSD storage appliance, purpose-built for real-time media workflows. It is unique in that it meets the challenges faced by organizations today and is prepared for the key storage challenges of tomorrow.

R&S<sup>®</sup>SpycerNode2 was designed to provide users with an excellent building block for their data management requirements. It scales as the demands on production increase – starting small and growing to a size without limits by adding additional workflows and capacity.

#### Advanced accessibility

The architecture to connect single storage units to bigger storage networks or clusters, and to connect the clients, is standard Ethernet up to 400 Gbit Ethernet – independent of the utilized delivery protocol. This leads to significant cost savings for administration as there are no niche specialists required to maintain the entire infrastructure.

Each client can mount the file system via the best protocol for the specific application. Clients requiring real-time top performance, such as a 4K DPX color correction suite, can be connected with the high-performance block protocol through a software agent available for Linux or Windows. Clients requiring lower performance or not having an OS with a native file system driver available can use SMB or NFS standard clients.

In addition, the network connectivity can be chosen depending on the application, e.g. 100 Gbit Ethernet for clients requiring high performance, 10 Gbit Ethernet or 1 Gbit Ethernet for clients requiring less performance.

Different clients can access the same files in the same file system, with fully respected file ACL permissions and file ownerships. Coupling the R&S<sup>®</sup>SpycerNode2 storage to your active directory server for authentication is easy.



# **KEY FACTS**

### Protocolls

Windows and Linux Spectrum Scale block access clients, NFS v3, NFS v4, SMB 2.1, SMB 3, FTP

### Performance

Delivers hundreds of Gbit/s performance and 100000s of IOPS using a building block approach; single building block delivers up to 10 Gbit/s. More capabilities are:

- RAID bundle building block up to 12 Gbit/s per appliance
- World-leading performance of hundreds of Gbit/s per namespace
- ► Single client I/O up to over 6 Gbit/s
- ► Erasure code QoS for real-time video application

### Streams

Scales to hundreds of concurrent media streams using a building block approach; single building block delivers up to five 4K uncompressed streams

### **Scalability**

From 10 Tbyte to Ybyte using a building block approach

### **Data protection**

Erasure code, end-to-end checksum, several replication/ mirroring mechanisms, snapshots

### **Connectivity options**

100 Gbit Ethernet, compatible with 40 Gbit Ethernet, 25 Gbit Ethernet, 10 Gbit Ethernet (200 Gbit Ethernet or 400 Gbit Ethernet NICs upon request)

### **Drives supported**

SSD and nearline SAS

### Simplicity

- 2 HU controller bundle and minimum one 5 HU JBOD chassis
- Start small and scale non-disruptively by adding R&S<sup>®</sup>SpycerNode2 systems as building blocks
- Network based and standard protocol appliance, simple deployment in your workflow

### Flexibility

- Thousands of clients, block access clients, NFS and SMB
- > Dynamic, online capacity scaling over 100 Pbyte
- Diagonal scalability Independently scale performance and capacity
- ► High-density enclosure (up to 84 drives/5U)

### **Flexible architecture**

- ► SSD/NLSAS on the same system
- ► ILM for storage tiering
- ► High-performance native and NAS clients

### Data access and management

- ► Fine-grained file locking for real-time concurrent access
- Policy based data migration and storage tiering
- Optional HSM interfaces and backup
- Online file system rebalancing
- Active directory and LDAP integration
- Posix, NFS and Windows style ACL support and translation

### Rich file system feature set

R&S<sup>®</sup>SpycerNode2 contains an IBM Spectrum Scale file system that delivers a rich feature set:

- Snapshots to recover deleted or corrupted files
- Quotas
- Sync-async replication
- End to end data encryption
- Integrated HSM and file placement policies
- Local caches and AFM
- Geographically distributed file system clusters
- ► S3, file system API
- Some of these features may require engineering time to be qualified

### No performance degradation over time

- ► No defragmentation required
- ► No performance degradation over time
- ▶ 99% file system space available (~78% of RAW space)

## **BENEFITS**

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## HARDWARE ARCHITECTURE

R&S<sup>®</sup>SpycerNode2 features a no-single-point-offailure design with each storage unit consisting of a dual 1 HU controller bundle, up to four JBOD storage chassis units, and a number of HDD and/or SSD drive bundles.

### Future-proof storage system

Each hardware unit features redundant, hot-swappable power supplies, multiple fans and an appropriate level of drive security measures, e.g. mirroring of system drives and better-than-RAID mechanisms for media drives.

The controller bundle consists of two 1 HU server units with each controller having the following connectivity:

- 2 × 100 Gbit Ethernet with QSFP28 ports (down scalable to 40 Gbit Ethernet, 25 Gbit Ethernet, 10 Gbit Ethernet)
- ▶ 2 × 10 Gbit Ethernet ports with RJ-45
- ► 2 × 1 Gbit Ethernet management Ethernet ports with RJ-45
- 2 × HD mini SAS connectors (8 ports) for expansion enclosures
- ▶ USB, mini HDMI for KVM

Fans, PSUs and drives can be hot-swapped keeping the system in production. Firmware upgrades are non-disruptive and can be performed online.

### Data redundancy and reliability

The controllers hold the Spectrum Scale file system, the software erasure coding mechanism, the device manager web server, the web based IBM management software, the packet delivery services (for SMB/CIFS, NFS, FTP, etc.) and many other background routines to take care of the data and its management.

The controllers are designed in a failover fashion, meaning that each controller directly connects to half of the drives, while the secondary drive ports connect to the other controller for failover operation.<sup>1)</sup>

<sup>1)</sup> Rohde&Schwarz uses dual-ported drives.

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## R&S<sup>®</sup>SpycerNode2 5U84 JBOD

## The R&S<sup>®</sup>SpycerNode2 5u84 JBOD is the high-end hybrid enclosure for the entire R&S<sup>®</sup>SpycerNode2 storage range.

The R&S<sup>®</sup>SpycerNode2 5u84 JBOD is based on a 5 HU enclosure, with 84 hot-swappable drives (3.5"), populated with NLSAS (8 Tbyte, 16 Tbyte or 20 Tbyte) drives or SSD drives (from 960 Gbyte to 7.68 Tbyte).

In the back of the enclosure, there are redundant, hotswappable fans and redundant power supplies.

The connectivity to the controller units is realized via the appropriate mSAS cables and connectors (included within the JBOD ordering option).

### Flexible JBOD extension for Spectrum Scale

The current number of expansions supported for a controller bundle is 4. However, it is possible to add additional controller based main units (with JBOD expansions) into the same file system (namespace), ensuring additional scalability. Thus, a single controller based storage unit can be scaled from 224 Tbyte up to 6.72 Pbyte with HDDs and from 28 Tbyte up to 2.58 Pbyte with SSDs until it would have to be expanded by another controller based unit. Alternatively, the RAID group can be expanded, providing more speed and more capacity to the same storage cluster.

Different drive capacities and types (SSD and SAS) can be mixed in the same 5u84 JBOD enclosure and between different R&S<sup>®</sup>SpycerNode2 configurations, leading to tiered flexible configurations providing high-end performance and greater capacity in a single system. The R&S<sup>®</sup>SpycerNode2 5u84 JBOD storage enclosure provides an extremely high data density with up to 1.7 Pbyte raw capacity for a single 5 HU block (NL-SAS) and top performance, with up to ~12 Gbit/s per controller and JBOD bundle. This brings massive cost savings in terms of data center floor space, cooling power and electrical power, again improving the total cost of ownership.

### **Reliability without performance loss**

Instead of a classic RAID approach, the controllers hold a software-defined erasure coding mechanism with a reliable data/parity ratio of 4:1. This is joined by a declustered array leading to up to four times faster rebuild times with less impact on data rate and much faster passage of potential critical phases (states with degraded redundancy).

Another unique feature of the cleverly arranged data/parity/spare blocks is the fact that there is no performance degradation over time, which inevitably happens with classic RAID approaches. Thus, the performance of a R&S<sup>®</sup>SpycerNode2 system is always the initial one, even after an arbitrary amount of disk write/erase cycles.

Furthermore, the given net capacity is available for operations without the need to reserve the final 15% to 20% capacity for file system maintenance.

The hardware is designed to use automatic multi-pathing for control and data connections.



R&S<sup>®</sup>SpycerNode2 with the R&S<sup>®</sup>SpycerNode2 5u84 JBOD endclosure

# SCALABILITY

The entire storage system is extremely scalable – from entry level to many tens of gigabytes/second speeds and from a single drive bundle to sizes beyond zettabytes.

### The R&S<sup>®</sup>SpycerNode2 system was designed to scale freely in every direction

New clients can be added without the need to add additional licenses or modules. Only a network port is required for connecting the new client.

More performance and capacity can be achieved by adding more RAID controller bundles plus JBODs (with the same drive population as the existing one(s)). This allows inflation of existing clusters via the Ethernet backbone. The RAID cluster(s) are subsequently expanded with an automated background load-balancing mechanism. New capacity can be added by adding more JBODs and drive bundles to the existing storage system or by simply adding a new controller bundle plus JBODs into the same namespace. The new node can be of a different capacity or different drive technology than the systems already in place.

There is no limitation on the number of storage units in a single namespace that can scale virtually limitlessly to hundreds of Gbit/s and dozens of petabytes.

All resizing/expansions (even tier and cluster modifications) can be performed without stopping the file system.

### R&S®SpycerNode2 architecture and scalability



# **TOTAL COST OF OWNERSHIP (TCO)**

R&S<sup>®</sup>SpycerNode2 provides an exceptionally good TCO due to its design flexibility – each system can be used across many applications and different industry-standard protocols. A single system can be the centralized storage system in a facility, replacing the traditional and expensive "storage silos" approach.

**Optimisation of TC0 through intelligent data management** A single system can be configured to provide high performance and high capacity at the same time by mixing SSD and NL-SAS drives in the same (file system) namespace. R&S°SpycerNode2 includes an information lifecycle management (ILM) engine to manage storage tiering and automating data management across the different kinds of drives. This improves the TCO by reducing the necessary investment to fewer systems for any given workflows.

The high scalability of the system, with both the scale-up and scale-out models, provides a very positive TCO with a pay-as-you grow scheme. Therefore, expanding storage and thus adding performance and/or capacity is only required when production needs demand it. Moreover, R&S<sup>®</sup>SpycerNode2, with its user-friendly interfaces running on non-specialized network hardware, leads to cost savings on infrastructure and maintenance costs.

If you are looking for a high-performance storage or archive system, R&S<sup>®</sup>SpycerNode2 is the solution that perfectly combines flexibility with performance and is coupled with the best return on investment for your present and future needs.



### $R\&S^{\circledast}SpycerNode2-TCO\ optimization$

## CONNECTIVITY, BACKBONE AND PROTOCOLS

R&S<sup>®</sup>SpycerNode2 offers unified block and file storage accessible via standard Ethernet. The internal block-level protocol NSD (with drivers available for Windows and Linux systems) as well as packet-delivery protocols like SMB/CIFS or NFS all use the same Ethernet infrastructure. However, even legacy protocols such as FTP and its derivatives are available. Packet protocol conversion takes place either directly inside the controller head units and/or with external protocol conversion servers ("NAS heads" in the IBM terminology). The SMB provision can be configured as a packet delivery cluster ("CES" = cluster export services), thus offering redundancy as well on the access level.

The R&S<sup>®</sup>SpycerNode storage family has a built-in S3 protocol client and as for R&S<sup>®</sup>SpycerNode2, the storage can even serve as an on-premises S3 cloud (option currently under development). Using block access, best-in-class performance per single client is available, up to 6 Gbit/s per client if connected to 100 Gbit Ethernet.



### NAS clients deliver high flexibility

#### Features

- ▶ SMB and NFS access
- Higher performance than traditional NAS
- No license requirement
- ► No agent software
- Automatic high availability and load balancing
- ► File and block unified access on a single namespace





### Features

- Designed for highly concurrent access
- Client side intelligent cache
- Locking engines designed for massive parallelism
- Balance access across all resources
- Ideal for highly concurrent file/directory access
- ► Transparent failover in an active-active fashion
- Massively scalable addition of clients and storage devices

## CAPACITY AND PERFORMANCE CHARACTERISTICS

Thanks to these unique features and best-in-class hardware, each R&S<sup>®</sup>SpycerNode2 unit can provide up to 12 Gbit/s of real-time performance in real-world video environments. This performance can be linearly scaled up by adding more storage appliances in the same namespace (file system).

### **Build options**

Build	R&S®SpycerNode2	
Server build	Controller set (2x 1u)	
	5u 84 JBOD	
Default network ports	Two controllers each with 1 × 1 Gbit Ethernet RJ-45, 2 × 10 Gbit Ethernet RJ-45, 2 × 100 Gbit Ethernet QSFP	
Optional network ports	N/A	
Minimum build configuration	1 × controller set, 1 × JBOD and 1 × disk bundle	
Main Unit/JBOD size	84 drive	
Total number of disk chassis	4	
Disk bundle options	$3 \times 28$ disks per chassis HDD or SSD <sup>1)</sup>	
Disk bundles HDD Safe useable changes with additional bundles and chassis	224 Tbyte 166 Tbyte 560 Tbyte	448 Tbyte 332 Tbyte
Disk bundles SSD Safe useable changes with additional bundles and chassis	26 Tbyte 22 Tbyte 107 Tbyte 90 Tbyte	53 Tbyte 45 Tbyte 215 Tbyte 179 Tbyte

<sup>1)</sup> When mixing drive types SSD bundles must be installed before HDD.

### Where it needs to be



Speed is calculated as read performance, this will change with mixed read/write.

# **FILE SYSTEM FEATURES**

## R&S<sup>®</sup>SpycerNode2 features IBM Spectrum Scale (the former GPFS/general parallel file system) as a high-performance computing file system with full POSIX compatibility.

Initially designed for multimedia, it was quickly adopted by huge enterprises (NASA, large banks, global insurance companies) due to its massive scalability and its unmatched data protection features with an extremely high mean time to data loss.

Rohde & Schwarz partners with IBM to bring Spectrum Scale's plethora of enterprise features back into the entertainment and media industry, supported by many years of successfully adapting and delivering file systems to meet the challenges of today's broadcast, post and telecommunications markets.

### Maximum performance, minimum downtime

Licensing headaches that come along with other file systems are a thing of the past when using R&S®SpycerNode2. Since each server license is based on (and comes with) the drive bundles, every user gets the appropriate full-lifetime license in conjunction with the hardware and no further client licenses are required – regardless of the number of clients or the used delivery protocol.

Some of the data protection features include multiple meta data copies, a "disk hospital" to continuously monitor drive performance and watch over suspicious drives (before a drive failure is detected), end-to-end checksums to verify the integrity of data blocks throughout any transfer processes and avoid silent data corruption, and of course, multiple instances (copies) of important files to avoid losses in case the redundancy of the low-level security features mentioned above is insufficient.

The Spectrum Scale file system keeps running even if entire clusters are unavailable or unreliable without interfering with the operation of other sound clusters. The very high mean time to data loss (MTTDL) also counts as a protection mechanism.

### Information lifecycle management

Another very prominent feature is the built-in tiering (information lifecycle management), which allows user-defined rules and policies to regularly check media files for condition fulfillment and then move the media appropriately between those tiers while maintaining the same entry in the directory tree listing. Of course, tiers can be resized without stopping the file system.

User quotas (the "soft" version) and snapshots are more built-in features of Spectrum Scale.

For systems requiring user authentication (e.g. broadcast stations or multi-tenancy post houses), an existing AD controller can be used to grant configurable user/group access to the media files. If no AD controller is present, an internal R&S<sup>®</sup>SpycerNode2 domain controller can be set up during the commissioning phase.

## AVAILABILITY

R&S<sup>®</sup>SpycerNode2 is designed for "no single point of failure" and is redundant from the first node, providing 24/7 operations. The main maintenance tasks, such as expansion and updates, are performed online.

The erasure coding algorithm used to secure the data leverages an internal 8+2 schema over big pools of drives. This allows an average of four times faster rebuilds, compared with a traditional RAID system, providing a very high mean time to data loss. When the data is rebuilt, only the blocks containing real files are rebuilt (unlike traditional storage systems which rebuild empty areas). R&S<sup>®</sup>SpycerNode2 provides an automatic end-to-end checksum to ensure detection of disk "silent data corruption" and network errors that can corrupt data. If any corruption of the stored data occurs, it is fixed transparently and the correct data is retrieved for the user.

## MIRRORING AND ARCHITECTURAL ADVANTAGES

R&S<sup>®</sup>SpycerNode2 offers a built-in synchronous mirroring mechanism allowing construction of failsafe mirrored systems. Even WAN connections are possible, but stable WAN tunnels are required.

Another (optional) built-in mechanism allows creation of an asynchronous offsite backup of an entire storage cluster or a portion thereof (AFM = active file management). This works even over unreliable WAN connections.

For seamless failover, Rohde & Schwarz has developed VSA – a patented mirroring mechanism that handles two mirrored R&S<sup>®</sup>SpycerNode2 storage systems in an active-active fashion. This mechanism completely avoids the notorious data outage in case of a controller failure and allows construction of ingest as well as playout-safe storage systems without having to mirror entire portions of the appropriate chains.

### The virtualization layer covers errors and long latencies on one storage system:

- ► Uninterrupted media transfers
- ► Ensured response time
- ► Simultaneous execution of file system operations
- ► No failover process necessary
- Conditions are forwarded to a central management service for later resynchronization



Rohde & Schwarz virtual storage access technology -

handling of storage failures

# USABILITY

R&S<sup>®</sup>SpycerNode2 supports the most demanding media workflows. It not only provides high flexibility and performance, but also delivers a full set of tools to make storage as well as video asset and project management simple and user-friendly.

R&S<sup>®</sup>SpycerNode2 can be maintained and managed by IT engineers, and no specialized knowledge about video storage environments and embedded technologies is required.

## **DEVICE MANAGER**

R&S<sup>®</sup>SpycerNode2 gets its extraordinary performance, scalability and reliability by integrating best-in-class technologies, such as erasure coding, declustered array schemes and the IBM Spectrum Scale file system.

All these technologies are tightly integrated and tuned by R&S<sup>®</sup>SpycerNode2 and are configured via the device manager software. This is a single point solution for configuring and monitoring file video solutions from Rohde&Schwarz, such as R&S<sup>®</sup>VENICE-S playout servers, R&S<sup>®</sup>Spycer MediaGateway servers, R&S<sup>®</sup>SpycerNode and R&S<sup>®</sup>SpycerNode2 storage systems.

### **Easy control and access**

The device manager is accessible via a web browser and runs directly on the R&S<sup>®</sup>SpycerNode2 controllers, taking away the complexity for the user of configuring common system operations. It offers an "easy setup" mechanism for simple storage architectures and more sophisticated access to network, shares, permissions, file sets, quotas configuration and many more tools to administer your storage system in a convenient manner. The device manager includes a full set of statistics and graphs, providing simple graphical representations of the system, making tuning and troubleshooting a simple task.

SSH secure shell access is also available for scripting and advanced usability. The storage system can be monitored via SMTP and email alerts, compatible with most common IT monitoring tools.





The device manager setup is very intuitive and clearly shows all available connected controllers at a glance.

A simple semaphore color coding allows a quick health status assessment at a glance; full details of health statistics, system settings and more can then be accessed under the maintenance menu.

## R&S®SPYCER SOFTWARE

R&S<sup>®</sup>SpycerNode2 comes with the exclusive R&S<sup>®</sup>Spycer software, allowing the user to review and manage huge storage volumes of video, film and CG data simply and effectively.

The R&S<sup>®</sup>Spycer software offers an excellent basis for content control on rich media storage systems with the ability to manage media files locally and remotely inside the shared storage network. It comes with a versatile feature set:

- ► Browsing of local and network storage systems
- ▶ High-speed hash and copy
- ▶ Reports for copy processes
- Renaming of files/folders and special renaming function for image sequences
- Fast, R&S<sup>®</sup>SpycerNet-wide search for arbitrary clip features (name, date, metadata etc.)
- ▶ Preview support for more than 100 graphic file formats
- ► Monitoring of jobs in the R&S<sup>®</sup>SpycerNet via a job list
- ▶ P2 and XDCAM ingest
- ► Rights management for R&S<sup>®</sup>Spycer groups
- Job scheduler that executes jobs at a specified time or at regular intervals
- Metadata editing and transfer
- Visual QC
- QC of technical metadata
- P2 and XDCAM virtualization
- Avid ISIS/Nexus and Interplay/MediaCentral gateway (optional)
- Display of closed caption information
- Bandwidth limitation for copy jobs to ensure real-time processes
- Verification of all data after a completed copy job
- ► Web service API (SOAP) for third-party interaction
- ► AS-11 read support including descriptive metadata
- Creation of PNG thumbnails (available only via web service API)
- Growing media files copying mechanism
- ► Copy to/move to with multi-selection from search result
- ▶ Free floating and resizable closed caption window

R&S<sup>®</sup>Spycer is a valid alternative for media asset management (MAM) systems in environments where MAM systems are too big and expensive. It complements MAM and PAM systems for intelligent video file handling. R&S<sup>®</sup>Spycer can be programmed via API and integrated into third-party applications and management systems as a middleware software layer.

### Service at Rohde & Schwarz You're in great hands

- ► Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependabilit

### Rohde & Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

### Sustainable product design

- Environmental compatibility and eco-footprint
- ► Energy efficiency and low emissions
- ► Longevity and optimized total cost of ownership

Certified Quality Management

Certified Environmental Management

### Rohde & Schwarz training

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