

Technical Project (Home Lab):

**Backup and Restoration of VMs with
Veeam B&R**

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Summary

This project aims to deploy and validate a **backup and recovery solution for virtual machines** in a **local lab environment**, using Veeam Backup & Replication 12.3.1.1139.

The main objective is to simulate **data loss scenarios** and demonstrate the **capability to recover critical services** in virtualized environments. To achieve this, a lab was built on **nested VMware ESXi**, with several test VMs and a dedicated backup server.

The approach is eminently practical: **full and incremental backups, total and granular restores, retention configurations, instant recovery tests** have been performed, and advanced features such as **backup encryption and compression** have been analyzed.

Beyond the technical aspects, the project is oriented towards **business continuity**, showing how the application of these practices increases **resilience**, reduces **recovery time**, and protects **critical information**.

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1. Technical Objectives and Scope

1.1 General Objective

Deploy a functional lab with **Veeam Backup & Replication** simulating the use of a corporate data protection solution, covering both the creation of **backups** and the **complete and granular restoration** of services.

1.2 Specific Objectives

- Install and configure Veeam on a dedicated Windows Server.
- Integrate Veeam with the previously deployed **VMware ESXi host**.
- Create and run backup jobs for full virtual machines.
- Apply retention policies and validate full restores.
- Perform granular restores of files and virtual disks.
- Simulate critical VM failures and recover services from backup.
- Test advanced features:
 - Instant VM Recovery
 - Backup Copy Job
 - Backup encryption and compression
 - Automated validation with **SureBackup** (documented, not executed in the lab)
- Document the entire process with screenshots and clear explanations.

1.3 Project Scope

Includes:

- Installation and configuration of **Veeam Backup & Replication (Community Edition)**.
- Integration with the VMware ESXi environment.
- Protection of lab VMs (Windows Server and Ubuntu).

- Full, instant, and granular restores.
- Configuration of storage repositories, retention policies, and encryption.
- Simulation of incidents and documentation of results.

1.4 Professional Context

This project is part of a training plan in **infrastructure** and **business continuity**. Its development provides hands-on experience with tools commonly used in corporate environments and delivers a practical perspective on:

- How a virtualized environment is protected.
- Which technical decisions (repositories, policies, security) define resilience.
- How these practices translate into availability, security, and operational efficiency.

2. Environment Design and Architecture

2.1 General Structure

The lab is built on a **nested environment** in VMware Workstation Pro. On top of it, an **ESXi 8.0 host** is virtualized to host the protected VMs (Windows and Ubuntu). The backup server VM (**Veeam-BKP01**) runs directly on Workstation, with connectivity to ESXi to orchestrate backup and restore operations.

2.2 Lab Topology

Elemento	Rol	Sistema operativo	Recursos asignados
Physical host	Lab base	Windows 11 + Workstation Pro	Intel i7-12700KF, 15,8 GB RAM, Discos: C (232 GB SSD), D (3,64 TB HDD), E (931 GB SSD)
VM – ESXi 8.0	Nested hypervisor	VMware ESXi 8.0	4 vCPU, 8 GB RAM, 40 GB SSD
VM – Win-SRV01	Protected workload	Windows Server 2022	2 vCPU, 4 GB RAM, 60 GB SSD
VM – Ubuntu-SRV01	Protected workload	Ubuntu Server 22.04	2 vCPU, 2 GB RAM, 40 GB SSD
VM – Veeam-BKP01	Backup server	Windows Server 2022 + Veeam	2 vCPU, 6 GB RAM, 100 GB SSD

Note: although the Community Edition requires a minimum of 4 GB RAM, 6 GB were allocated to the backup VM to ensure greater stability during instant restore tests.

2.3 Network and Connectivity

- Network configured as **NAT** in Workstation (with bridge option available if needed).
- All VMs on the same virtual network.
- Direct connection between **Veeam-BKP01** and the ESXi host.
- Static IPs configured for each VM.
- No DNS deployed, IP-based configuration was used.

2.4 Environment Resources

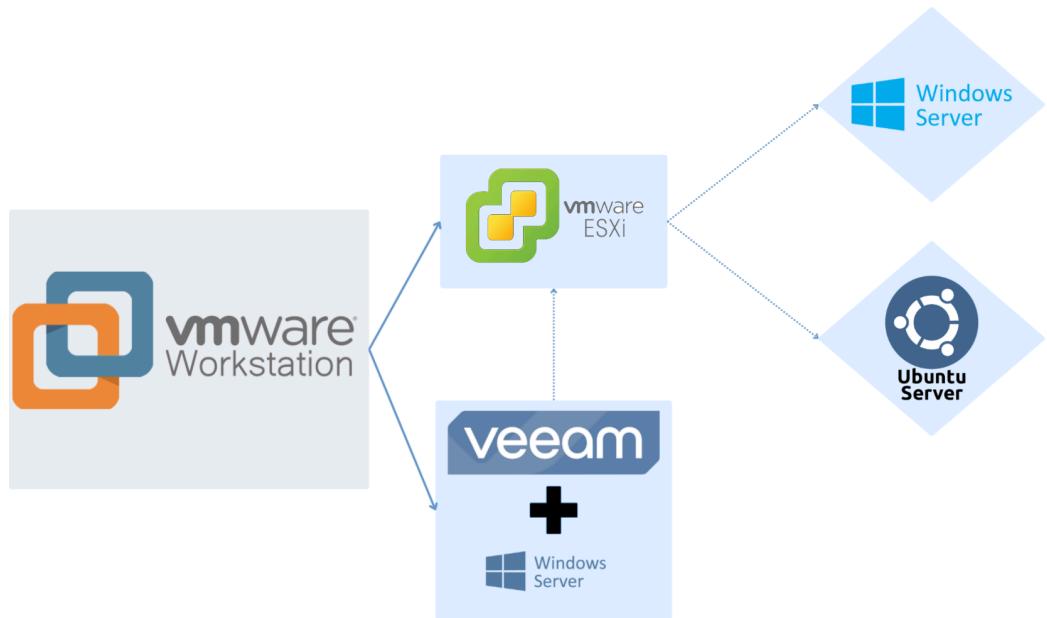
Physical host:

- **CPU:** Intel Core i7-12700KF (12 cores / 20 threads)
- **RAM:** 15.8 GB
- **Storage:**
 - C (232 GB SSD) → Main operating system
 - D (3.64 TB HDD) → Lab folder, VMs, and backup repositories
 - E (931 GB SSD) → Additional space for intensive testing

Notes:

- The entire lab was run on drive D (HDD).
- Performance was sufficient for the project goals.
- Drive E (SSD) was reserved as an optional upgrade for more demanding scenarios (e.g., Instant Recovery).

2.5 Environment Diagram



3. Requirements and Necessary Resources

3.1 Hardware Requirements

The lab was designed to run on a single personal machine, without the need for external infrastructure. To reproduce it, the following is sufficient:

- RAM ≥ 16 GB (32 GB recommended for heavier workloads).
- SSD/HDD storage with at least 200 GB free for VMs and backups.
- Host operating system: Windows 11.
- Base hypervisor: VMware Workstation Pro.

3.2 Software Requirements

The components required to deploy and validate the project were:

- VMware ESXi 8.0 (installed in nested mode on Workstation).
- Windows Server 2022 (for workloads and the Veeam server).
- Ubuntu Server 22.04 LTS (as the Linux workload).
- Veeam Backup & Replication 12.3.1.1139 Community Edition (installed on Windows Server).

Additional tools:

- VMware Tools on Windows VMs.
- SSH client on Ubuntu for access tests and granular restores.

3.3 Dependencies and Considerations

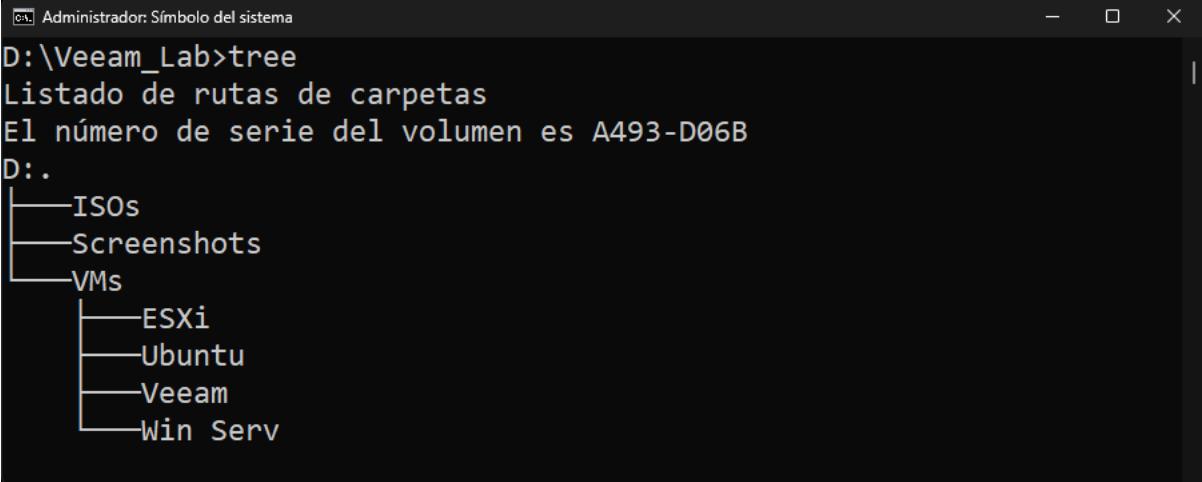
- The protected VMs (Windows and Ubuntu) require **static IP configuration** to be managed by Veeam.
- The Veeam server must have **direct access** to the ESXi host to execute backup and restore operations.
- Some advanced features (SureBackup, Immutability, Veeam ONE) require Enterprise licenses and additional resources, which are not part of this lab.

4. Step-by-Step Environment Setup

4.1 Preliminary Preparation

4.1.1 Folder Structure

To keep the lab organized, the following structure was created on drive **D:**, where both installation resources and project outputs are stored:



```
D:\Veeam_Lab>tree
Listado de rutas de carpetas
El número de serie del volumen es A493-D06B
D:.
└── ISOs
└── Screenshots
└── VMs
    └── ESXi
    └── Ubuntu
    └── Veeam
    └── Win Serv
```

This organization makes file access faster and ensures the project can be replicated in an orderly way in the future.

4.1.2 Required Files

The following ISO files were downloaded and stored in the **ISOs** folder:

- VeeamBackup&Replication_12.3.1.1139_20250315.iso
- SERVER_EVAL_x64FRE_en-us.iso
- ubuntu-22.04.5-live-server-amd64.iso

4.1.3 Previous Checks

Before starting the deployment, the following checks were performed on the physical host and VMware Workstation Pro:

- Free space greater than 200 GB available on drive D:.
- Sufficient RAM to run ESXi, the protected VMs, and the Veeam VM simultaneously.
- Planning of static IP addresses for each virtual machine.

- Basic connectivity verified between ESXi, Windows Server, Ubuntu, and the Veeam VM using ping.
- Windows Firewall temporarily disabled on Windows Server VMs.

Initial VM snapshots and connectivity tests were carried out later, after completing the base installation of each system.

4.2 Creating the Veeam-BKP01 VM in VMware Workstation

4.2.1 Create a New Virtual Machine

- Open **VMware Workstation Pro**.
- Select **Create a New Virtual Machine**.
- Choose **Custom (advanced)** and click **Next**.

4.2.2 Hardware Compatibility

- Select the highest version available compatible with Workstation (17.5 or later).

4.2.3 Select ISO File

- In **Installer disc image file (ISO)**, select:
 - SERVER_EVAL_x64FRE_en-us.iso

4.2.4 Operating System Type

- Guest OS: Microsoft Windows.
- Version: Windows Server 2022 (64-bit).

4.2.5 VM Name and Location

- Name: **Veeam-BKP01**.
- Location: **D:\Veeam_Lab\VMs\Veeam**.

4.2.6 Assigned Resources

- CPU: 2 vCPU.
- RAM: 6 GB.
- Hard disk: 100 GB (single file).
- Disk controller: LSI Logic SAS.
- Virtual disk type: SCSI (recommended).

4.2.7 Network Configuration

- Network type: **NAT**, on the same network as ESXi and the protected VMs.

4.2.8 Windows Server Installation

- Start the VM.
- Complete the Windows Server 2022 installation wizard (Desktop Experience).
- Create an administrator user.
- Assign computer name: **Veeam-BKP01**.
- Configure static IP: **192.168.119.60/24**.
- Disable Microsoft Defender Firewall.

4.2.9 Post-Installation Actions

- Install **VMware Tools**.
- Create an initial snapshot of the base system.
- Verify connectivity between Veeam-BKP01, ESXi, and Win-SRV01 using ping.

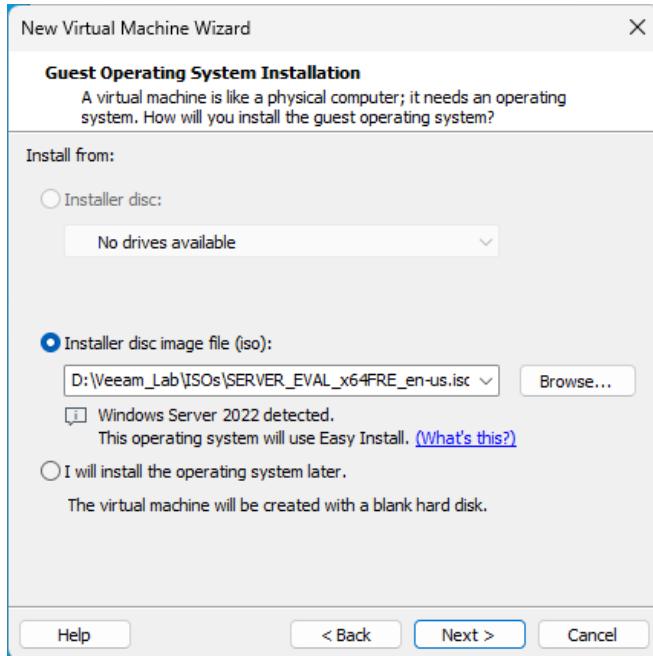
4.2.10 Issues

- The installer requested a license; since it was an Evaluation version, no key was needed. After reboots, the installation completed successfully.

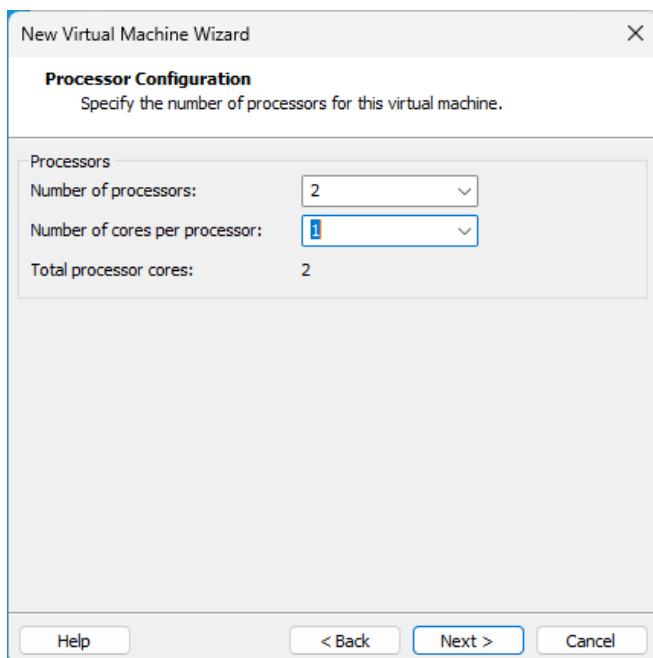
- After applying OS updates, the VM failed to boot correctly. To resolve this, the previously created initial snapshot was used, which allowed a quick recovery without loss of configuration.

4.2.11 Process Screenshots

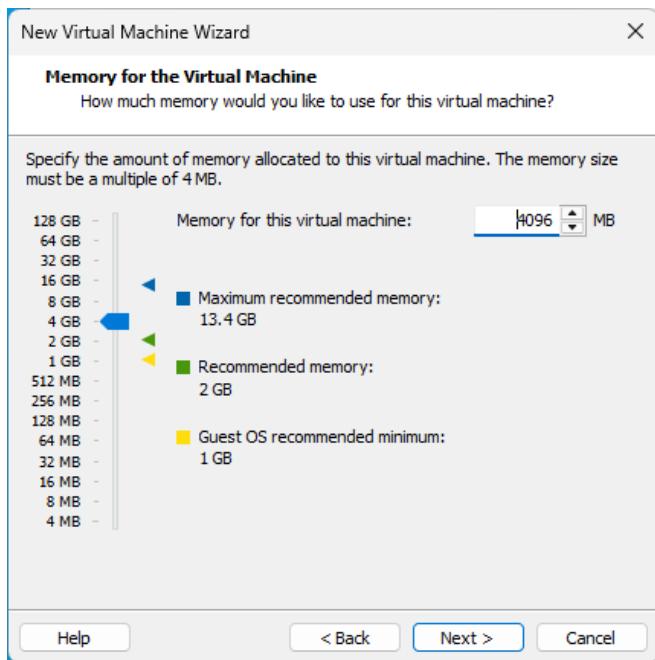
- Figure 1 – Selection of the Windows Server 2022 ISO file.**



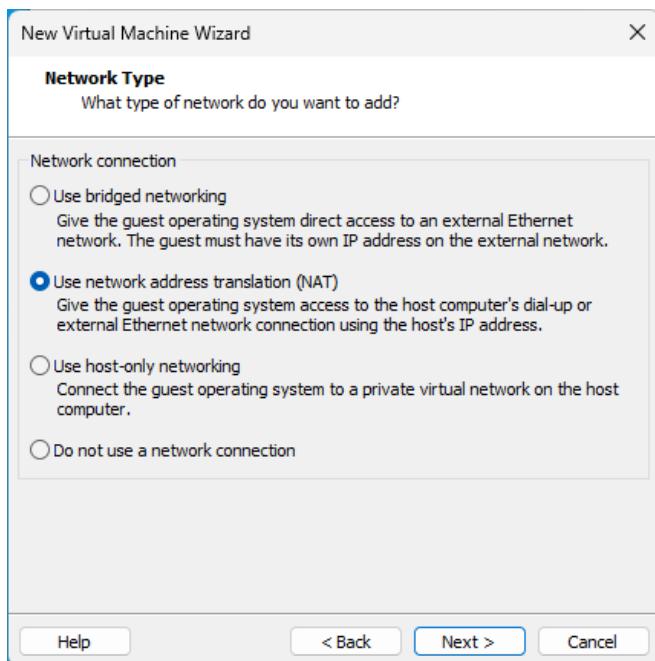
- Figure 2 – VM CPU configuration.**



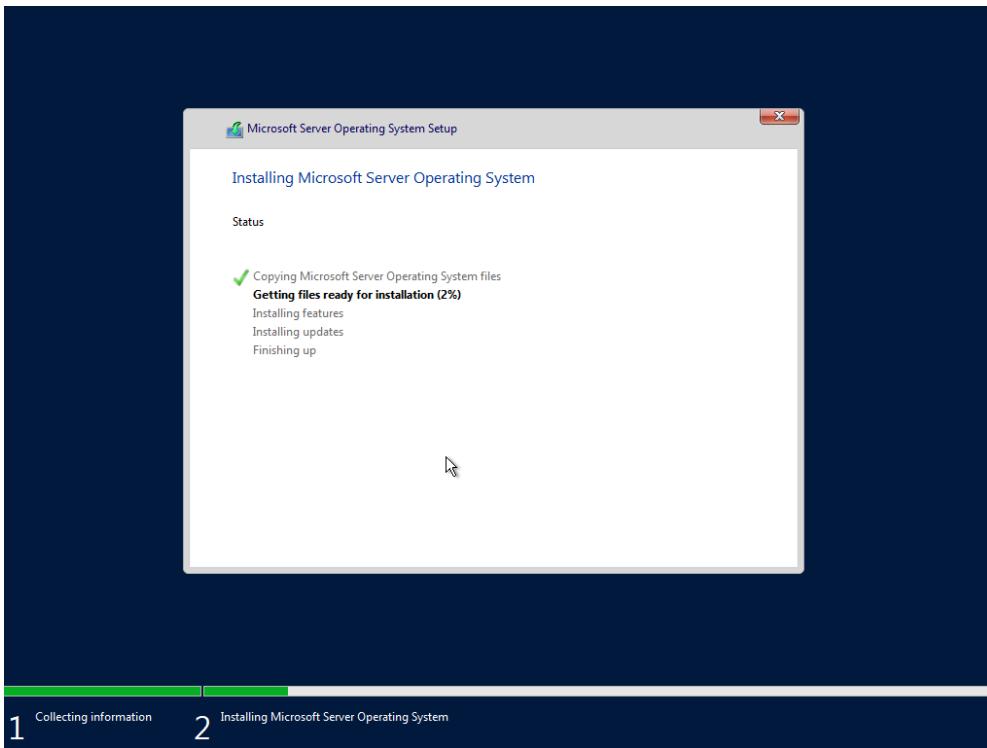
- **Figure 3** – VM RAM configuration.



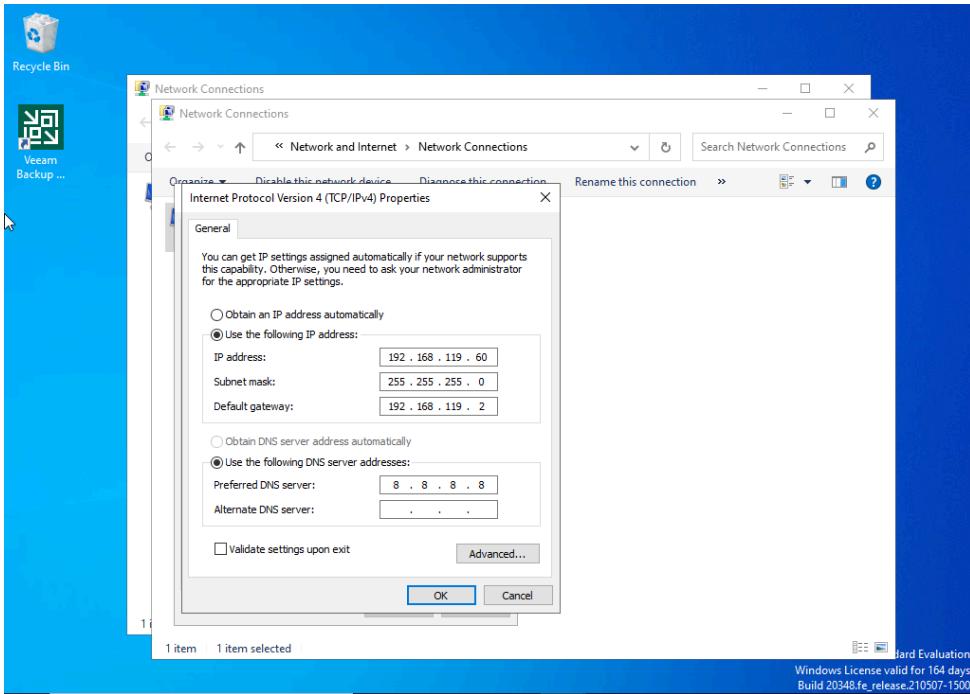
- **Figure 4** – NAT network configuration in Workstation.



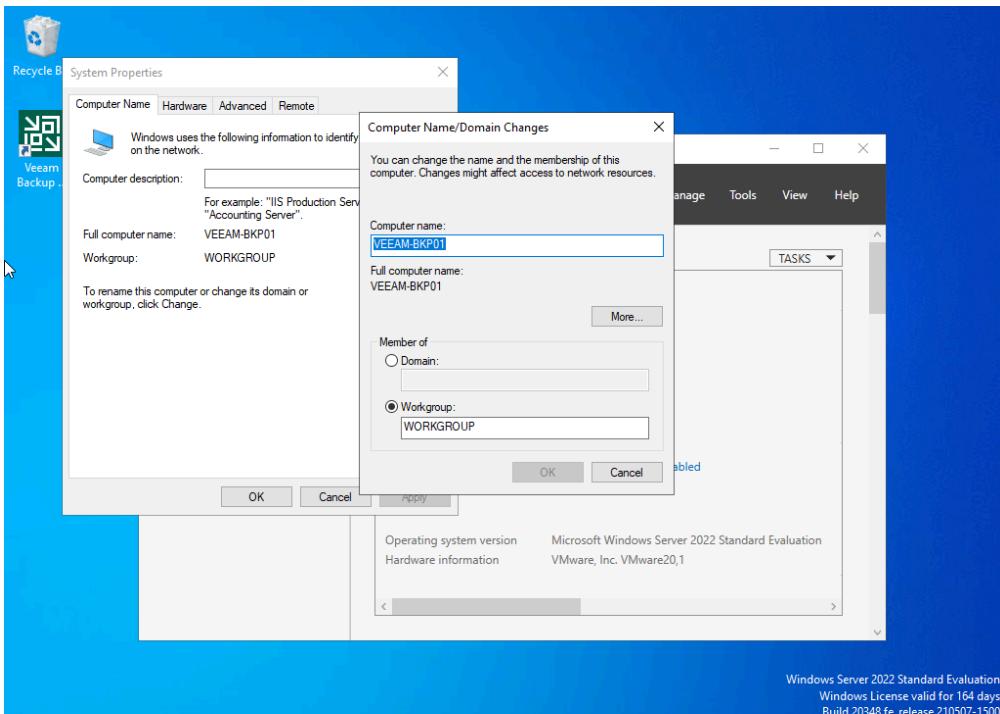
- **Figure 5 – Windows Server installation in progress.**



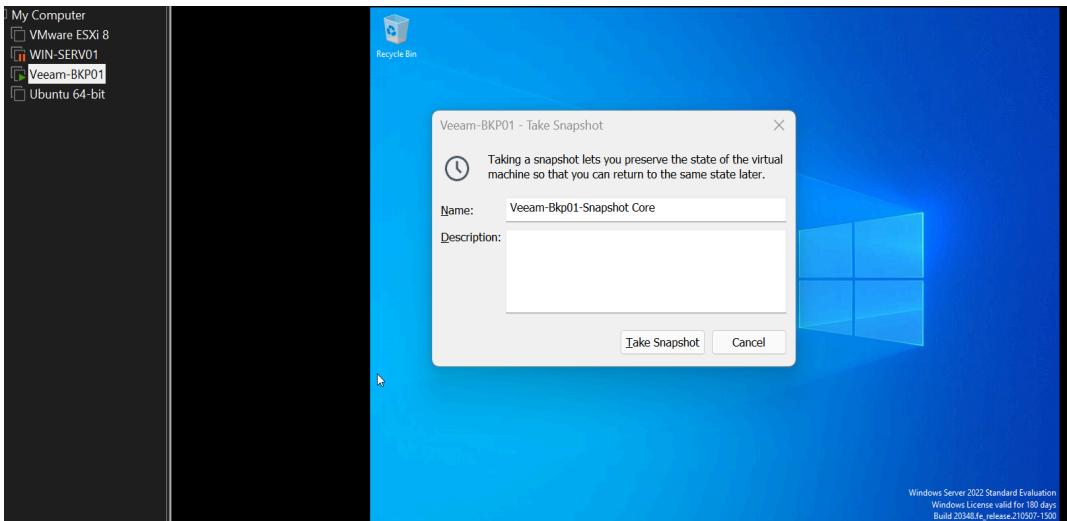
- **Figure 6 – Static IP configuration.**



- **Figure 7 – Computer name assignment.**



- **Figure 8 – Creation of the initial snapshot before making changes.**



4.3 Installation of Veeam Backup & Replication

4.3.1 Download the Installer

- Accessed the official Veeam website: <https://www.veeam.com>.
- Downloaded the latest version of **Veeam Backup & Replication Community Edition**.
- The downloaded file was provided in ISO format:
 - VeeamBackup&Replication_12.3.1.1139_20250315.iso

4.3.2 Mount the ISO in the Veeam-BKP01 VM

- In VMware Workstation, navigated to **Settings > CD/DVD (SATA)**.
- Selected the option **Use ISO image file**.
- Loaded the Veeam ISO file.
- Left the **Connect at power on** option checked.

4.3.3 Start the Installer

- Accessed the mounted virtual drive in the system.
- Executed **Setup.exe** from the disk.
- On the initial screen, clicked **Install**.
- In the following window, selected **Veeam Backup & Replication**.

4.3.4 License Selection

- In the license section, no key was entered, so the system automatically activated the **Community Edition**.

4.3.5 Installation Path and Default Settings

- The wizard displayed the default installation path:
 - C:\Program Files\Veeam\Backup and Replication\

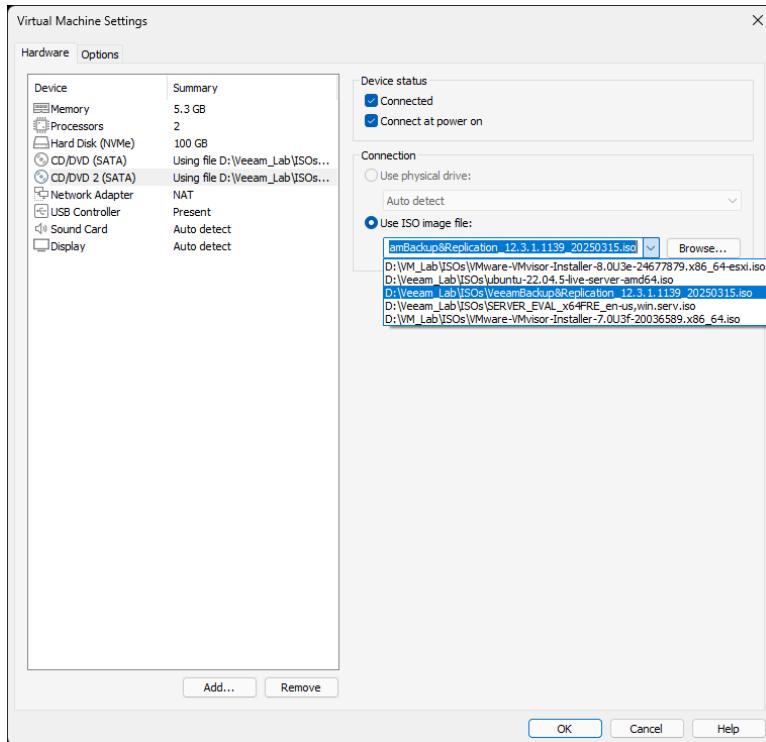
- This path was kept unchanged.
- Clicked **Install** to start the process.

4.3.6 Complete the Installation

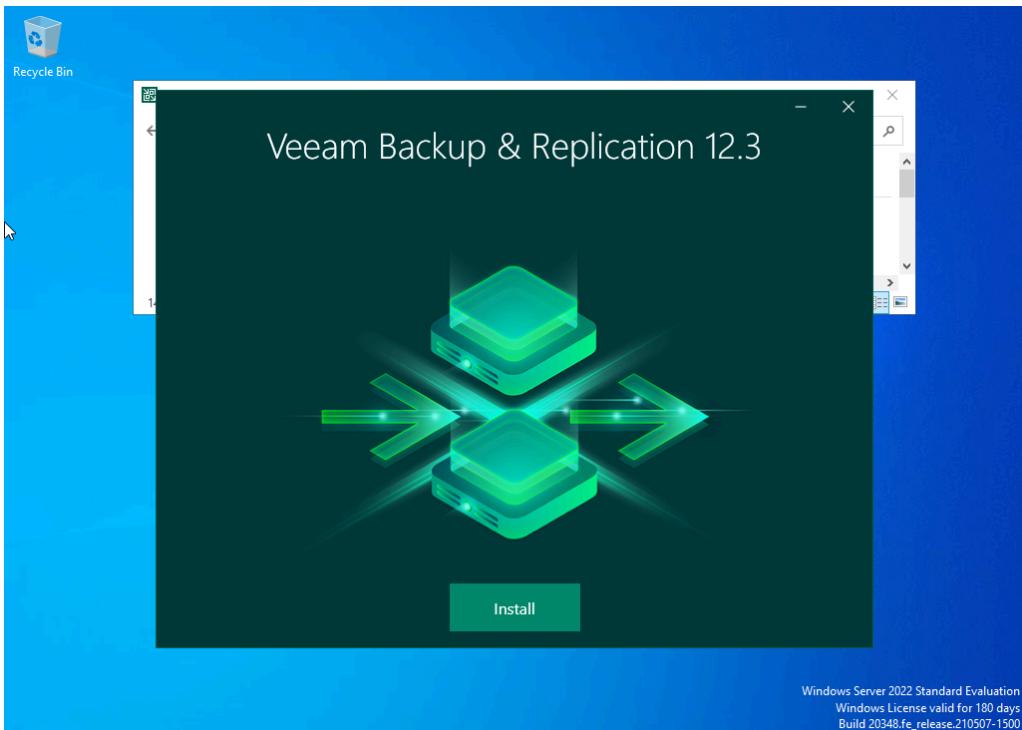
- The installation process was completed within a few minutes.
- At the end, the initial configuration window opened.
- The wizard requested the **Backup Server Name or IP Address**, port, and authentication.
- Default values were kept (localhost, port 9392, Windows session authentication).
- Clicked **Connect** to access the console.
- The installation finished successfully, leaving the system ready to add infrastructure and perform backup tests.

4.3.7 Process Screenshots

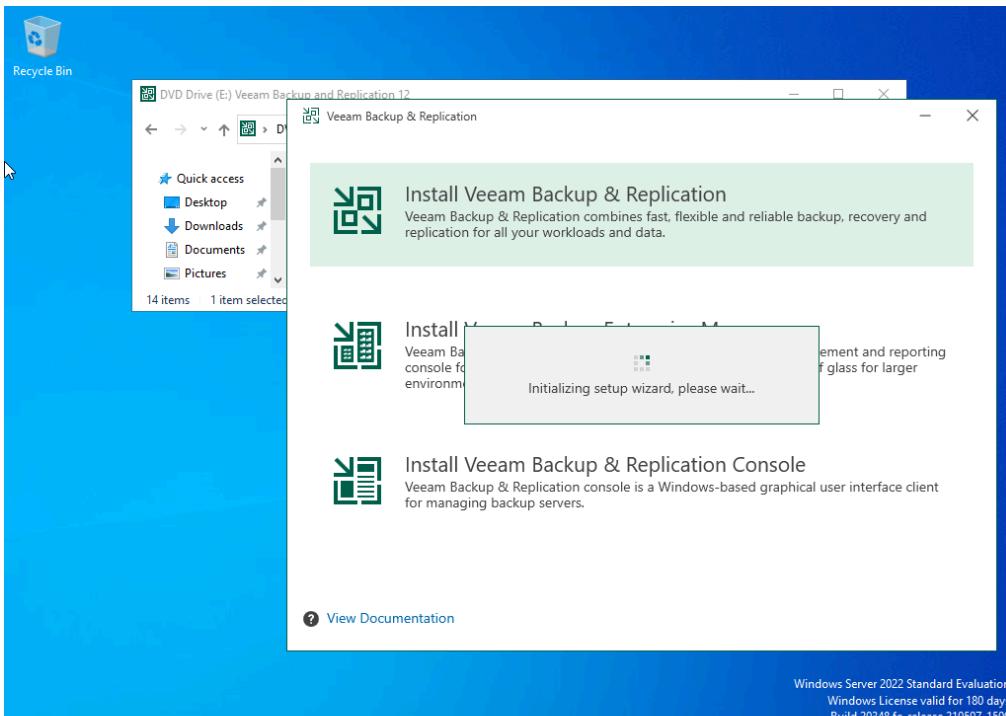
- **Figure 9** – Veeam ISO file mounted on the VM.



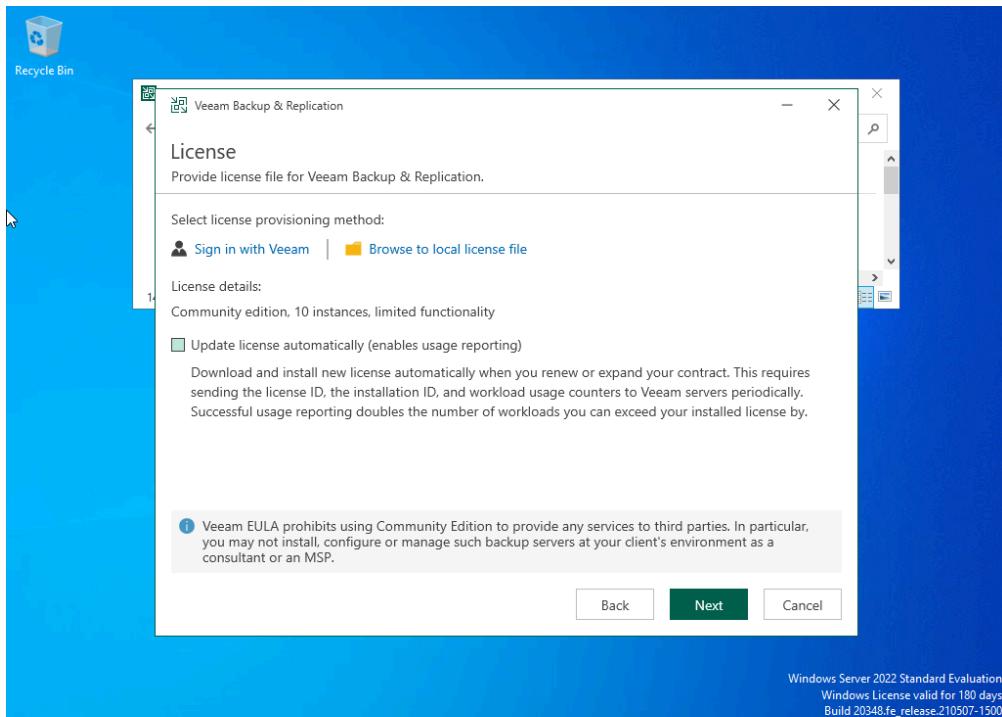
- **Figure 10** – Installer start screen.



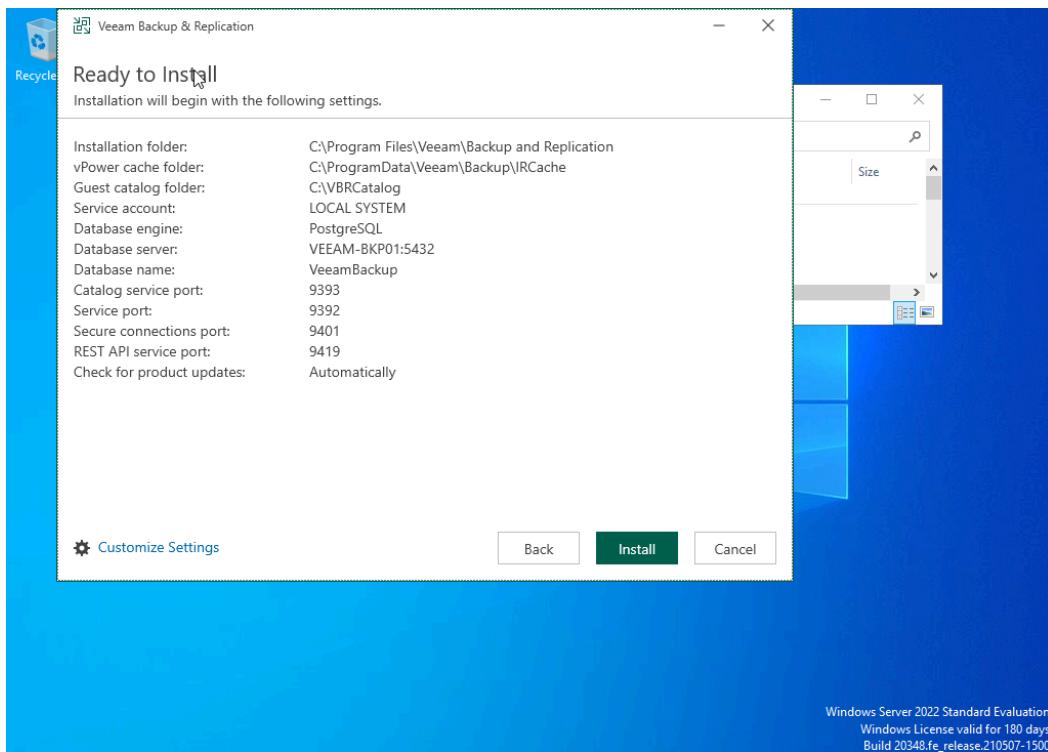
- **Figure 11** – Selection of “Veeam Backup & Replication” in the wizard.



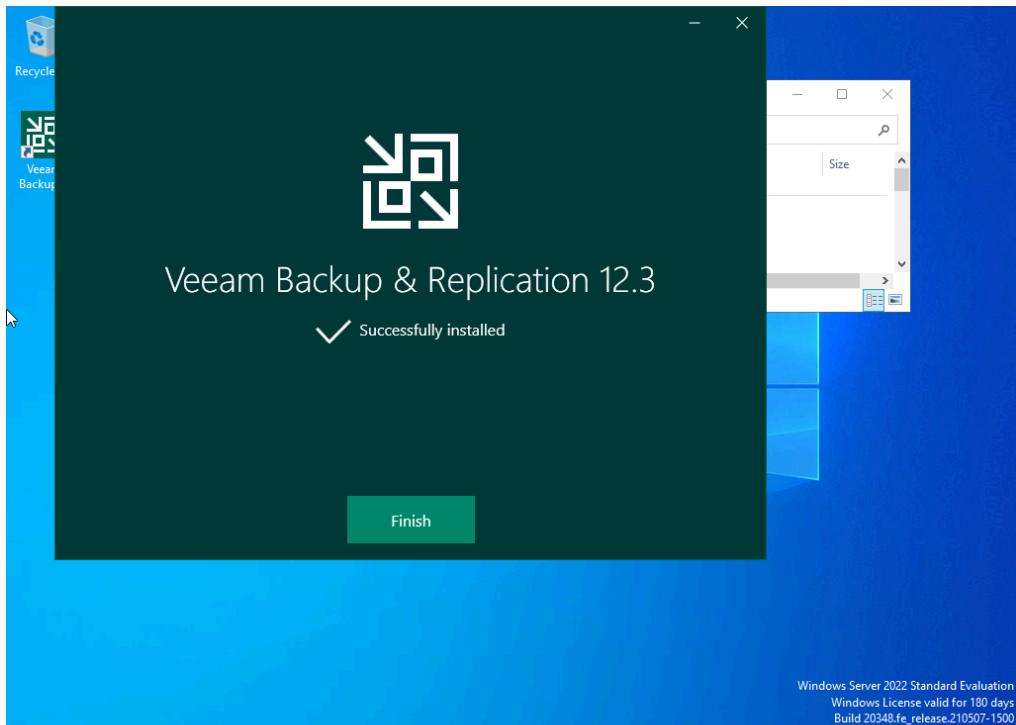
- **Figure 12 – License screen.**



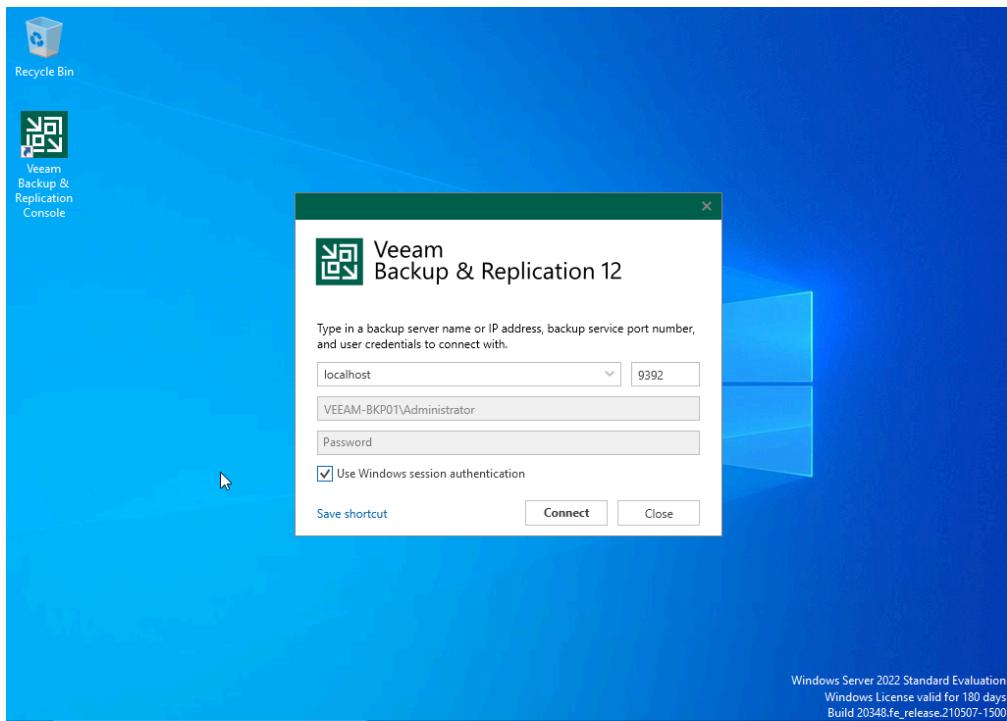
- **Figure 13 – Default installation path shown in the wizard.**



- **Figure 14** – Completed installation.



- **Figure 15** – Initial connection window after installation finished.



4.4 Creation of the ESXi Environment and Deployment of Test VMs

4.4.1 ESXi Host Deployment

- From VMware Workstation, a virtual machine was created to host the VMware ESXi 8.0 hypervisor.
- Configured parameters:
 - Name: VMWARE ESXi 8
 - ISO used: VMware-VMvisor-Installer-8.0U3e-24677879.x86_64.iso
 - Assigned resources: 4 vCPU, 8 GB RAM, 40 GB disk + 40 GB (Ubuntu) + 60 GB (WinServ)
- During the ESXi installation, the following were configured:
 - Root password for host administration
 - Static IP address: 192.168.119.100/24
- Once installation was completed, the ESXi web client was accessed from the browser to continue management.

4.4.2 Creation of the Windows Server VM (Win-SRV01)

- From the ESXi web client, the option Create / Register VM was selected.
- Configured parameters:
 - Name: Win-SRV01
 - Operating System: Microsoft Windows Server 2022 (64-bit)
 - Resources: 2 vCPU, 4 GB RAM, 60 GB disk
- The Windows Server 2022 Evaluation ISO was attached and the installation completed.
- Applied configuration:
 - Computer name: Win-SRV01
 - Static IP: 192.168.119.50/24
 - Firewall disabled

- Post-installation actions:
 - Installation of VMware Tools
 - Creation of an initial snapshot

4.4.3 Creation of the Ubuntu Server VM (Ubuntu-SRV01)

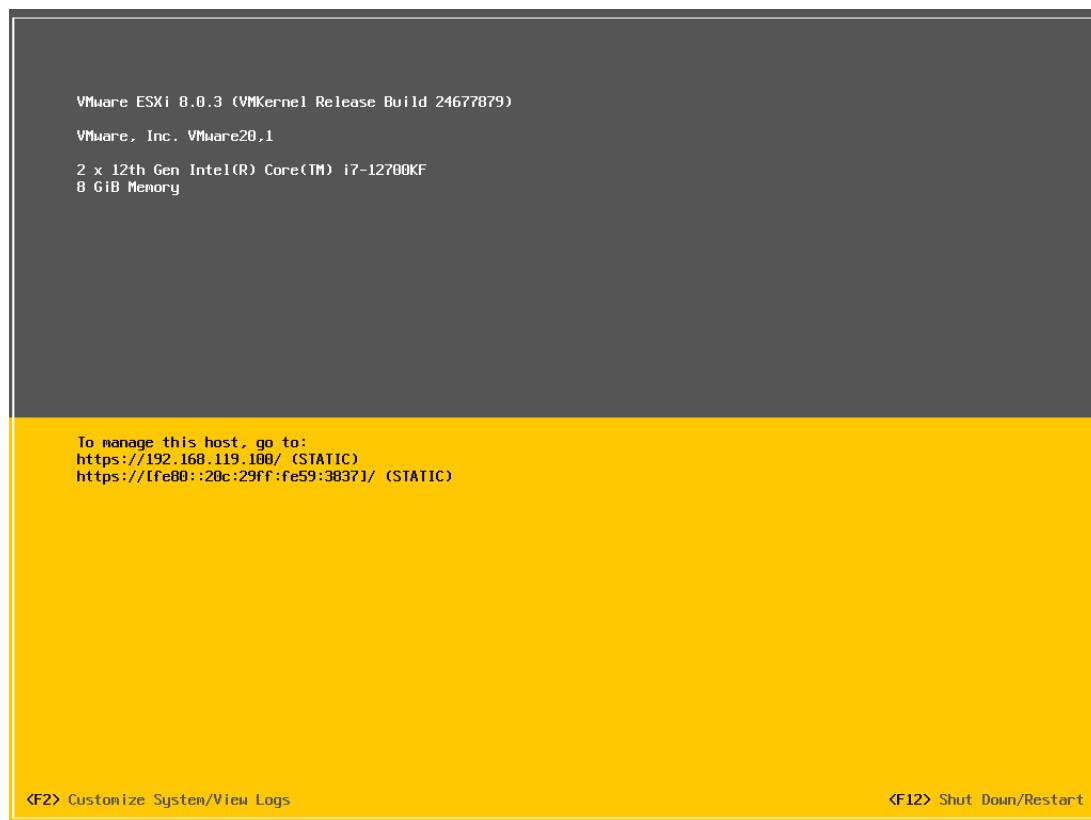
- The VM creation process in ESXi was repeated.
- Configured parameters:
 - Name: Ubuntu-SRV01
 - Operating System: Ubuntu Linux (64-bit)
 - Resources: 2 vCPU, 2 GB RAM, 40 GB disk
 - ISO used: ubuntu-22.04.5-live-server-amd64.iso
- Configuration applied during installation:
 - Server name: Ubuntu-SRV01
 - Initial user and password
 - Static IP: 192.168.119.70/24
 - OpenSSH Server enabled
- Post-installation actions:
 - Installation of updates and VMware Tools using:
 - sudo apt update
 - sudo apt install open-vm-tools -y
 - Installation of network package for connectivity tests:
 - sudo apt install iputils-ping -y
 - Verification of connectivity with the rest of the environment using ping
 - Creation of an initial snapshot

4.4.4 Issues During the Process

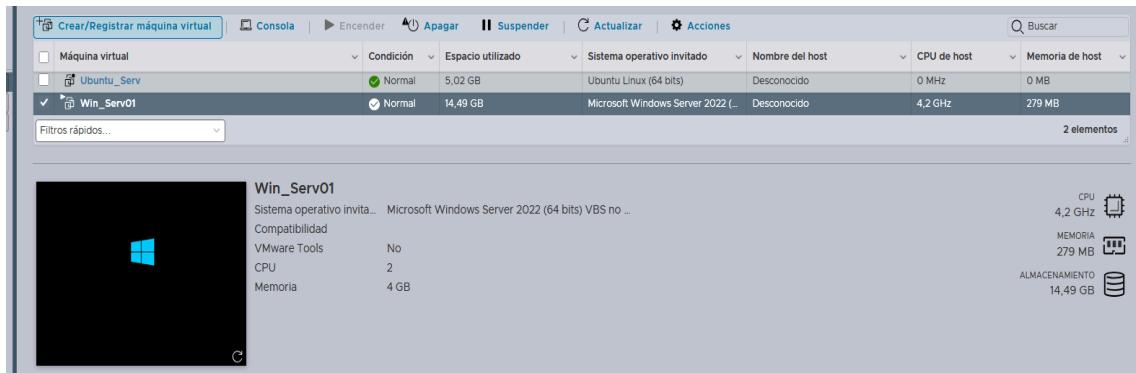
- Initially, the Windows and Linux VMs were created in Workstation instead of ESXi, which prevented them from being managed and connected to Veeam.
- To resolve this, they were migrated to the ESXi host, deleting the Workstation versions once migration was confirmed.
- In the case of Win-SRV01, since it was already configured in Workstation, it was exported in OVF format and imported into ESXi, maintaining all configuration and functionality.
- During the installation of Win-SRV01, it was not possible to apply critical Windows updates due to the same network limitation that also affected the Veeam-BKP01 VM.

4.4.5 Process Screenshots

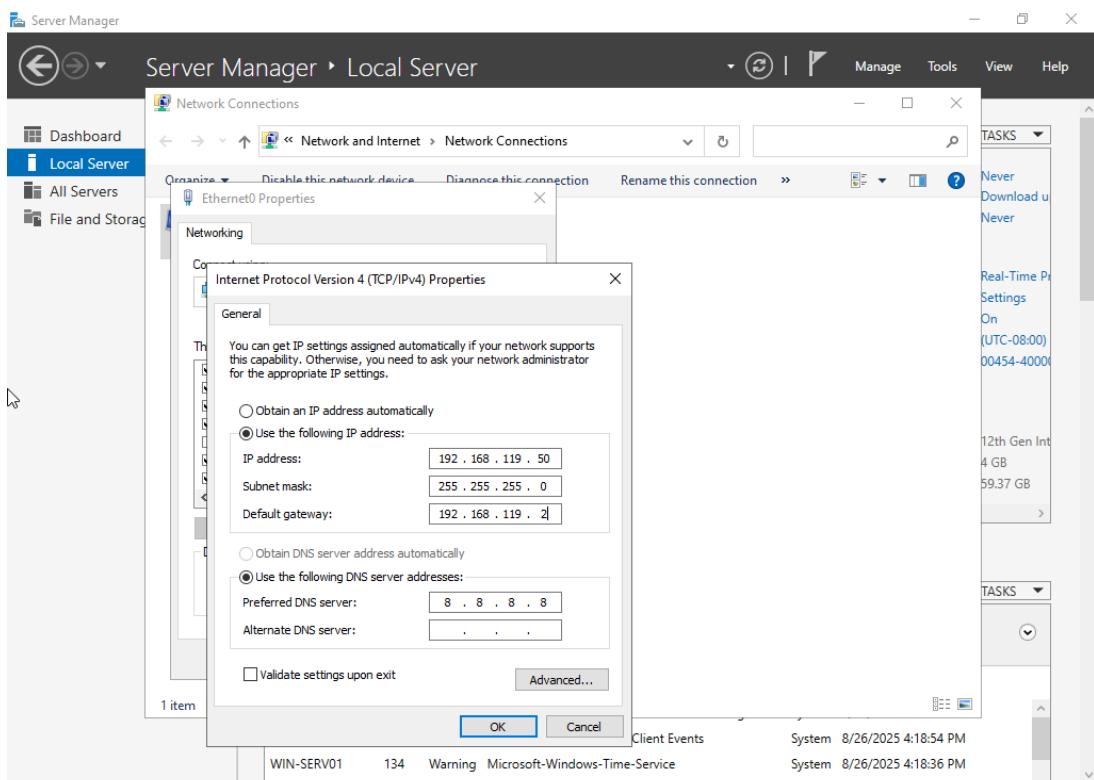
- **Figure 16 – ESXi hypervisor installation on dedicated VM**



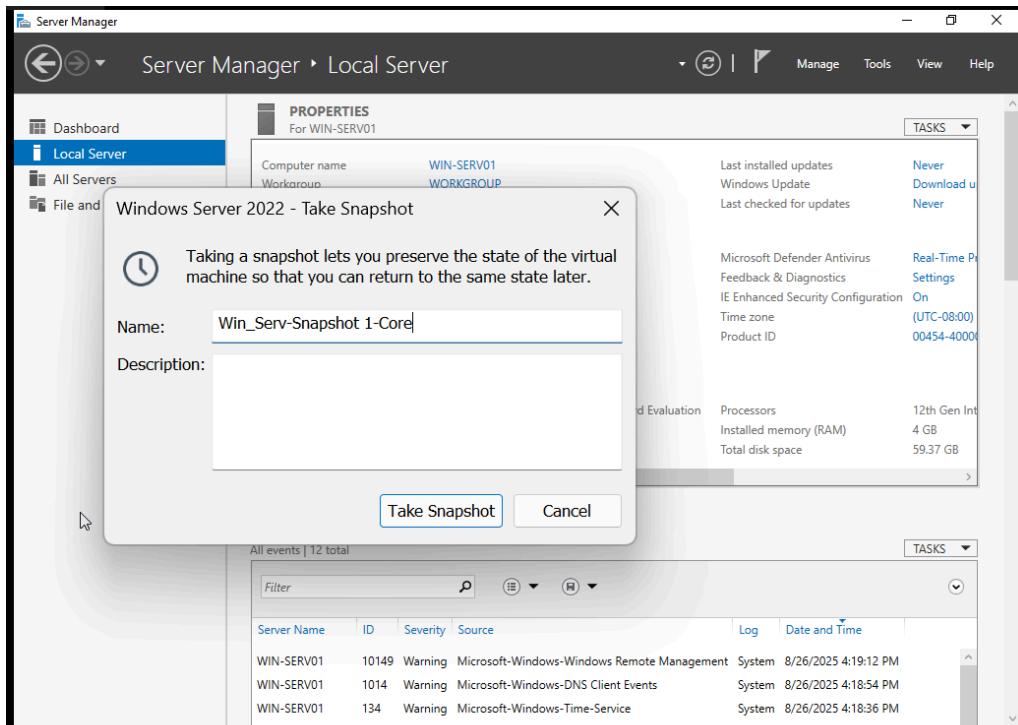
- **Figure 17 – Installation of Windows Server and Ubuntu Server on ESXi host**



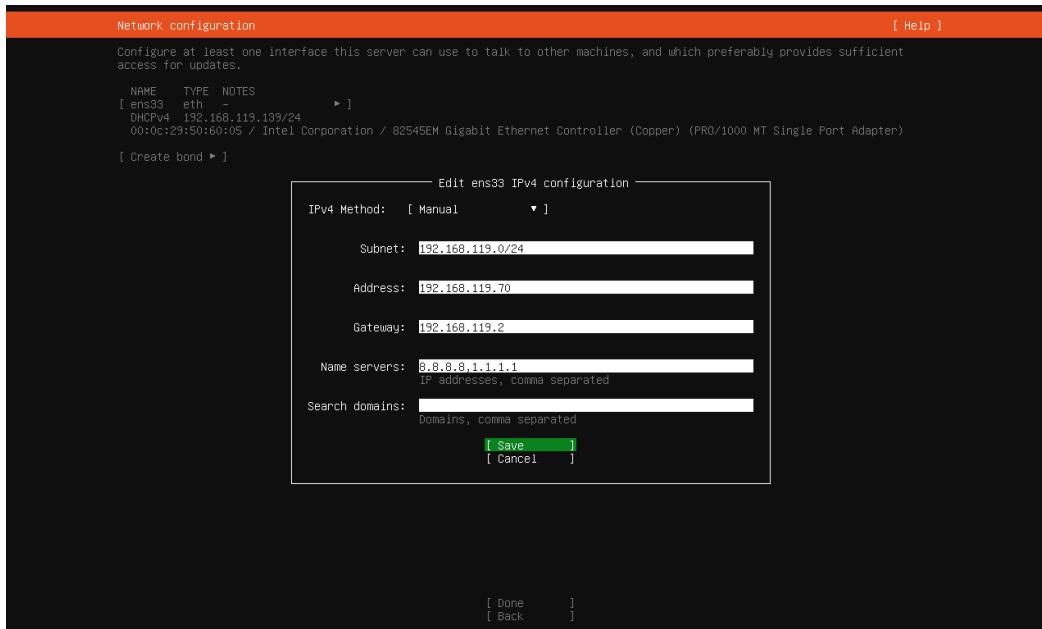
- **Figure 18 – Static IP configuration in Win-SRV01**



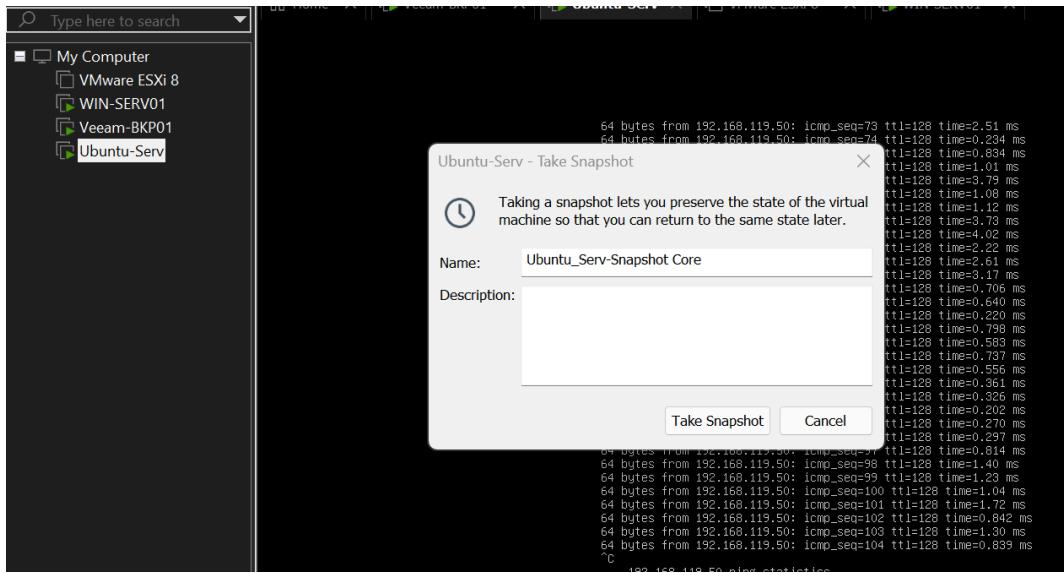
- **Figure 19 – Creation of initial snapshot of Win-SRV01**



- **Figure 21 – Static IP configuration in Ubuntu-SRV01**



- **Figure 22** – Creation of initial snapshot of Ubuntu-SRV01



- **Figure 23** – Connectivity test via ping between Win-SRV01 and Ubuntu-SRV01

```
64 bytes from 192.168.119.50: icmp_seq=73 ttl=128 time=2.51 ms
64 bytes from 192.168.119.50: icmp_seq=74 ttl=128 time=0.234 ms
64 bytes from 192.168.119.50: icmp_seq=75 ttl=128 time=0.834 ms
64 bytes from 192.168.119.50: icmp_seq=76 ttl=128 time=1.01 ms
64 bytes from 192.168.119.50: icmp_seq=77 ttl=128 time=3.79 ms
64 bytes from 192.168.119.50: icmp_seq=78 ttl=128 time=1.08 ms
64 bytes from 192.168.119.50: icmp_seq=79 ttl=128 time=1.12 ms
64 bytes from 192.168.119.50: icmp_seq=80 ttl=128 time=3.73 ms
64 bytes from 192.168.119.50: icmp_seq=81 ttl=128 time=4.02 ms
64 bytes from 192.168.119.50: icmp_seq=82 ttl=128 time=2.22 ms
64 bytes from 192.168.119.50: icmp_seq=83 ttl=128 time=2.61 ms
64 bytes from 192.168.119.50: icmp_seq=84 ttl=128 time=3.17 ms
64 bytes from 192.168.119.50: icmp_seq=85 ttl=128 time=0.706 ms
64 bytes from 192.168.119.50: icmp_seq=86 ttl=128 time=0.640 ms
64 bytes from 192.168.119.50: icmp_seq=87 ttl=128 time=0.220 ms
64 bytes from 192.168.119.50: icmp_seq=88 ttl=128 time=0.798 ms
64 bytes from 192.168.119.50: icmp_seq=89 ttl=128 time=0.583 ms
64 bytes from 192.168.119.50: icmp_seq=90 ttl=128 time=0.737 ms
64 bytes from 192.168.119.50: icmp_seq=91 ttl=128 time=0.556 ms
64 bytes from 192.168.119.50: icmp_seq=92 ttl=128 time=0.361 ms
64 bytes from 192.168.119.50: icmp_seq=93 ttl=128 time=0.326 ms
64 bytes from 192.168.119.50: icmp_seq=94 ttl=128 time=0.202 ms
64 bytes from 192.168.119.50: icmp_seq=95 ttl=128 time=0.270 ms
64 bytes from 192.168.119.50: icmp_seq=96 ttl=128 time=0.297 ms
64 bytes from 192.168.119.50: icmp_seq=97 ttl=128 time=0.814 ms
64 bytes from 192.168.119.50: icmp_seq=98 ttl=128 time=1.40 ms
64 bytes from 192.168.119.50: icmp_seq=99 ttl=128 time=1.23 ms
64 bytes from 192.168.119.50: icmp_seq=100 ttl=128 time=1.04 ms
64 bytes from 192.168.119.50: icmp_seq=101 ttl=128 time=1.72 ms
64 bytes from 192.168.119.50: icmp_seq=102 ttl=128 time=0.842 ms
64 bytes from 192.168.119.50: icmp_seq=103 ttl=128 time=1.30 ms
64 bytes from 192.168.119.50: icmp_seq=104 ttl=128 time=0.839 ms
^C
--- 192.168.119.50 ping statistics ---
104 packets transmitted, 104 received, 0% packet loss, time 104005ms
rtt min/avg/max/mdev = 0.159/0.882/4.018/0.750 ms
ubuntu_serv@ubuntuserv:~$ _
```

4.5 Adding the ESXi Host to the Veeam Environment

4.5.1 Access the Veeam Console

From the Veeam-BKP01 VM, the **Veeam Backup & Replication Console** was opened to begin the environment configuration.

4.5.2 Start the Add Server Wizard

In the main panel, the following was selected:

Add Server → VMware vSphere

4.5.3 Enter ESXi Host Parameters

- The static IP address of the ESXi host was specified.
- The previously configured administrative credentials on the host were selected.

4.5.4 Connection Validation

- The wizard validated connectivity and access credentials to the host.
- The connection was confirmed successful and the VM inventory was accessible from the Veeam console.

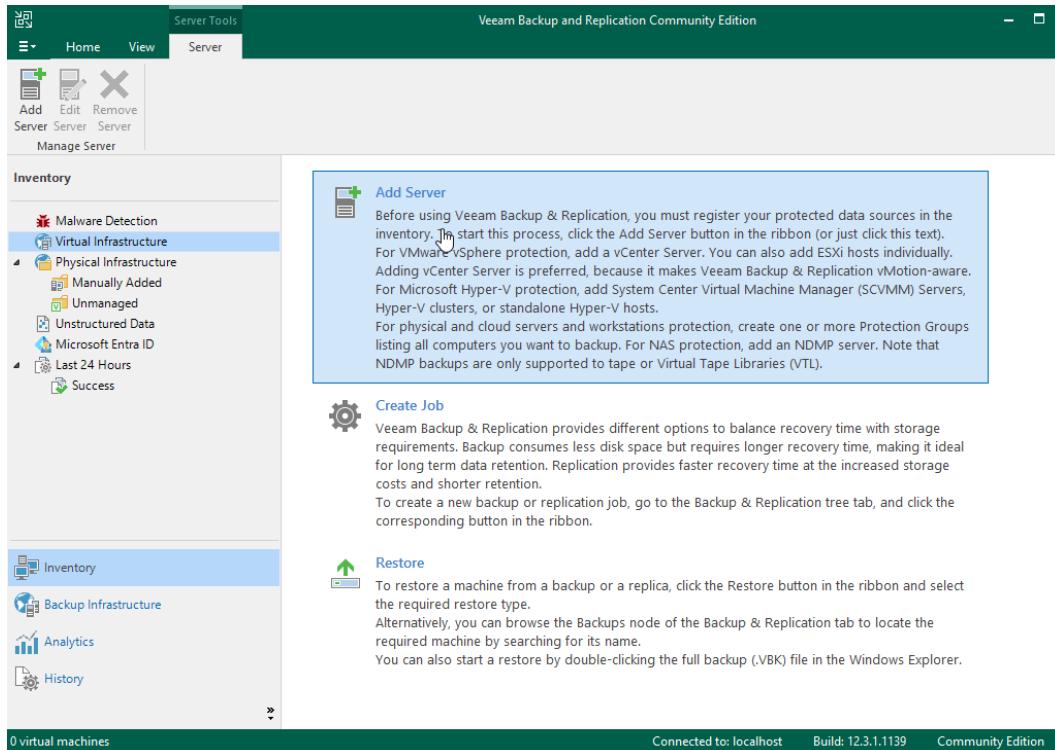
4.5.5 Addition Confirmation

Once validation was complete, the process was confirmed.

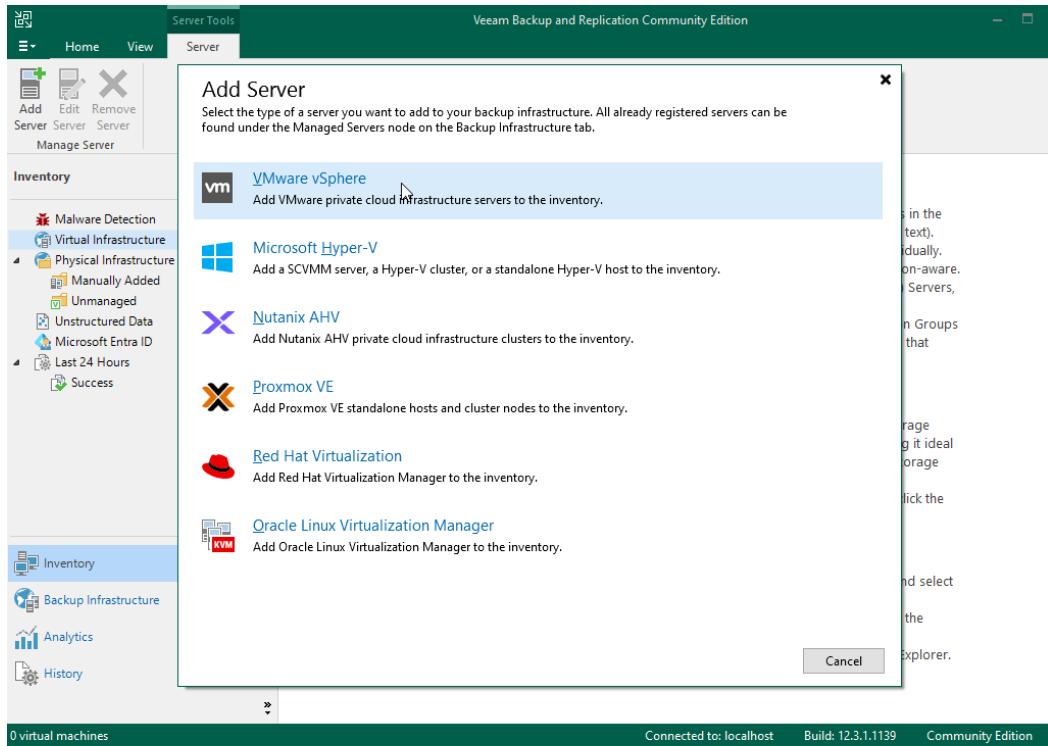
The ESXi host was registered in the **Managed Servers** section of the console.

4.5.6 Process Screenshots

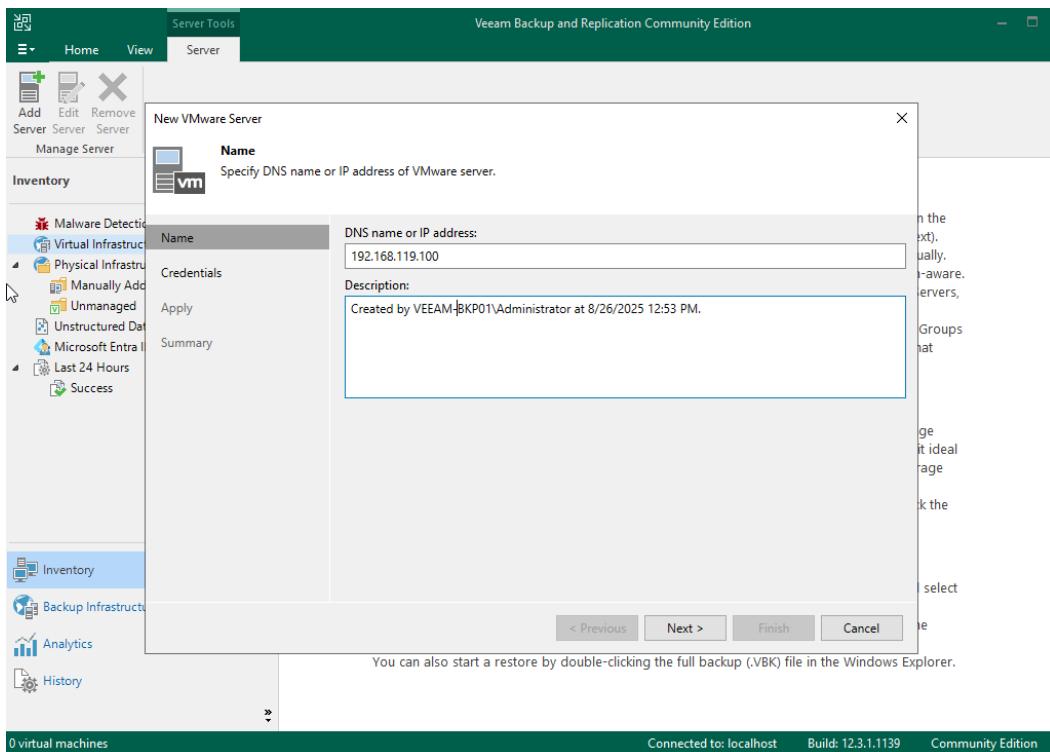
- **Figure 24 – Start of the Add Server wizard in the Veeam console**



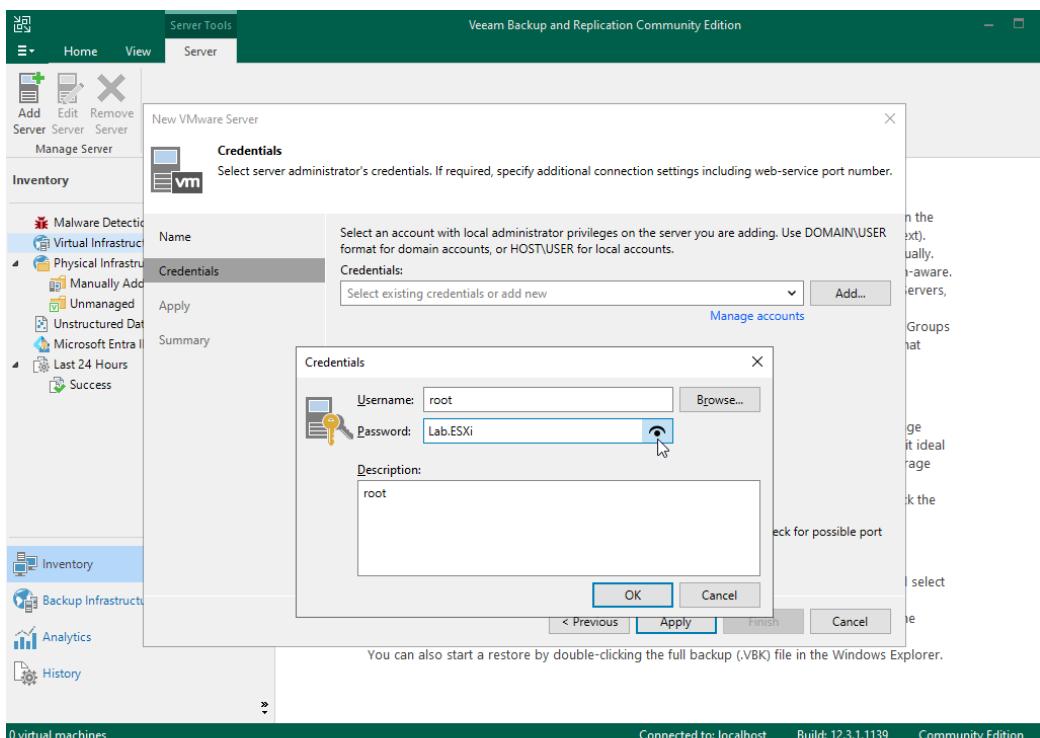
- **Figure 25 – Selection of VMware vSphere as server type**



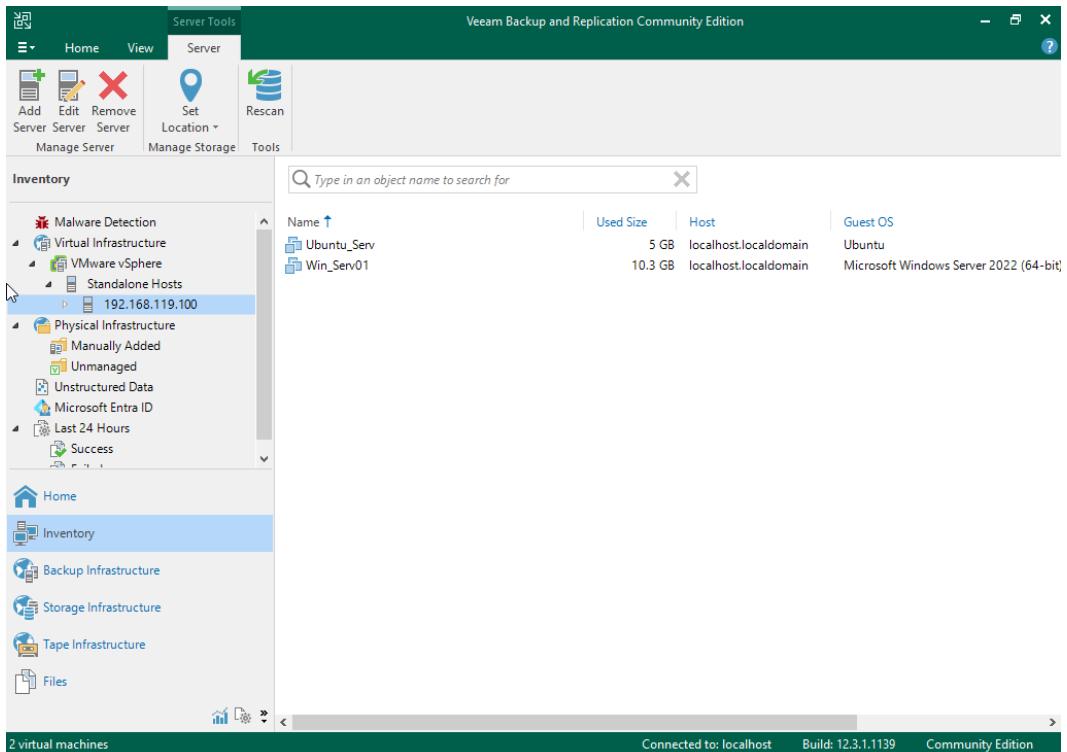
● **Figure 26** – Entry of ESXi host IP address



● **Figure 27** – Entry of administrative credentials (root user)



- **Figure 28 – VM inventory accessible from the Veeam console**



4.6 Create and Configure the First Backup Job

4.6.1 Access the Jobs Section

From the Veeam console, the **Home** menu was accessed.

In the top panel, the following was selected: **Backup Job > Virtual machine**

4.6.2 Backup Job Creation Wizard

- The **New Backup Job** wizard was opened.
- A descriptive name was entered: **Windows_Serv**.
- The rest of the initial parameters were left as default.

4.6.3 Select Virtual Machines to Back Up

- Clicked **Add > From vSphere**.
- Target VMs were selected from the ESXi inventory:
 - Win-SRV01

- Ubuntu-SRV01
- They were added to the job and the process continued.

4.6.4 Repository Selection

- In the **Storage** section, the default repository was selected:
Default Backup Repository

4.6.5 Retention Policy Configuration

- Set to **5 days**.

4.6.6 Additional Features (not enabled in this lab)

- **Application-aware processing:** not enabled
- **Guest file system indexing:** not enabled

4.6.7 Schedule Configuration

- The job was scheduled to run at **07:00 AM on weekdays**.
- *Note: in a production environment, it would be scheduled at night (e.g., 22:00).*

4.6.8 Final Confirmation

- The job configuration summary was reviewed.
- **Finish** was clicked and the job was registered.

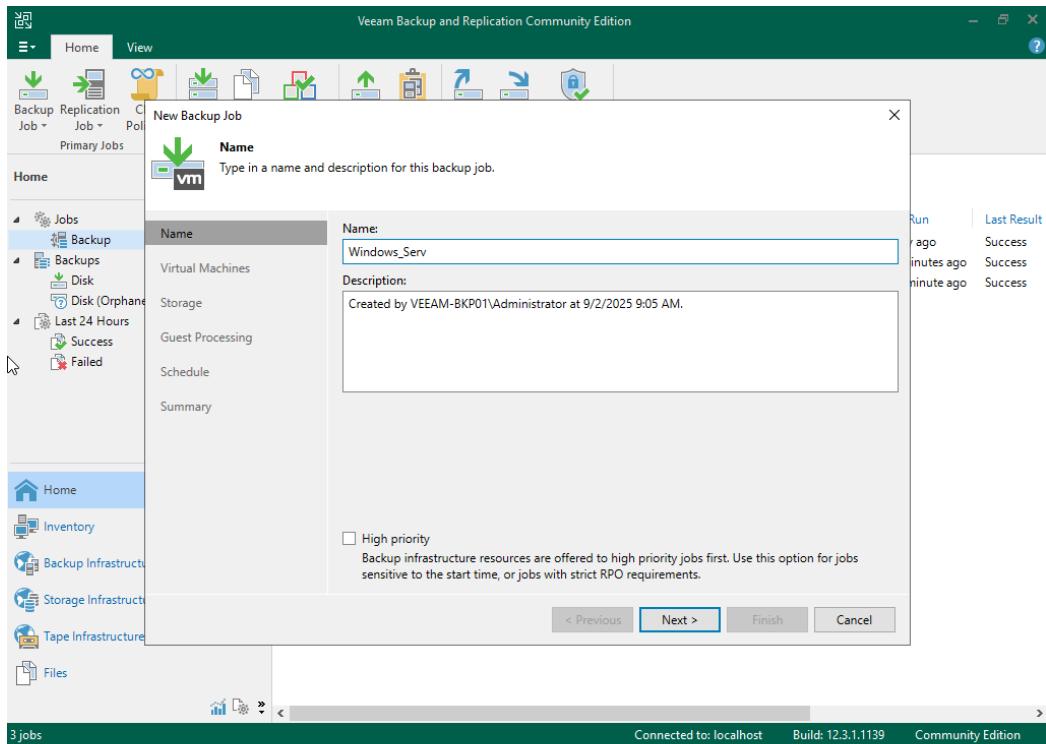
4.6.9 Run the Job for the First Time

- Right-clicked the created job > **Start**.
- The following execution phases were observed:
 - Snapshot creation
 - VM data read
 - Write to repository

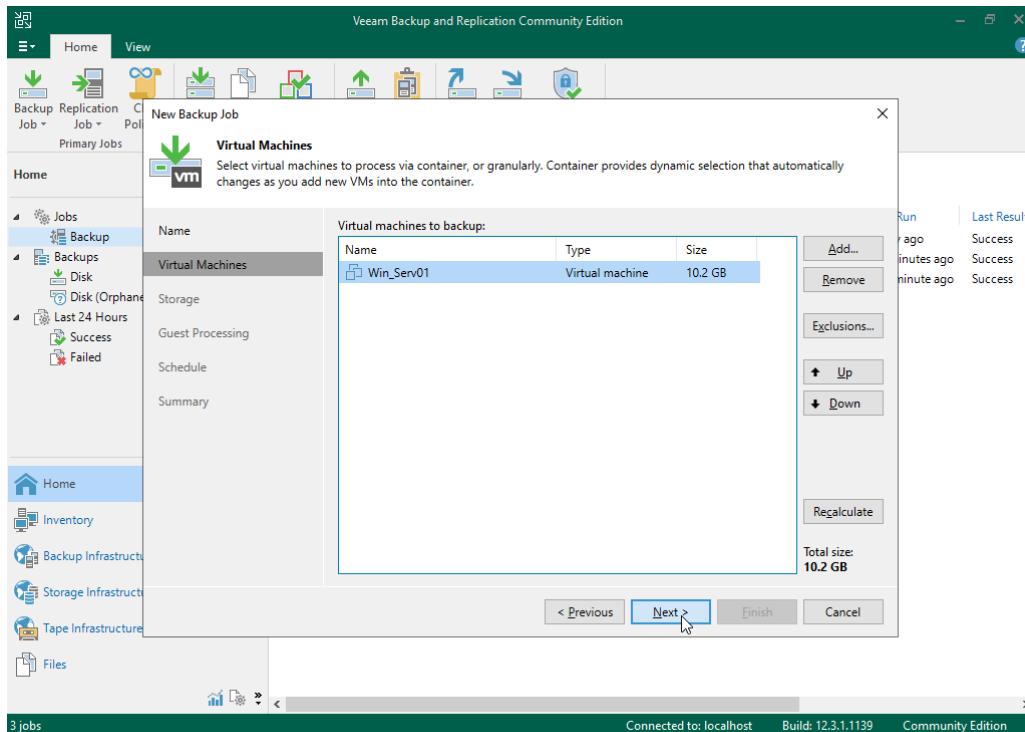
- The process completed successfully.

4.6.10 Process Screenshots

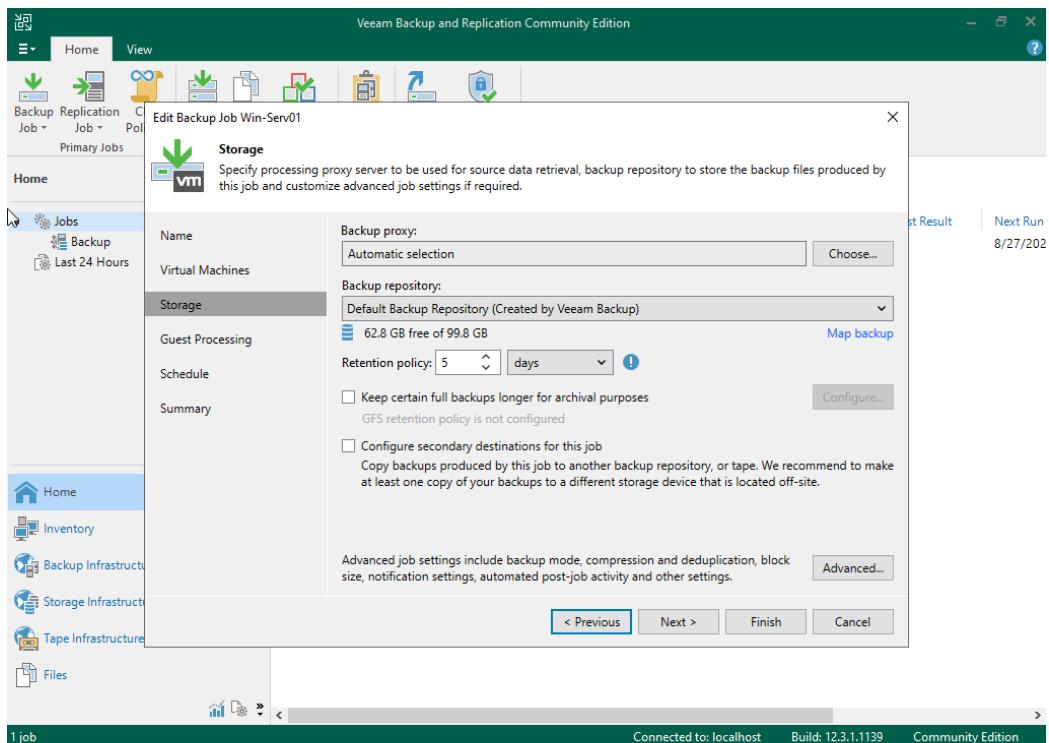
- **Figure 29 – Start of the New Backup Job wizard**



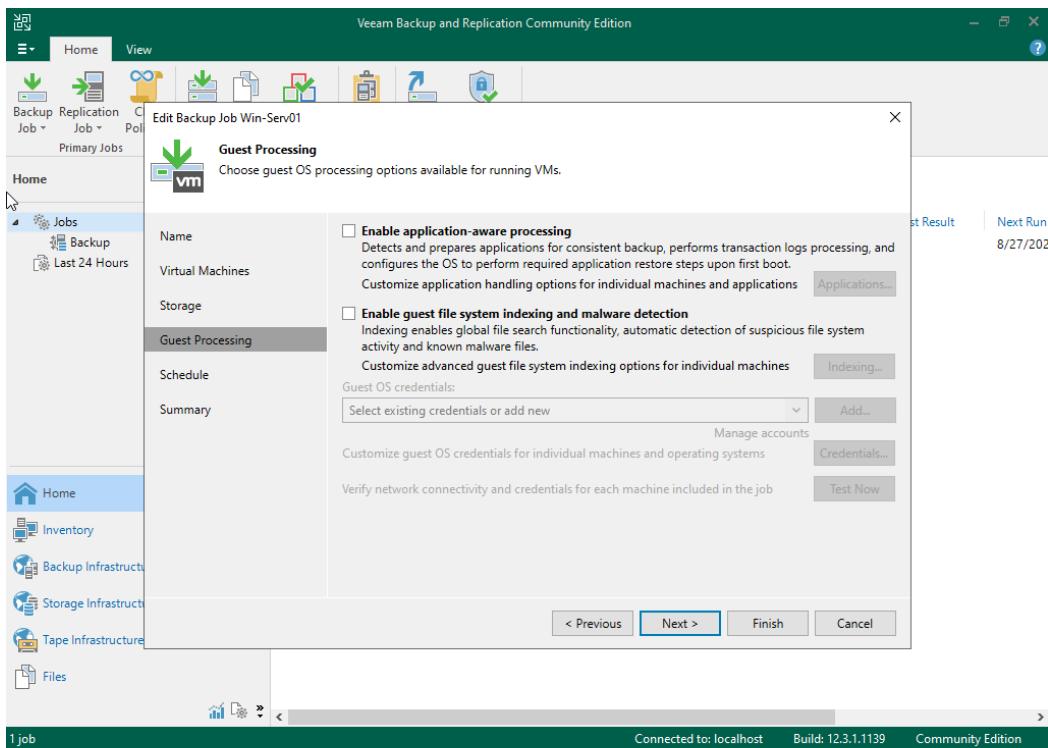
● **Figure 30 – VM selection from the ESXi inventory**



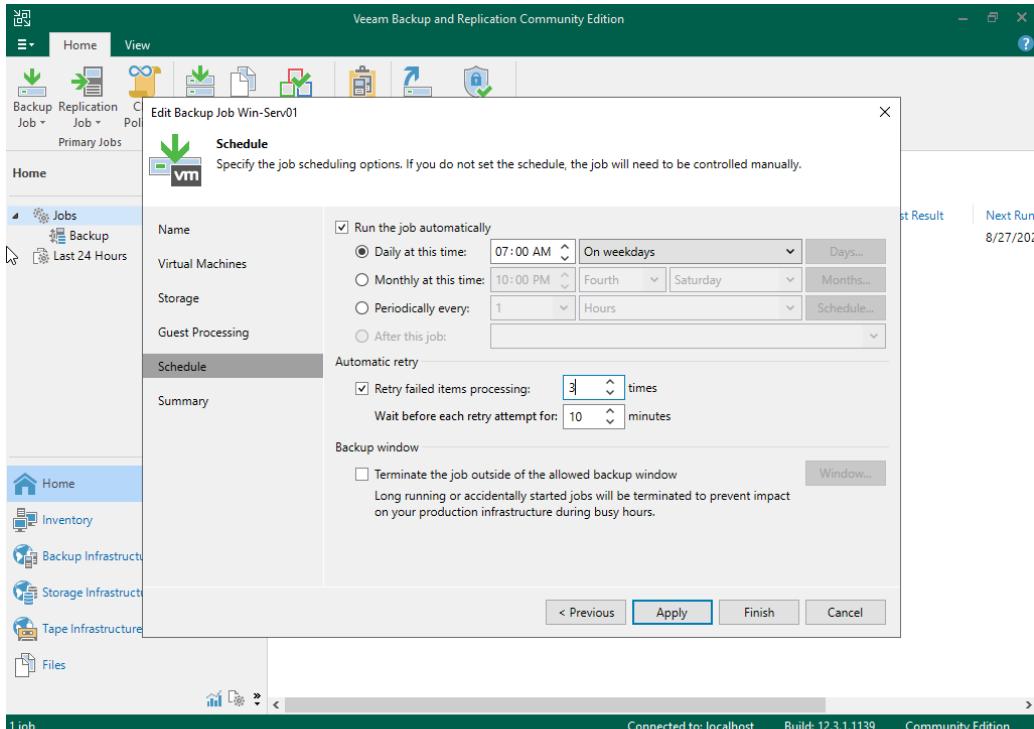
● **Figure 31 – Repository selection and retention configuration**



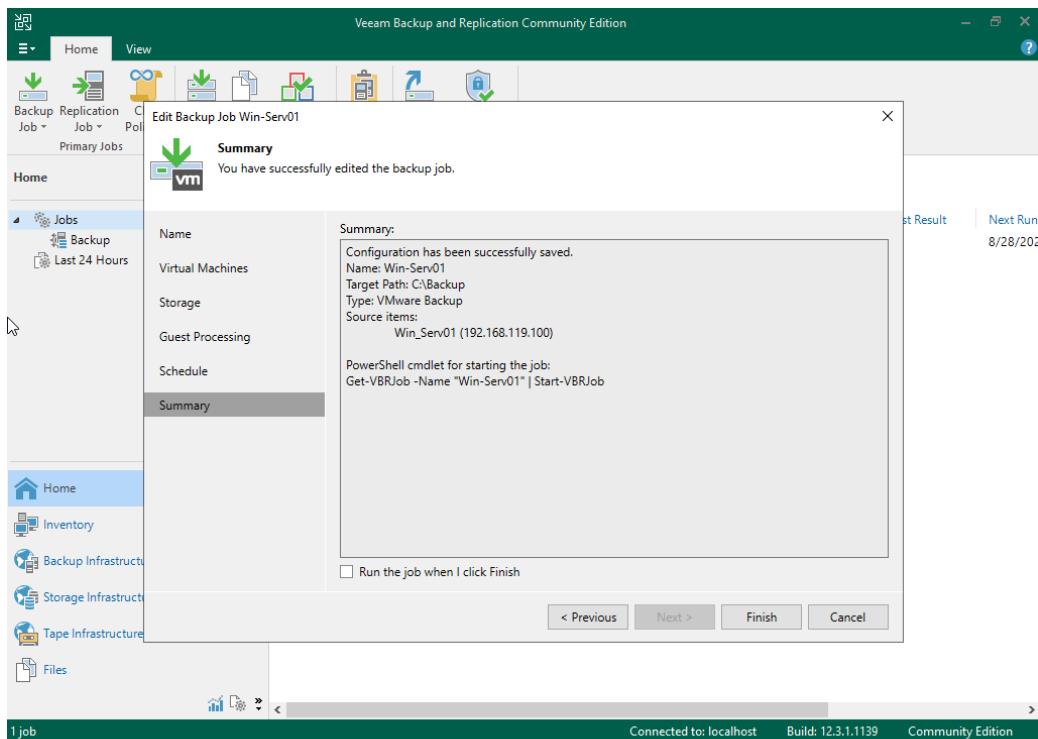
- **Figure 32 – Advanced job options**



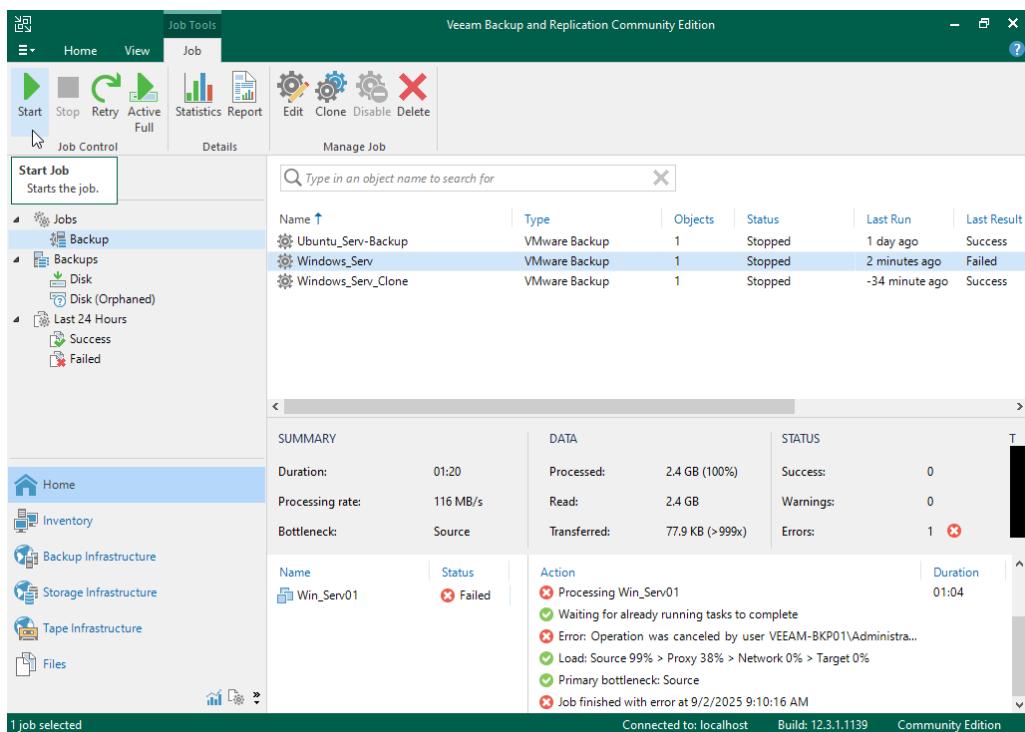
- **Figure 33 – Schedule configured at 07:00**



● **Figure 34 – Final job summary before creation**



● **Figure 35 – Manual job execution**



- **Figure 36 – Job completed successfully**

The screenshot shows the Veeam Backup and Replication Community Edition interface. The main window displays a list of jobs under the 'Success' category. One job, 'Win_Serv01 (Full)', is highlighted. The interface includes a sidebar with navigation links like Home, Inventory, Backup Infrastructure, Storage Infrastructure, Tape Infrastructure, and Files. A summary table provides details about the backup job, including duration, processing rate, and bottleneck information. Below the summary is a list of actions taken during the job, all marked as successful. The bottom status bar indicates '1 session selected' and the connection details.

SUMMARY		DATA		STATUS	
Duration:	29:39	Processed:	11.2 GB (100%)	Success:	1 ✓
Processing rate:	12 MB/s	Read:	10.4 GB	Warnings:	0
Bottleneck:	Source	Transferred:	6.6 GB (1.6x)	Errors:	0

Name	Status	Action	Duration
Win_Serv01	✓ Success	VM size: 60 GB (11.3 GB used) Changed block tracking is enabled Processing Win_Serv01 Load: Source 96% > Proxy 70% > Network 18% > Target 7% Primary bottleneck: Source Job finished at 8/27/2025 12:48:04 PM	29:20

1 session selected Connected to: localhost Build: 12.3.1.1139 Community Edition

4.7 Backup Repository Management and Storage Usage

4.7.1 Access Configured Repositories

- From the Veeam console, navigated to **Backup Infrastructure > Backup Repositories**.
- Confirmed that the default repository was available: **Default Backup Repository**.

4.7.2 Create a New Repository

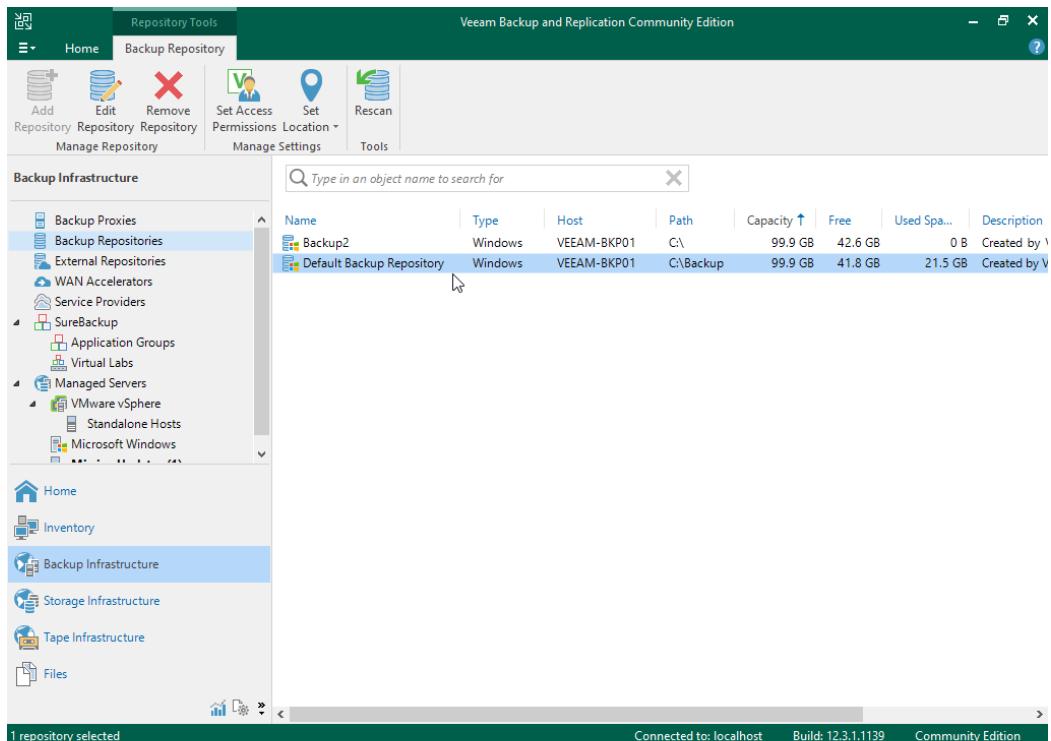
- A second repository of type **Direct Attached Storage** was created, pointing to a dedicated local folder.
- The new repository was named **Backup2**.

4.7.3 Create a Job Targeting the New Repository

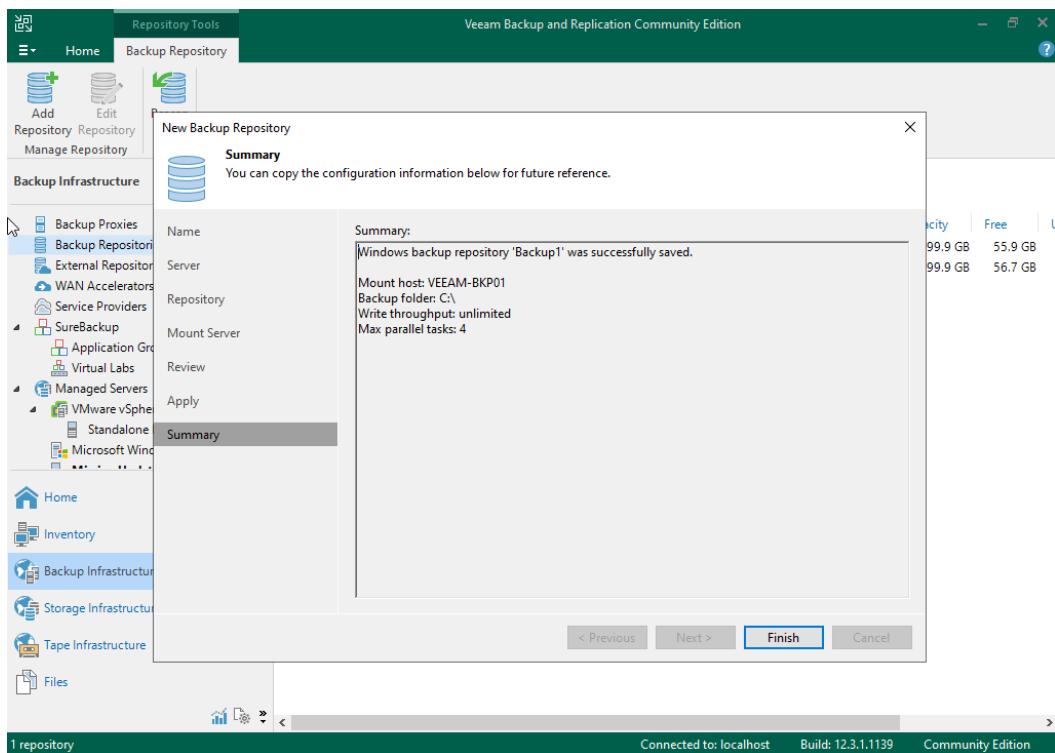
- A new backup job was created for the VM **Win-SRV01**.
- In this case, **Backup2** was selected as the target repository.
- The job was executed to validate the write process and confirm it worked independently of the original job.

4.7.4 Process Screenshots

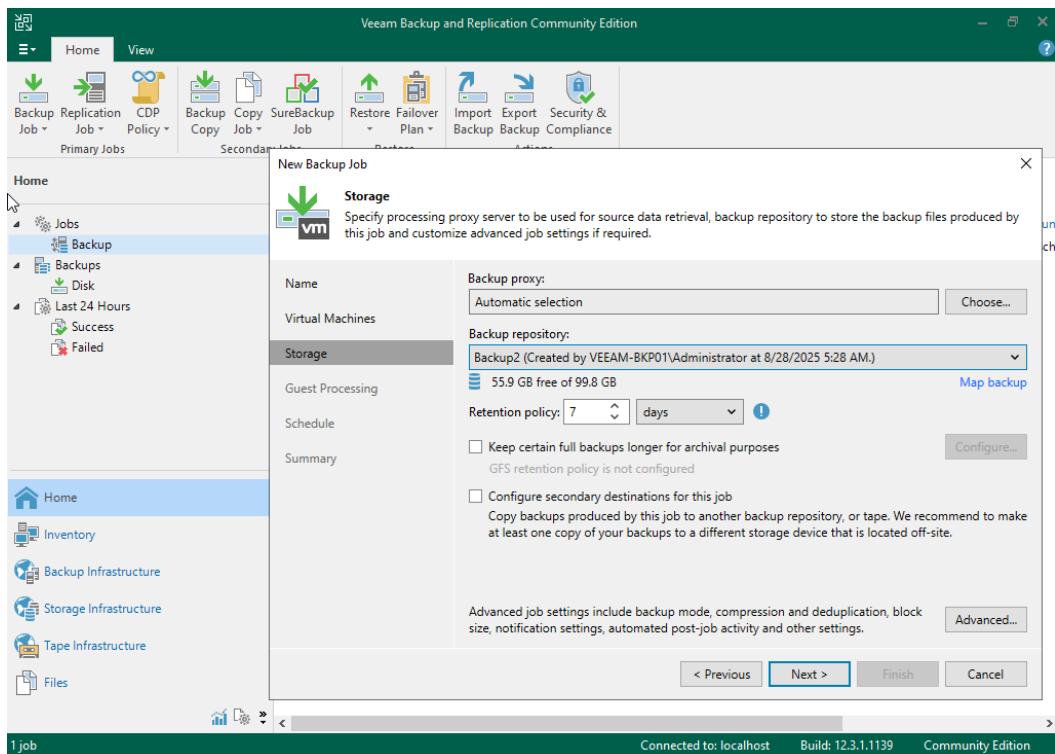
- **Figure 37 – View of repositories in the Veeam console (Default and Backup2)**



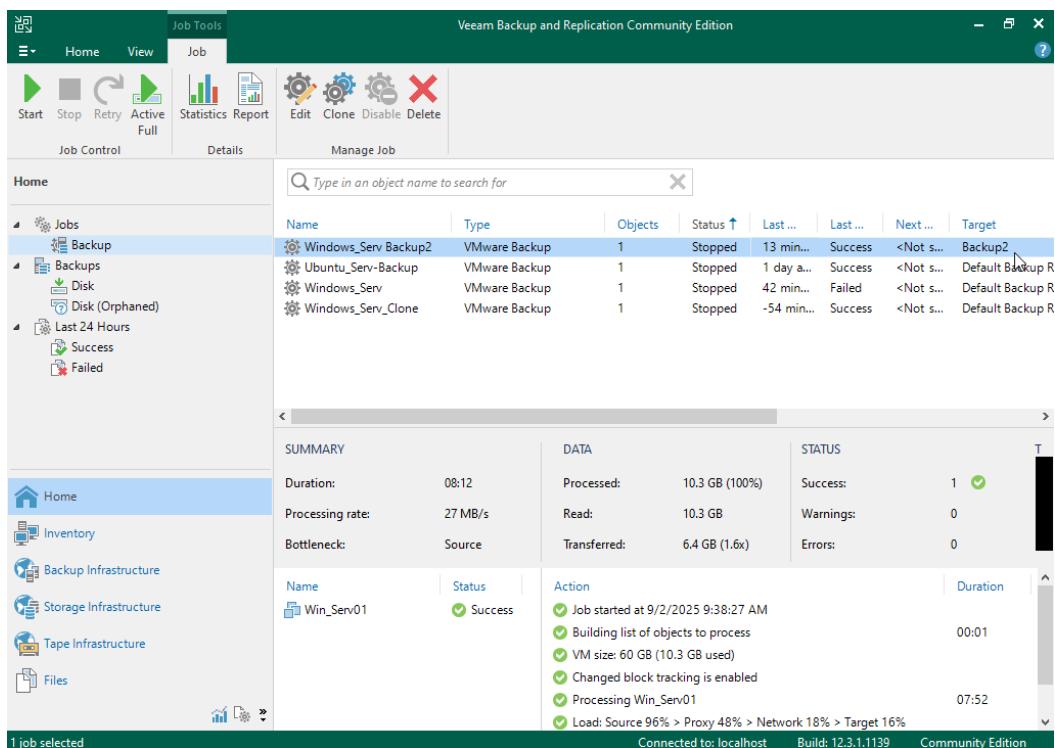
- **Figure 38 – Creation of the Backup2 repository**



● **Figure 39 – Configuration of the new job targeting Backup2**



● **Figure 40 – Execution and validation of the job in the new repository**



4.8 Full Virtual Machine Restore

4.8.1 Start the Restore Process

- From the Veeam console, navigated to **Home > Restore**.
- Selected the option **Restore from Backup**.
- From the menu, chose **Entire VM Restore**.

4.8.2 Restore Method Selection

- The wizard offered several modes: Instant Recovery, Entire VM Restore, Restore to Public Cloud.
- **Entire VM Restore** was selected to recover the full virtual machine from backup.

4.8.3 Backup and Location Selection

- The backup job corresponding to **Win-SRV01** was selected.
- The option **Restore to the original location** was chosen, preserving:
 - Host: Main ESXi host of the lab
 - Datastore: Same datastore where it was previously hosted
 - Resource pool and folder: Default values
 - Network: Original configuration without modifications

4.8.4 Execute the Restore

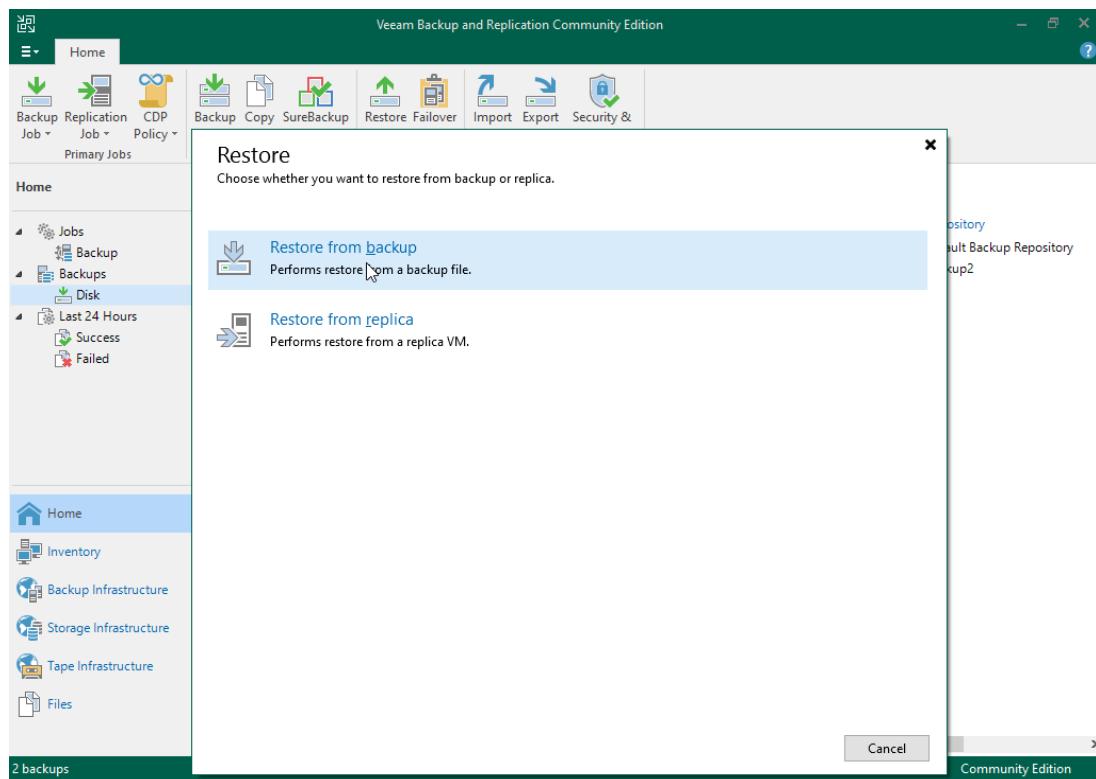
- Prior to the restore, the VM **Win-SRV01** had been manually deleted from the ESXi inventory to simulate a real failure scenario.
- After launching the wizard, the restore executed without issues.
- Task progress was monitored from the Veeam console.

4.8.5 Result Verification

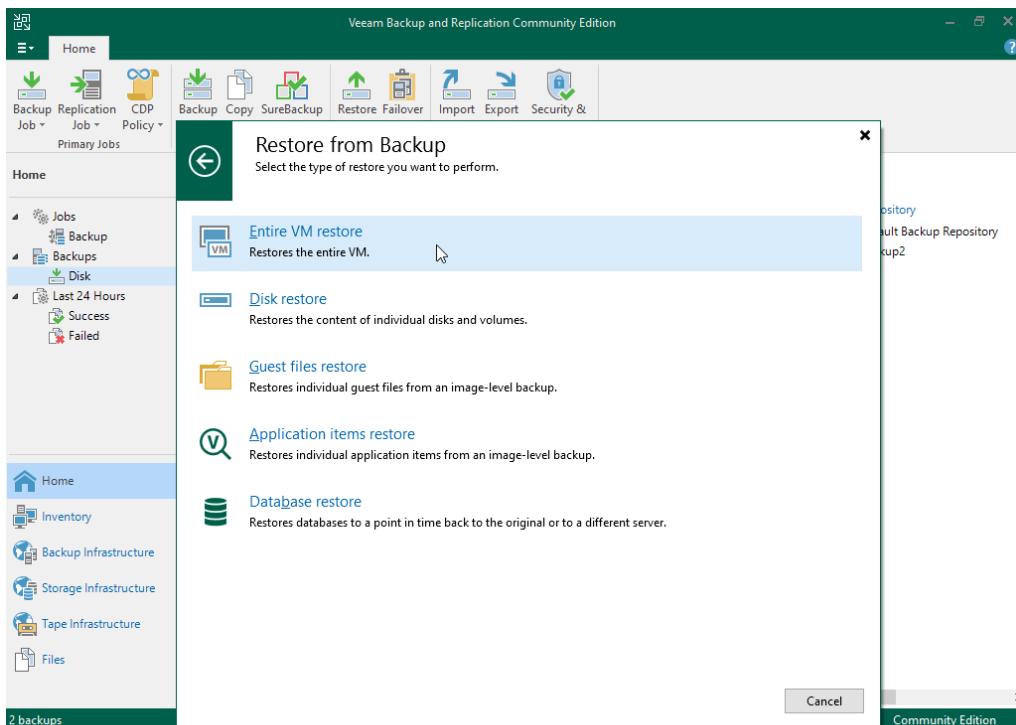
- Once the process was completed, the VM reappeared in the ESXi inventory.
- The VM was powered on and it was confirmed that:
 - The operating system booted correctly
 - Network connectivity was operational
 - The VM state matched the moment when the backup was taken

4.8.6 Process Screenshots

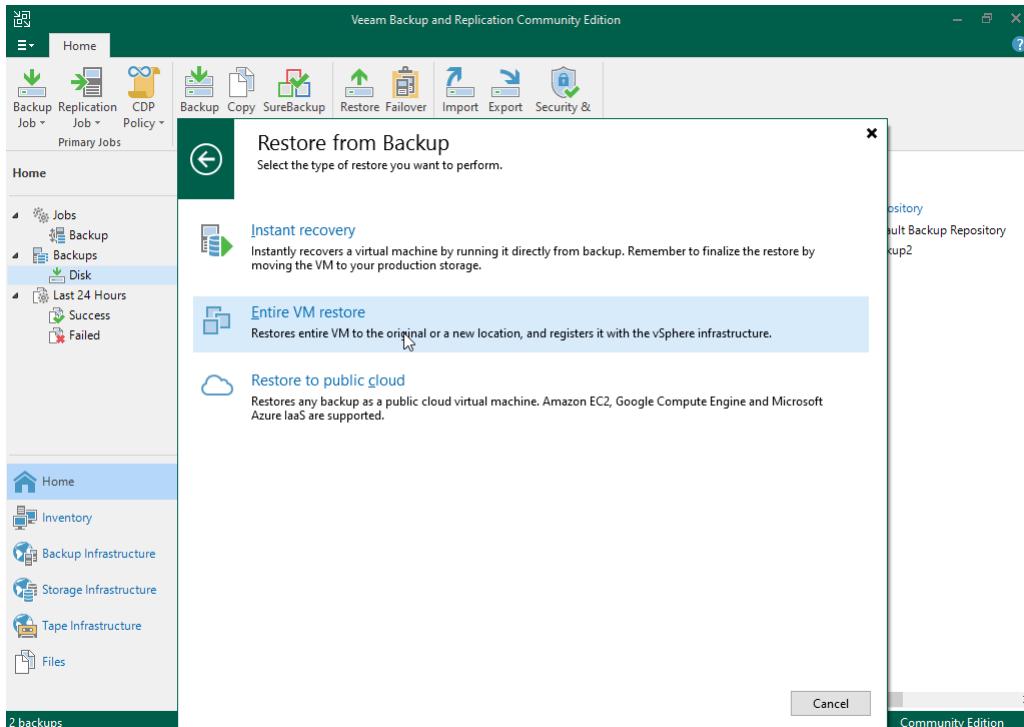
- Figure 41 – Initial Restore screen: source selection (Backup or Replica)**



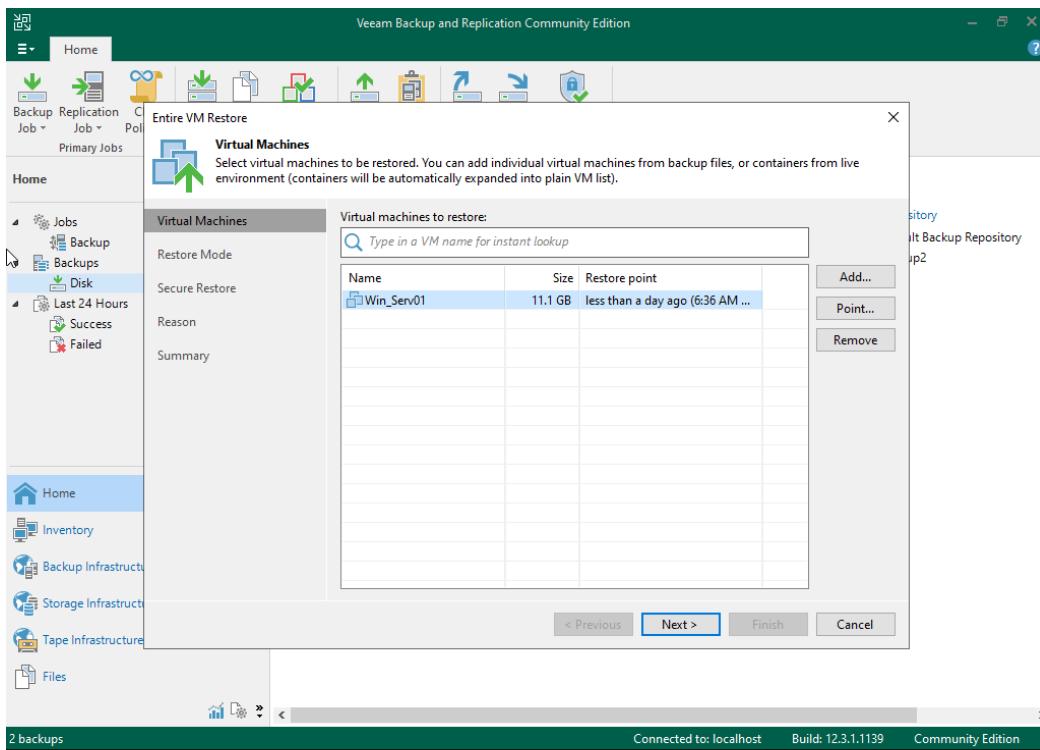
● **Figure 42 – Restore mode selection: Entire VM Restore**



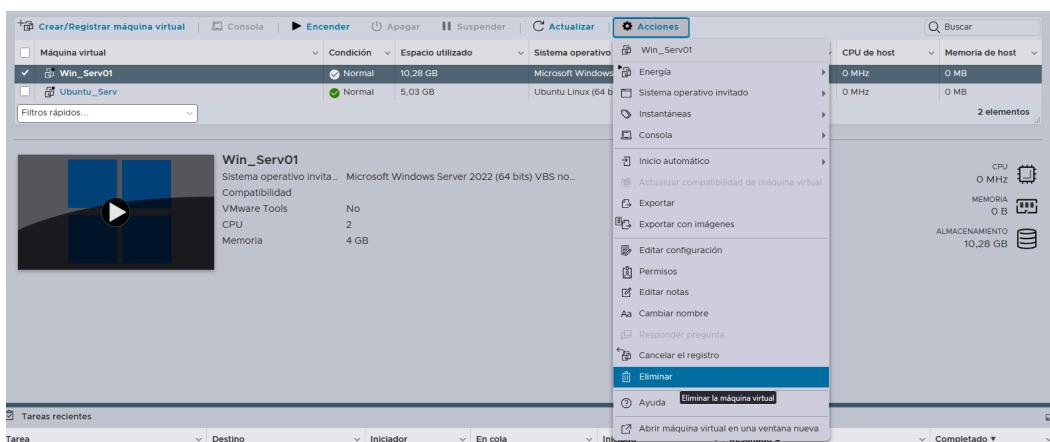
● **Figure 43 – Restore options: Instant Recovery, Entire VM, Public Cloud**



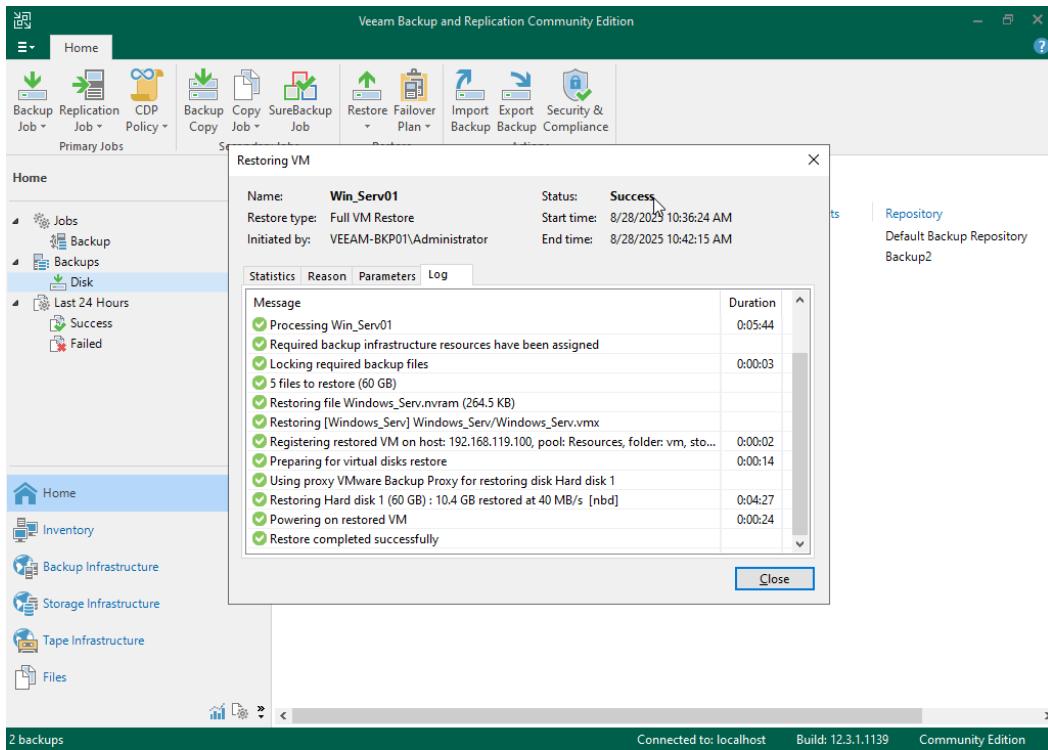
● **Figure 44** – Selection of the backup job for Win-SRV01



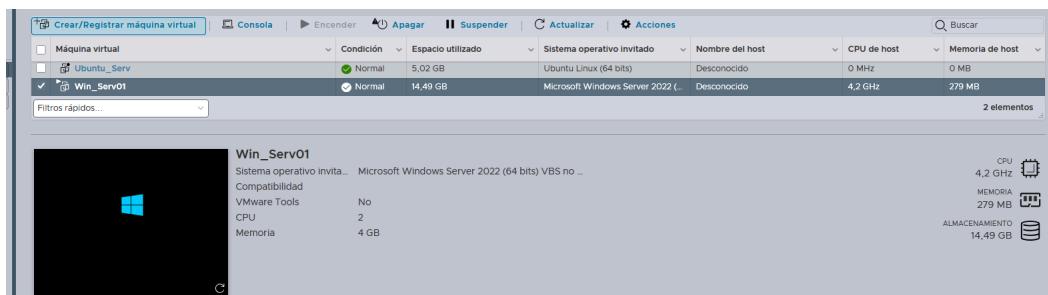
● **Figure 45** – Manual deletion of the VM in ESXi before restore



● **Figure 46** – Restore success confirmation



● **Figure 47** – VM Win-SRV01 restored again in ESXi



5. Advanced Features and Real Scenarios

5.1 Granular Restore of Individual Files

5.1.1 Preparation on Windows Server (Win-SRV01)

- A test text document was created on the VM Win-SRV01:
 - Name: **restore_text.txt**
 - Content: *File restore test text*
 - Location: **C:\Users\Administrator\Documents**
- A new backup job was executed to capture the state with the file created.
- The file was then deleted to simulate a real loss.

5.1.2 Restore on Windows Server

- From the Veeam console, the following was selected:
 - **Restore from a backup > Guest files restore > Microsoft Windows**
- The backup job of Win-SRV01 and the latest restore point were chosen.
- Accessed the **File Level Restore Explorer**.
- Located the *Documents* folder and the deleted file.
- When clicking **Restore**, VM credentials were requested.
- After the restore completed, the VM was powered on and verified:
 - The file **restore_text.txt** reappeared in the Documents folder with its original content.

5.1.3 Preparation on Ubuntu Server (Ubuntu-SRV01)

- A test file was created from the command line:
 - File created with:

```
echo "Test file4FLR - $(date)" > ~/restore test/restore_text.txt
```
 - Content verified with:

```
cat ~/restore test/restore_text.txt
```

- A backup job of **Ubuntu_Serv** was executed.
- After the backup, the file was deleted to simulate data loss.

5.1.4 Restore on Ubuntu Server

- From the Veeam console, the following was selected:
 - **Restore > VMware vSphere > Guest files (Linux and other)**
- The backup job of Ubuntu-SRV01 and the latest restore point were chosen.
- Inside the explorer, the file **restore_text.txt** was restored to its original location.
- Validation was performed by powering on the VM and checking that the file had reappeared correctly.

5.1.5 Real Use Cases

- Recovery of documents accidentally deleted by users
- Point-in-time restore without needing to recover the entire VM
- Access to data for audits or forensic analysis

5.1.6 Issues During the Process

Windows Server:

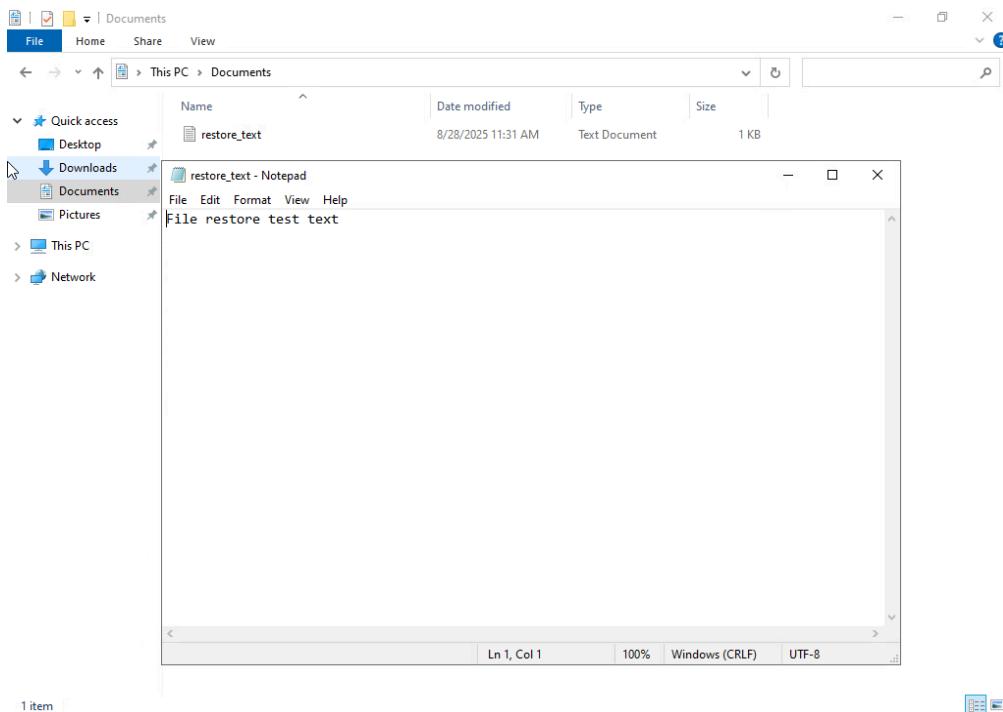
- Initially, authentication errors occurred when entering credentials with only **Administrator**.
- Access was resolved using the format **.\Administrator** with the configured password.

Ubuntu Server:

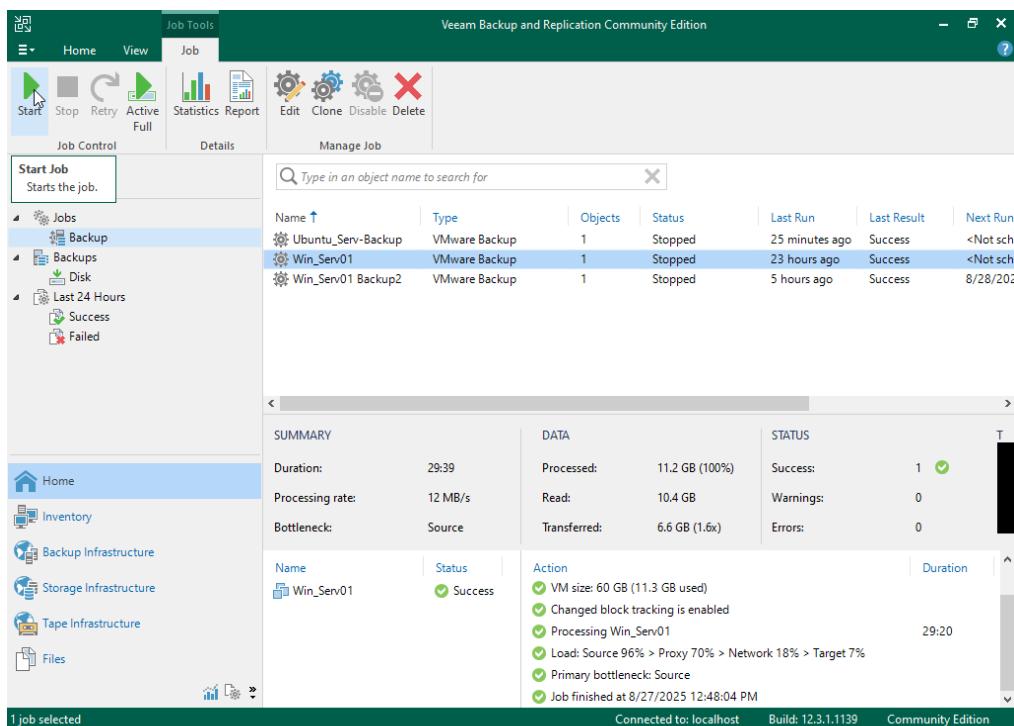
- There were difficulties configuring access credentials.
- It was necessary to enter the server IP along with valid username and password to allow SSH connection and access the Backup Browser.

5.1.7 Process Screenshots

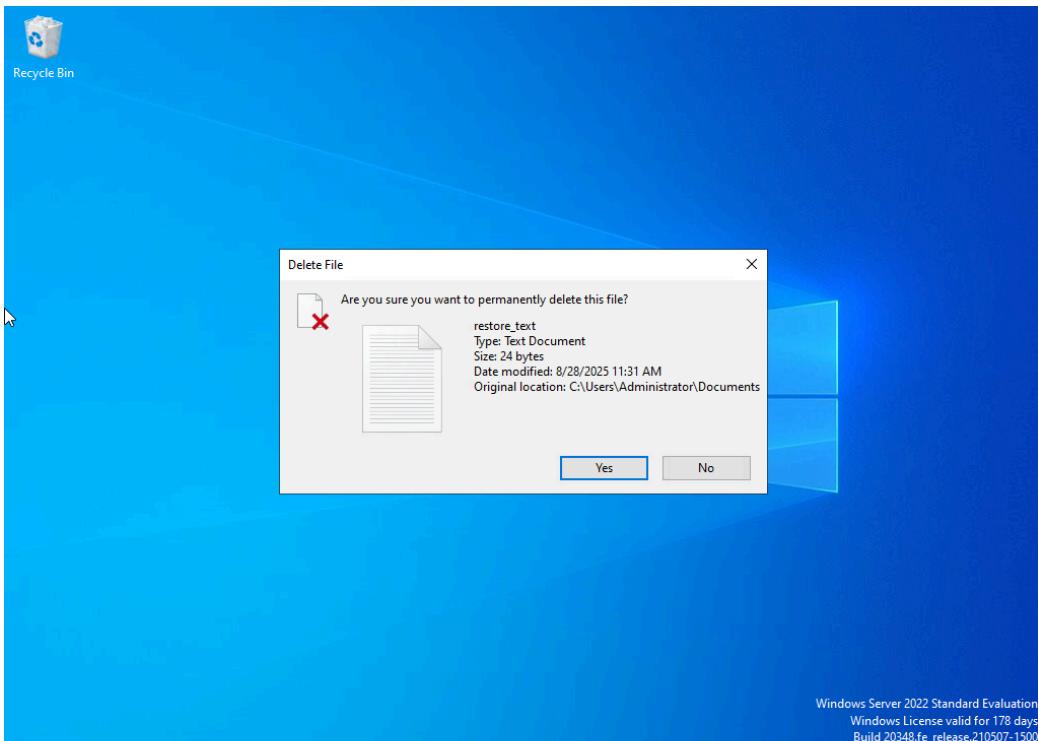
- **Figure 48 – Creation of the test file in Windows Server**



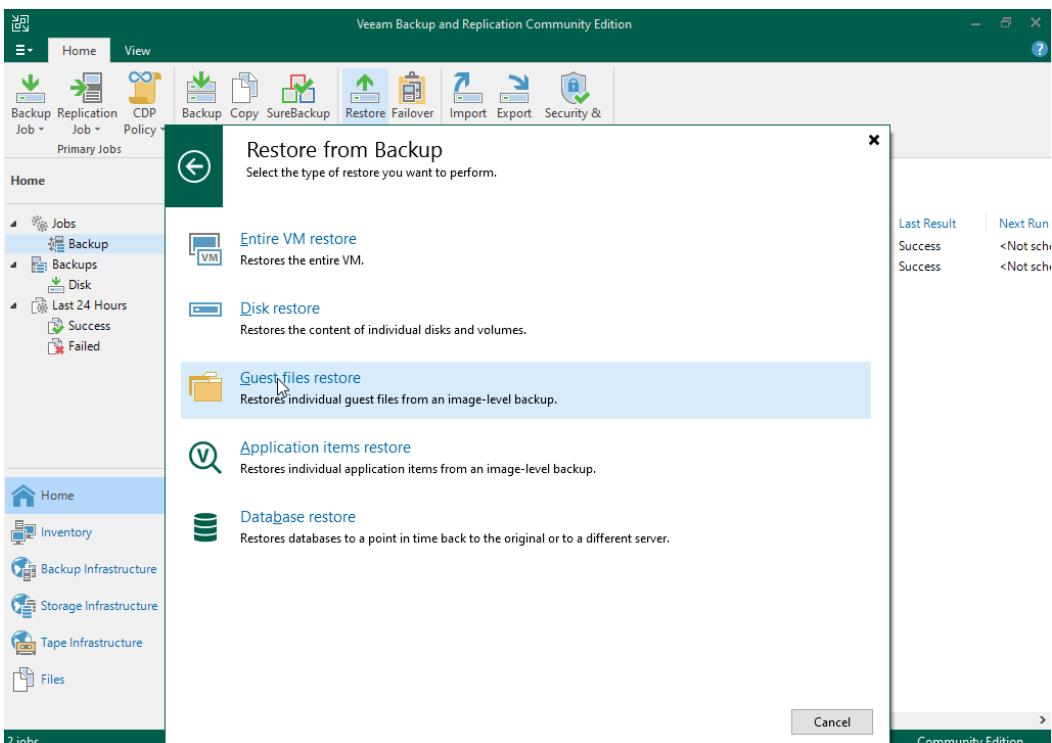
- **Figure 49 – Execution of the backup job prior to deletion**



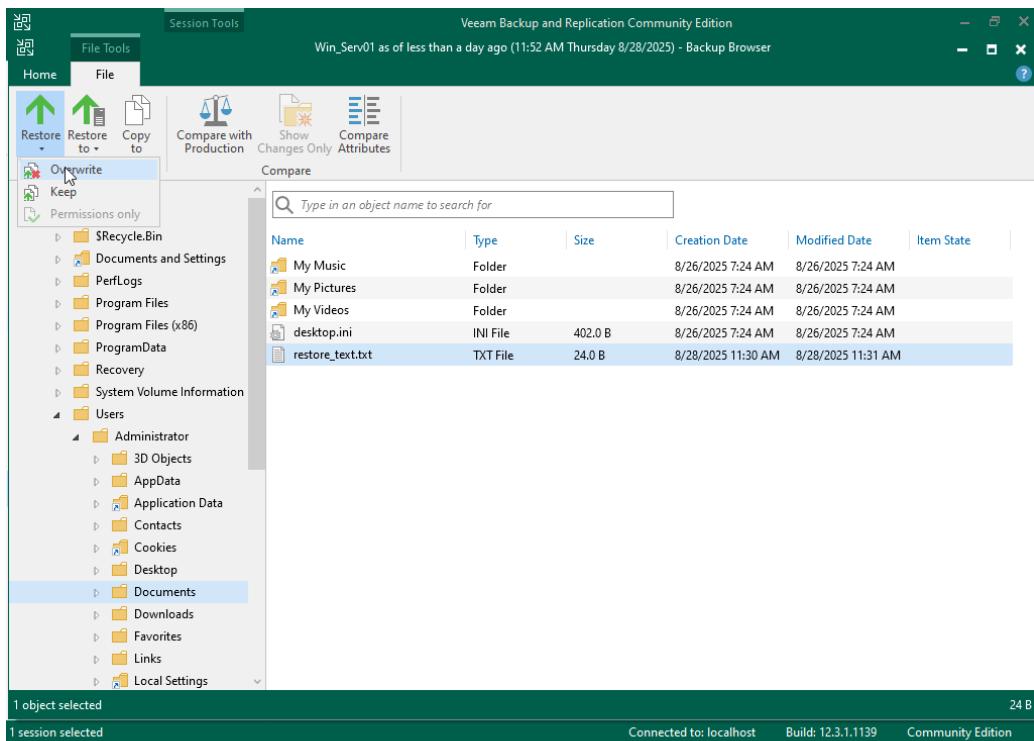
- **Figure 50 – File deletion before restore**



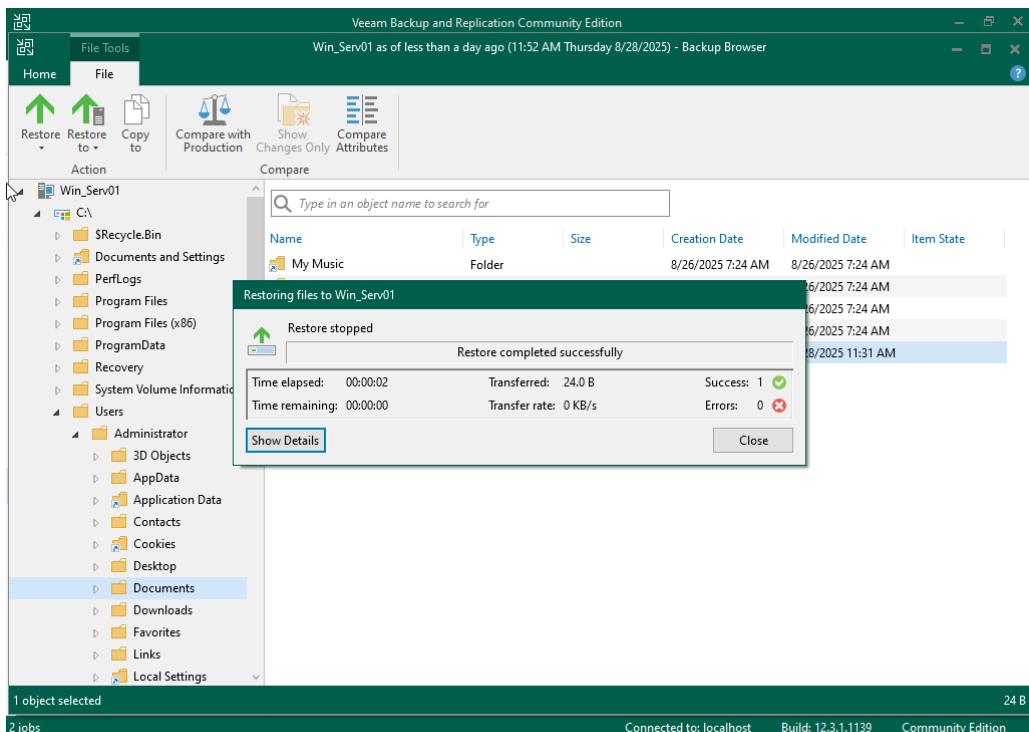
- **Figure 51 – Selection of Guest Files Restore (Windows) in Veeam**



● **Figure 52 – Backup Browser restoring the deleted file**



● **Figure 53 – File restored and validated in Windows Server**



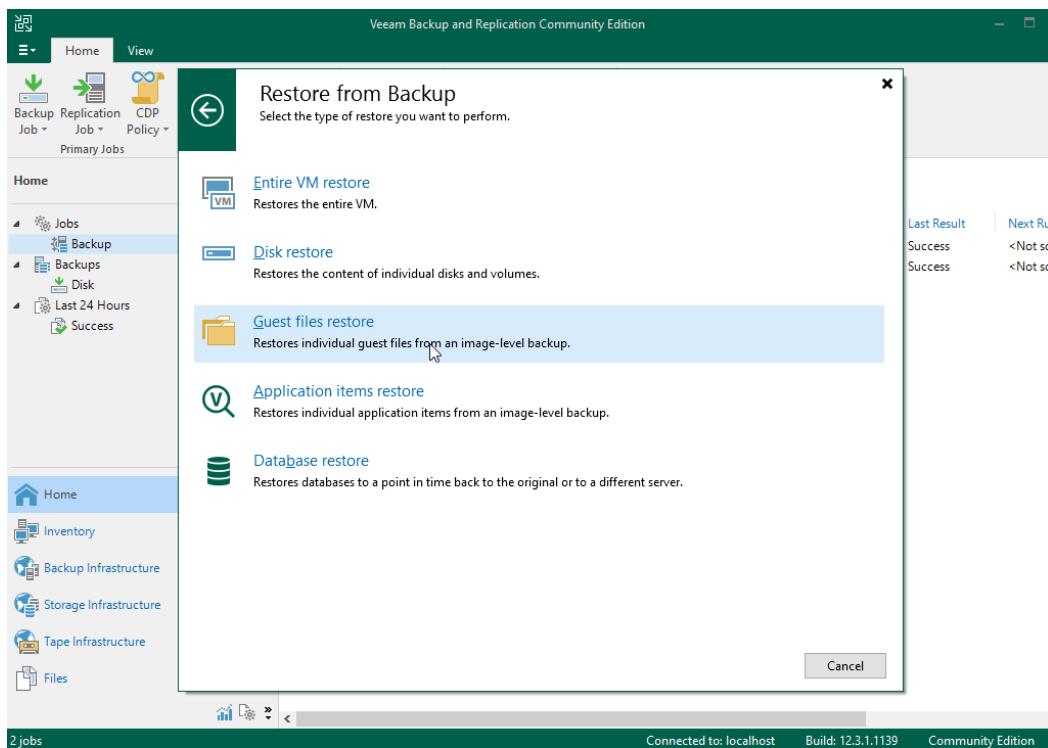
- **Figure 54** – Creation of the test file in Ubuntu Server

```
ubuntu_serv@ubuntuserv:~$ echo "Test file 4FLR - $(date)" > ~/restore_test/restore_text.txt
ubuntu_serv@ubuntuserv:~$ cat ~/restore_test/restore_text.txt
Test file 4FLR - Mon Sep 1 10:55:17 UTC 2025
ubuntu_serv@ubuntuserv:~$ _
```

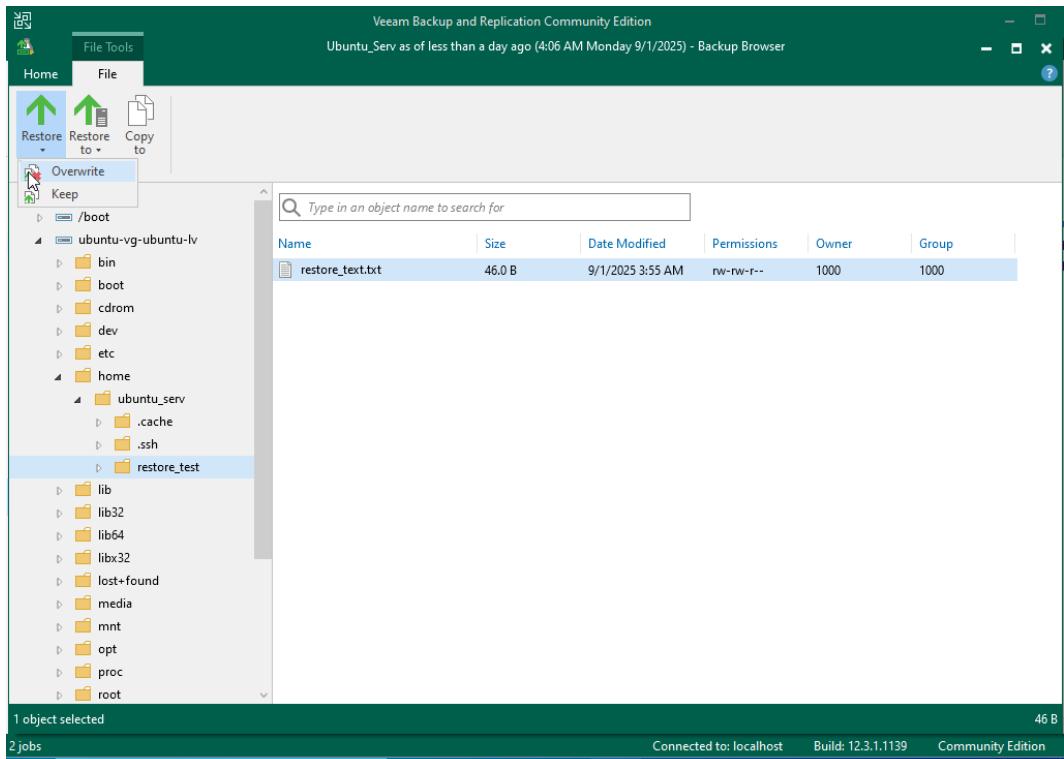
- **Figure 55** – File deletion before restore

```
ubuntu_serv@ubuntuserv:~$ rm -f ~/restore_test/restore_text.txt
ubuntu_serv@ubuntuserv:~$ ls -l ~/restore_test
total 0
```

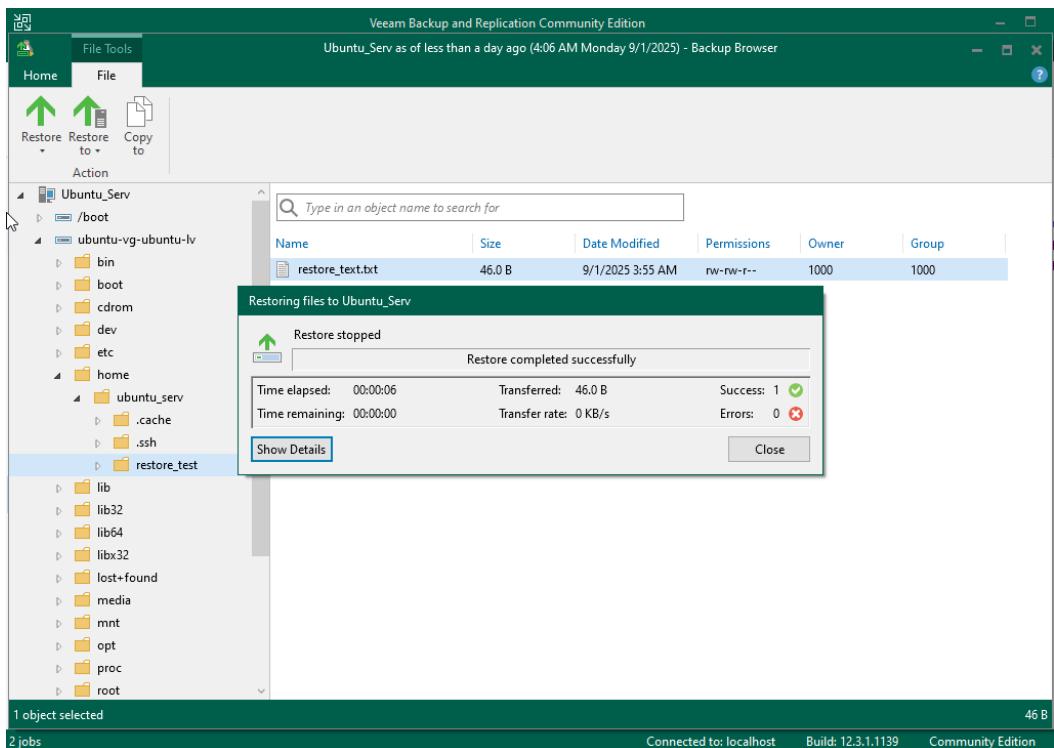
- **Figure 56** – Selection of Guest Files Restore (Linux) in Veeam



● **Figure 57** – Backup Browser showing the deleted file in Ubuntu



● **Figure 58** – File restored and validated in the Ubuntu VM



5.2 Instant VM Restore

5.2.1 Access Instant Recovery

- From the Veeam console, the following was selected:
Home → Restore → Restore from Backup → Instant VM Recovery

5.2.2 Select Restore Point

- The **Instant VM Recovery wizard** was opened.
- The target VM was selected (Win-SRV01 and later Ubuntu-SRV01).
- The most recent restore point was chosen.
- Clicked **Next**.

5.2.3 Configure Recovery Mode

- Initially, the option **Restore to a new location** was attempted, but the process returned an error.
- Finally, **Restore to the original location** was selected.
- Alternative names were assigned to differentiate (Win_SRV01-Instant, Ubuntu_SRV01-Instant).
- The option **Connect VM to network** was left unchecked to avoid network conflicts.

5.2.4 Resource Selection

- Configuration applied:
 - VM Folder: vm
 - Resource Pool: Resources
 - Datastore: datastore1
 - Connect VM to network: disabled

5.2.5 Start the Restore

- Clicked **Finish** to start the operation.
- Veeam mounted the backup disks as a VM ready to run.
- The operation appeared in the console as *In Progress*.

5.2.6 Result

- The restore completed successfully for both Win-SRV01 and Ubuntu-SRV01, validating the procedure.

5.2.7 Real Use Cases

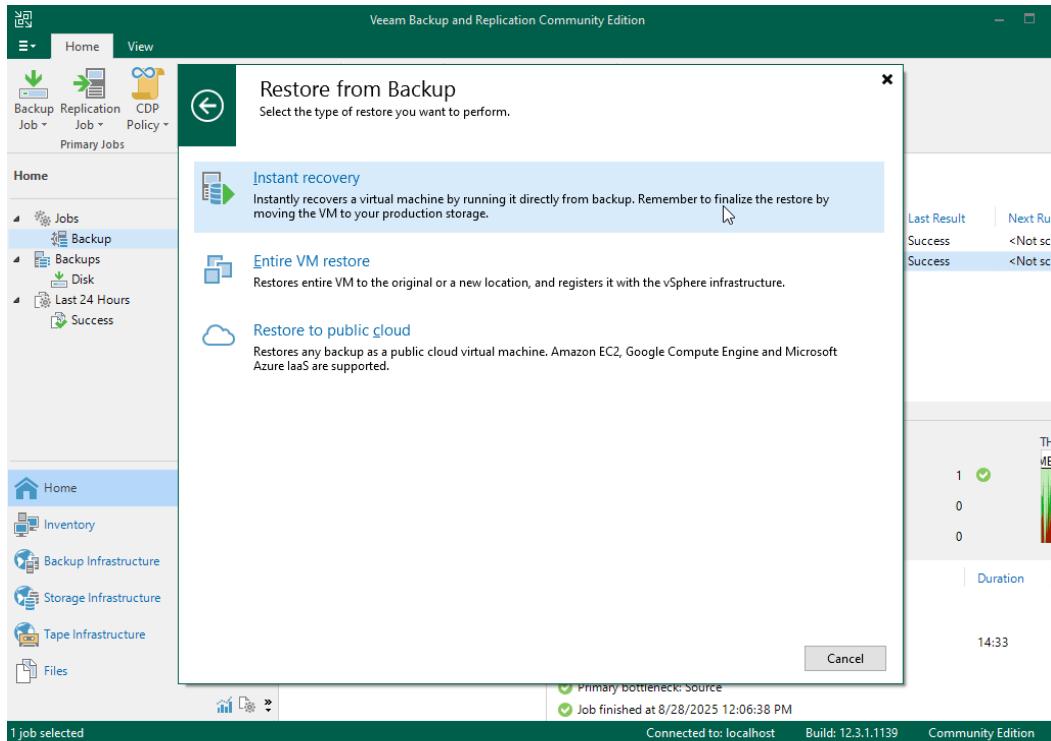
- Recover critical services in minutes in case of production failure
- Perform fast recovery tests without restoring the entire VM
- Simulate failures and analyze incidents in parallel to production

5.2.8 Issues During the Process

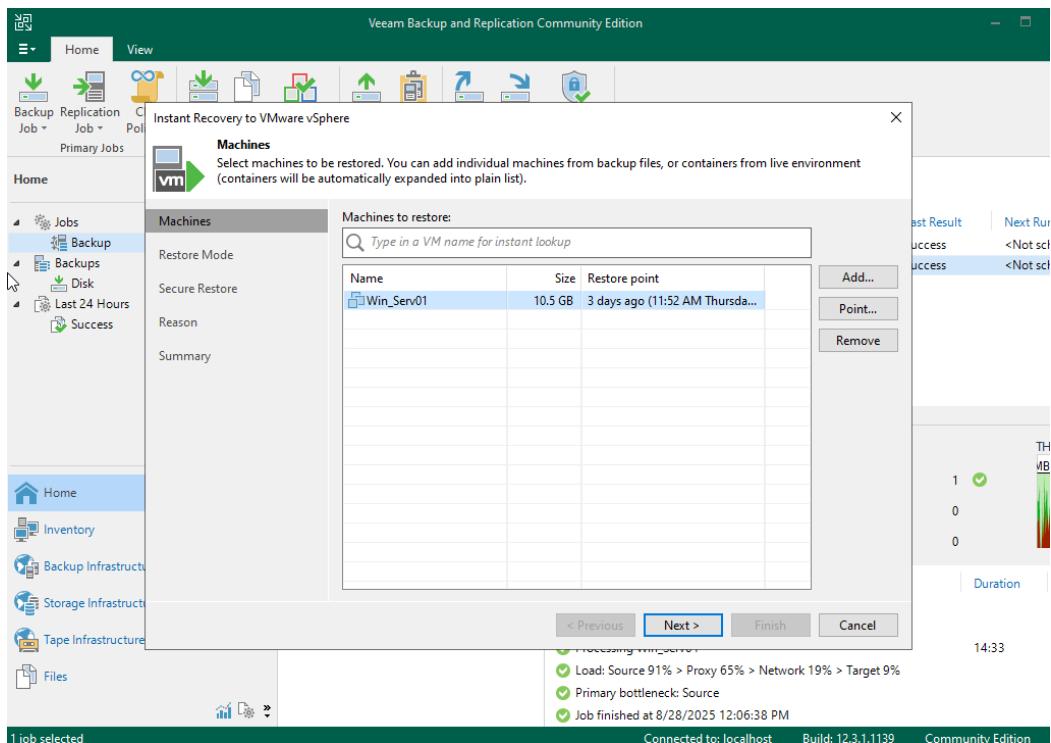
- The attempt with **Restore to a new location** failed, likely due to nested environment limitations and network/IP conflicts.
- It was resolved by selecting **Restore to the original location**.
- As a preventive measure, the restored VMs were kept disconnected from the network adapter until conflicts were ruled out.

5.2.9 Process Screenshots

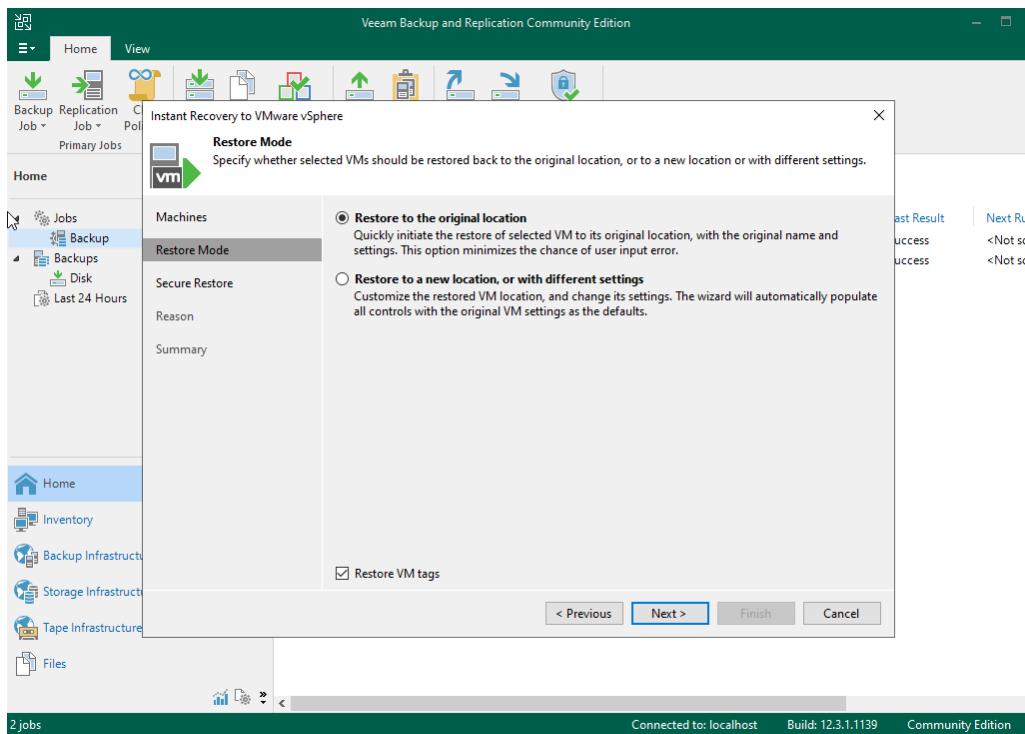
- **Figure 59 – Selection of Instant VM Recovery in the Restore menu**



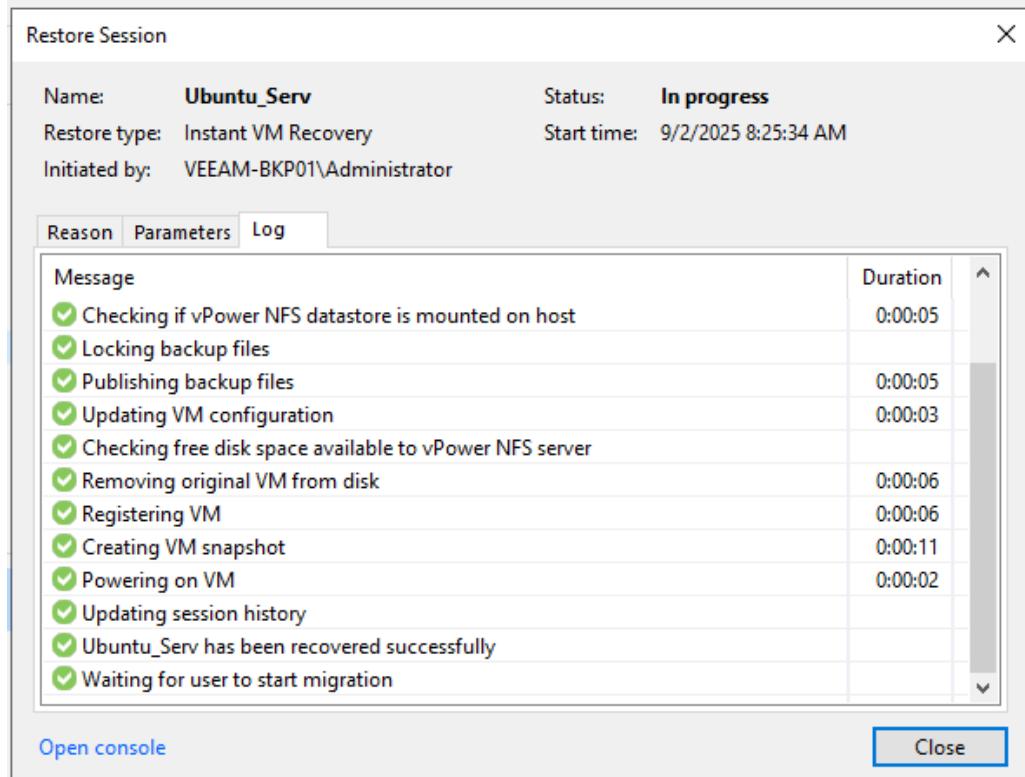
- **Figure 60 – VM and restore point selection**



- **Figure 61 – Destination configuration in the wizard**



- **Figure 62 – Process progress displayed in the console**



- **Figure 63 – Confirmation of successful instant restore**

The screenshot shows the Veeam Backup and Replication Community Edition software interface. The main window displays a table of backup and restore sessions. A search bar at the top right contains the placeholder text "Type in an object name to search for". The table has columns for Job Name, Session Type, Status, Start Time, and End Time. The data in the table is as follows:

Job Name	Session Type	Status	Start Time	End Time
Windows_Serv_Clone (Incr...)	Backup	Success	9/2/2025 10:45 AM	9/2/2025 10:48
Windows_Serv Backup2 (Full)	Backup	Success	9/2/2025 9:38 AM	9/2/2025 9:46 /
Win_Srv01	VM Disk Restore	Success	9/2/2025 9:32 AM	9/2/2025 9:37 /
Windows_Serv_Clone (Full)	Backup	Success	9/2/2025 9:01 AM	9/2/2025 9:07 /
Windows_Serv (Full)	Backup	Success	9/2/2025 8:50 AM	9/2/2025 8:56 /
Win_Srv01	Full VM Restore	Success	9/2/2025 8:39 AM	9/2/2025 8:43 /
Ubuntu_Serv	Full VM Restore	Success	9/2/2025 8:32 AM	9/2/2025 8:37 /
Ubuntu_Serv	Instant VM Recovery	Success	9/2/2025 8:25 AM	9/2/2025 8:28 /
Win_Srv01	Instant VM Recovery	Success	9/2/2025 8:25 AM	9/2/2025 8:28 /
Ubuntu_Serv	Instant VM Recovery	Success	9/2/2025 7:50 AM	9/2/2025 8:22 /
Win_Srv01	Instant VM Recovery	Success	9/2/2025 7:17 AM	9/2/2025 7:48 /

The left sidebar shows navigation links: Home, Inventory, Backup Infrastructure, Storage Infrastructure, Tape Infrastructure, and Files. The status bar at the bottom indicates "Connected to: localhost", "Build: 12.3.1.1139", and "Community Edition".

5.3 Clone a Job for Test Scenarios or Policy Changes

5.3.1 Access the Job List

- From the Veeam console, navigated to **Home > Jobs > Backup**.
- Located the existing job for the Win-SRV01 server.

5.3.2 Clone the Job

- The job was selected, and in the top bar, **Clone** was chosen.
- Initially, the name **Win_SRV01 Backup_Clone1** was assigned.

5.3.3 Adjust Parameters of the Cloned Job

- No additional technical parameters needed modification.
- After cloning, the job was renamed **Win_SRV01 Backup_Clone** to maintain naming consistency.

5.3.4 Execute the Cloned Job

- The cloned job was launched manually from the Veeam console.
- It was verified that it executed correctly, generating its own restore points independently of the original job.

5.3.5 Result

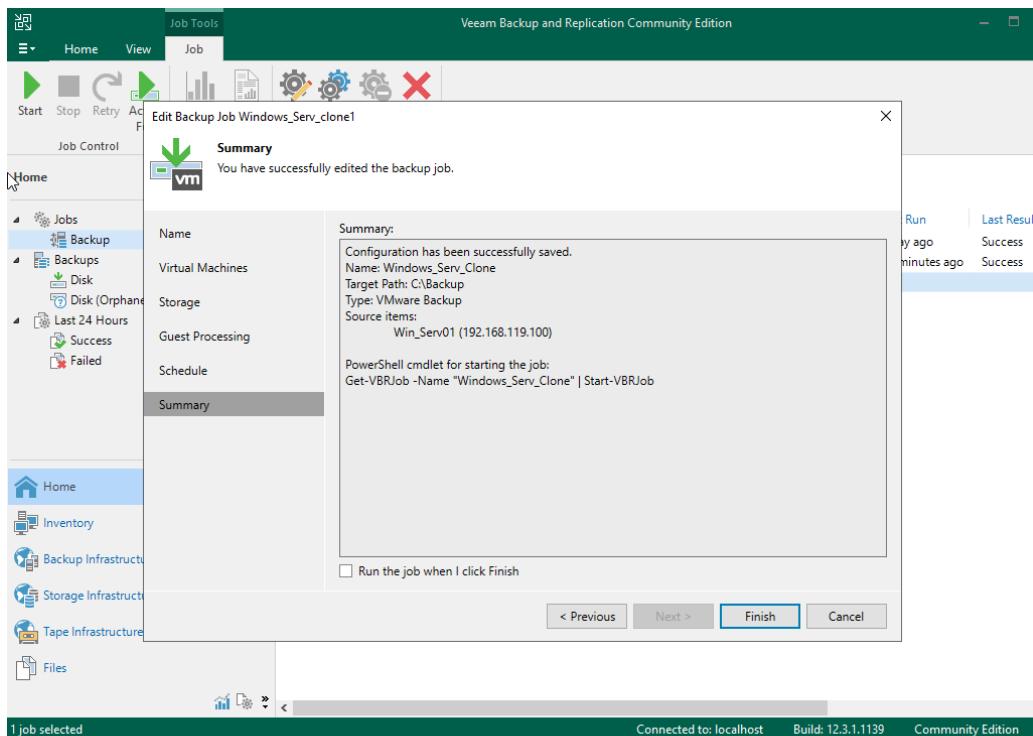
- The cloning and execution process completed successfully.
- It was validated that the cloned job did not interfere with the original job and functioned as a fully operational copy.

5.3.6 Process Screenshots

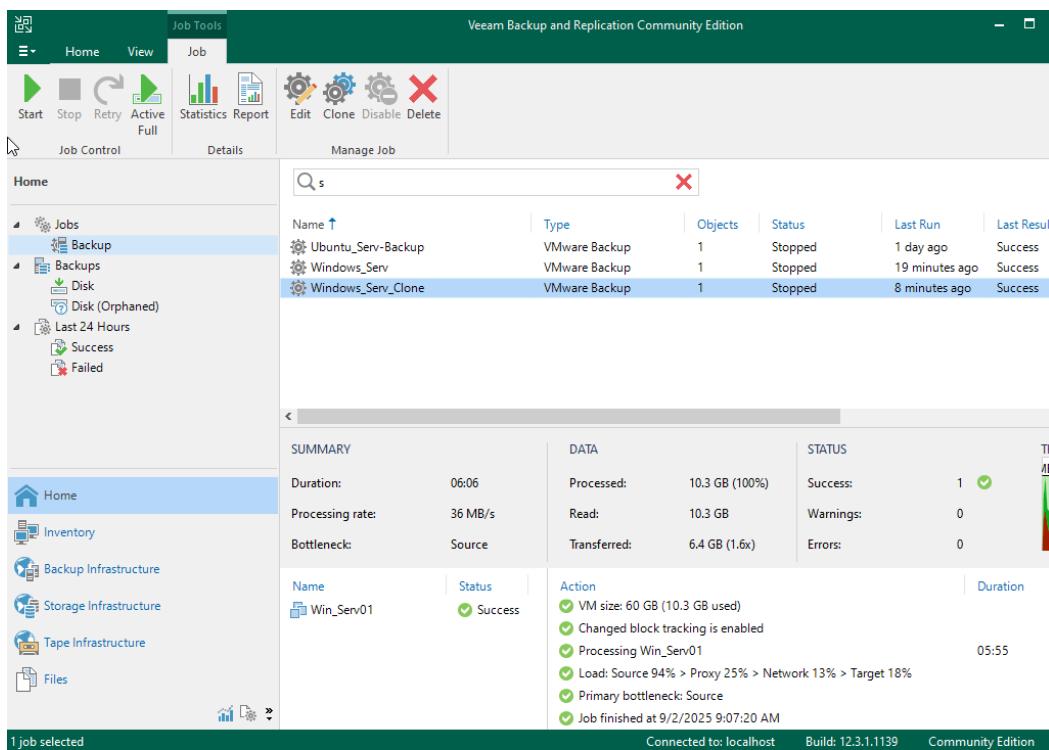
- **Figure 64 – Job list and clone option**

The screenshot shows the Veeam Backup and Replication Community Edition software interface. The main window displays a list of jobs under the 'Jobs' category. Two jobs are visible: 'Ubuntu_Serv-Backup' and 'Win_Serv01 Backup'. Both are listed as 'VMware Backup' type, with 1 object and a status of 'Stopped'. The 'Last Run' column shows '1 day ago' for the first and '4 days ago' for the second. The 'Last Result' column shows 'Success' for both. A 'Clone' dialog box is overlaid on the interface, containing the text 'Creates a disabled clone of the selected job.' Below the dialog, there is a table with columns for Name, Type, Objects, Status, Last Run, Last Result, and Next Run. The table shows the same two backup jobs. At the bottom of the interface, there is a summary table with columns for Duration, Processing rate, and Bottleneck. The summary table shows a duration of 14:49, a processing rate of 14 MB/s, and a bottleneck of 'Source'. There is also a detailed log table showing various actions taken during the backup process, such as VM size, changed block tracking, and processing progress. The bottom right corner of the interface shows the build number 'Build: 12.3.1.1139' and the 'Community Edition' label.

● **Figure 65 – Cloned job configuration**



● **Figure 66 – Manual execution of the cloned job and result validation**



5.4 Restore from Alternative Points: Virtual Disks (Virtual Disk Restore)

5.4.1 Access the Existing Backup

- From the Veeam console, navigated to **Home > Backups > Disk**.
- A previous backup of the Win-SRV01 virtual machine was selected.

5.4.2 Select Restore Type

- In the top bar, the option **Restore Virtual Disk** was chosen.
- The disk restore wizard opened, requiring only the selection of the disk to recover and confirmation of the operation.

5.4.3 Restore Configuration

- The most recent restore point was selected.
- In the **Disk Mapping** section, default parameters were kept.
- In **Restore Disk Type**, the option **Thin** was chosen (format that consumes space based on actual VM usage).

5.4.4 Confirmation and Execution

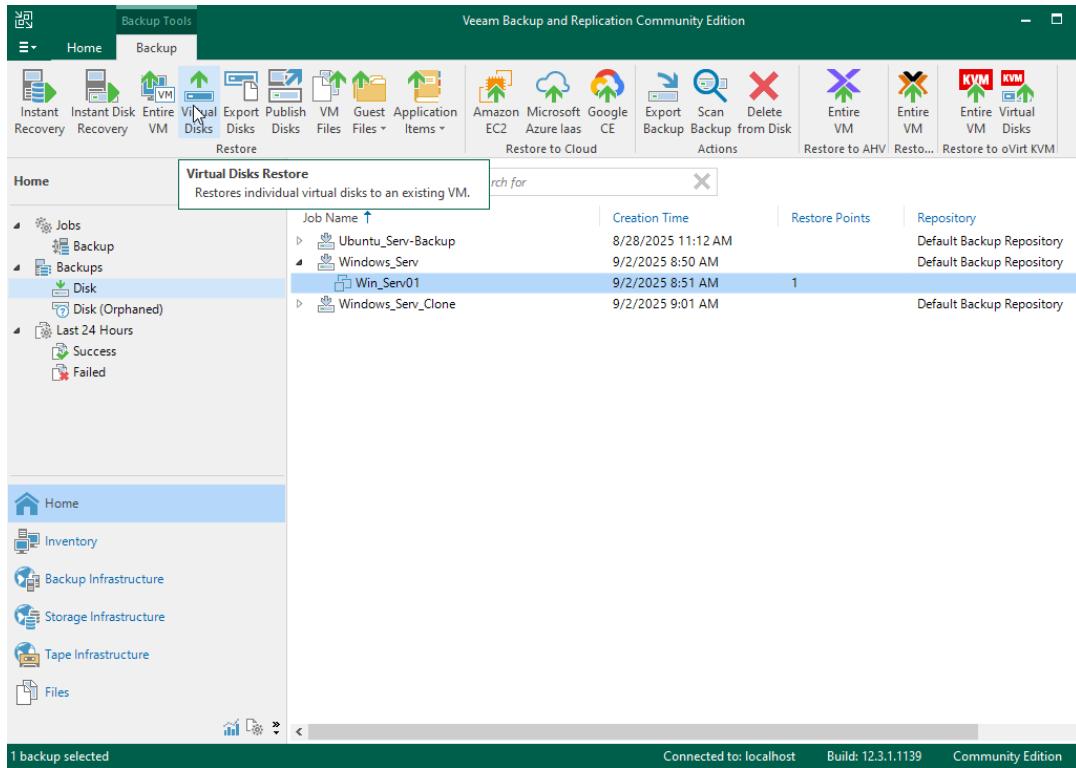
- The wizard warned that the process would overwrite the VM's current disk.
- The replacement was accepted and the restore was initiated.
- The process completed successfully, replacing the VM's disk with the content of the selected backup.

5.4.5 Result

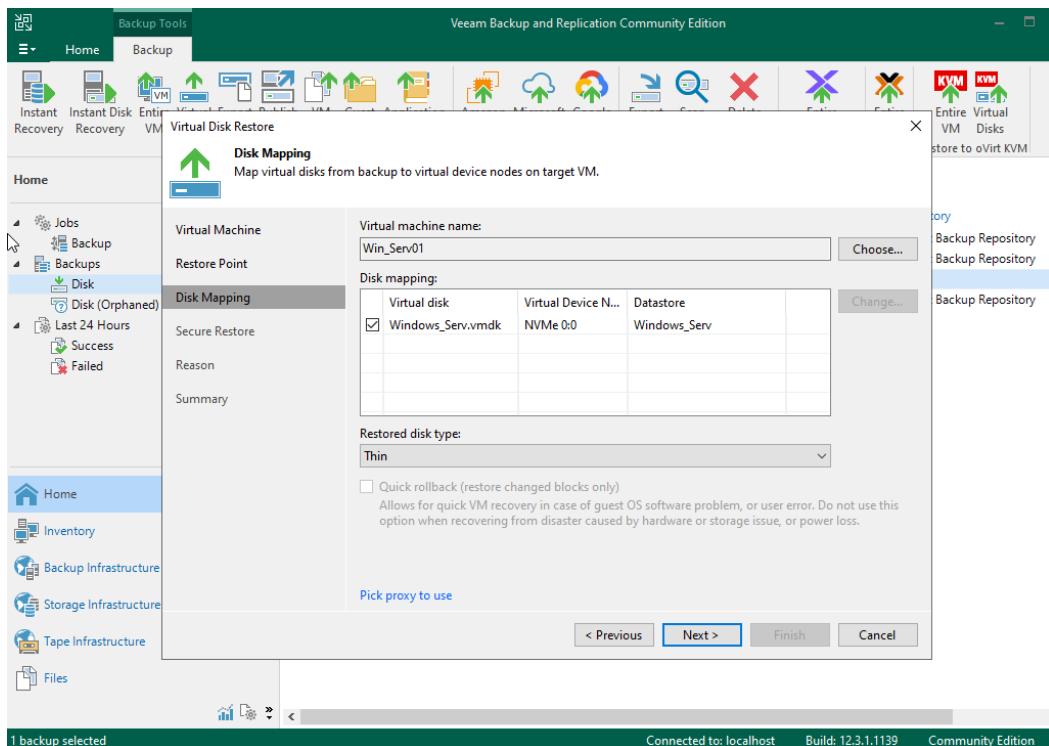
- The virtual machine was successfully restored from the backup disk.

5.4.6 Process Screenshots

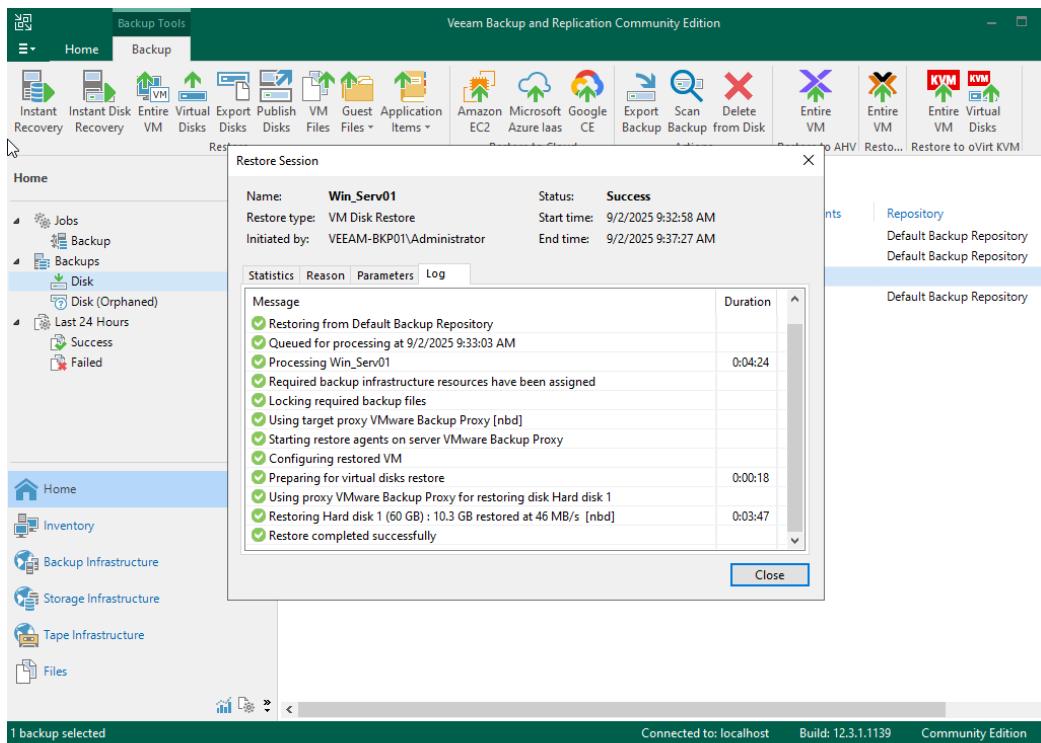
- **Figure 67 – Restore Virtual Disk option in the action bar**



- **Figure 68 – Restore point and Thin disk type configuration**



● **Figure 69** – Confirmation of successful restore completion



5.5 Other Useful Features in Real Environments

5.5.1 Backup Encryption

- The AES-256 encryption feature available in backup jobs was applied.
- Configuration: **Job Settings > Storage > Advanced > Storage**
- An encryption key was defined to protect information at rest.
- This measure is especially useful in environments with sensitive or regulated data.

5.5.2 Backup Compression

- The available compression levels were reviewed:
 - None: no compression
 - Dedupe-friendly: for deduplication repositories
 - Optimal: balance between performance and size (used in this lab)
 - High / Extreme: maximum compression with higher CPU usage
- All backups were executed with **Optimal** as the default value.

5.5.3 Post-Job Custom Scripts

- The option to run automated scripts after a backup was explored.
- Configuration: **Job Settings > Storage > Advanced > Scripts**
- Common use cases:
 - Email notification
 - Additional copies to another location
 - Integration with monitoring systems

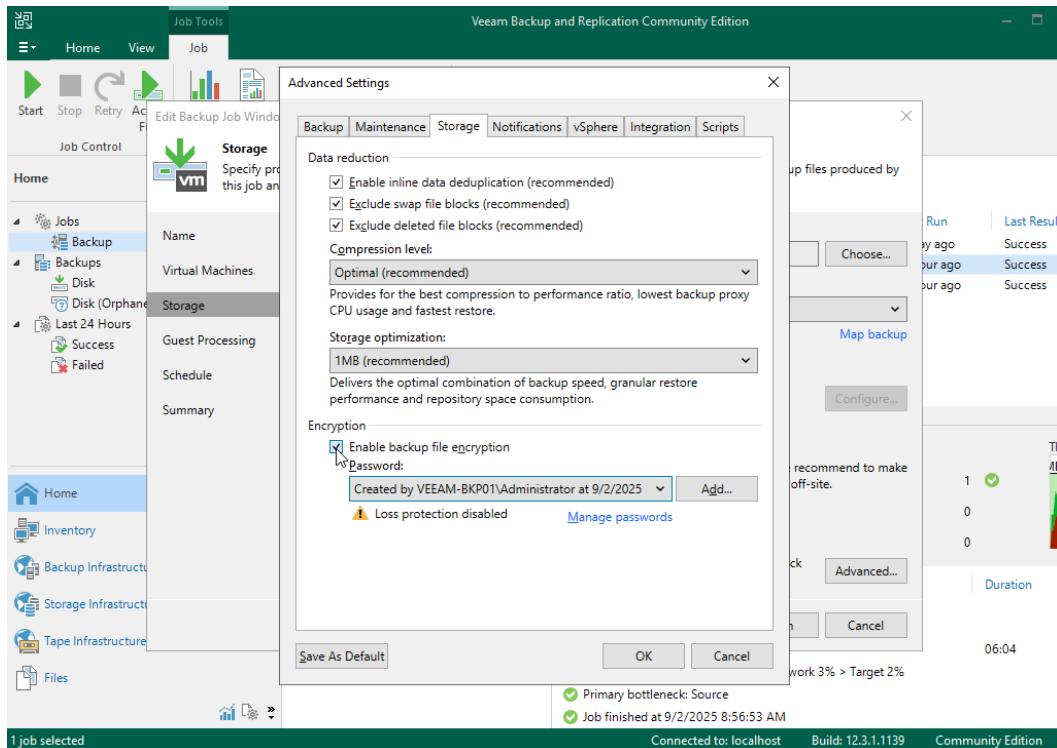
5.5.4 Backup Health Check

- The option to enable integrity checks for backups was verified.

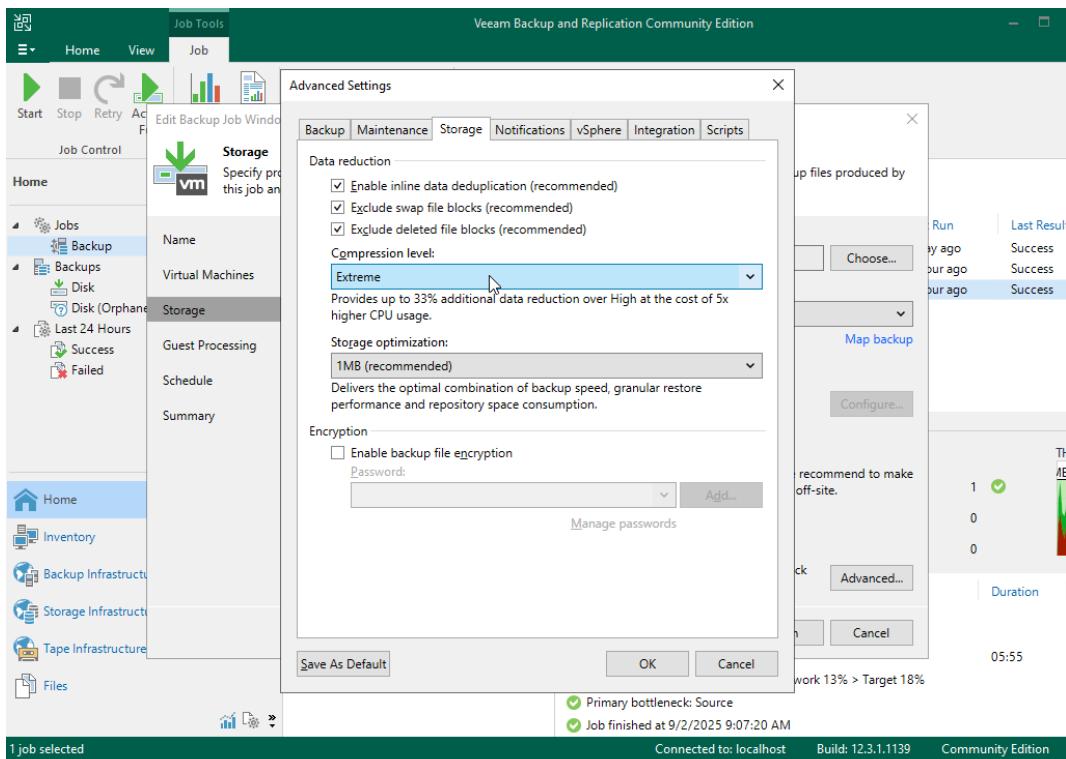
- Configuration: **Job Settings > Storage > Advanced > Maintenance**
- This feature validates that backup files are not corrupted and ensures restore points remain usable in the future.

5.5.5 Process Screenshots

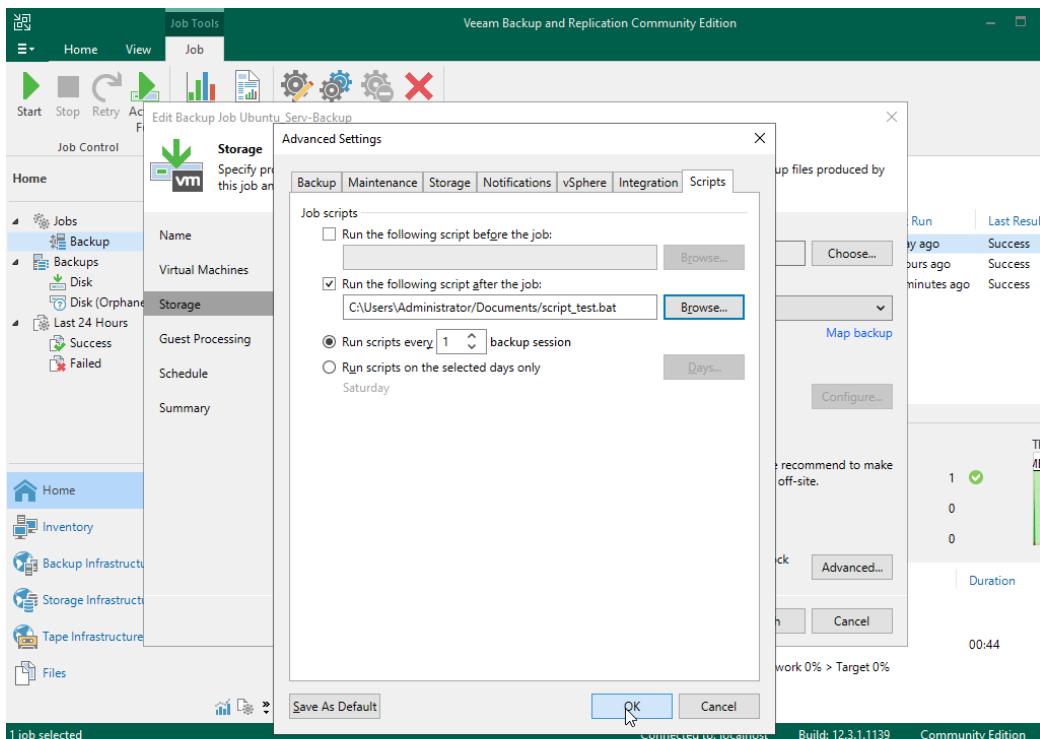
- **Figure 70 – Encryption configuration in Storage > Advanced**



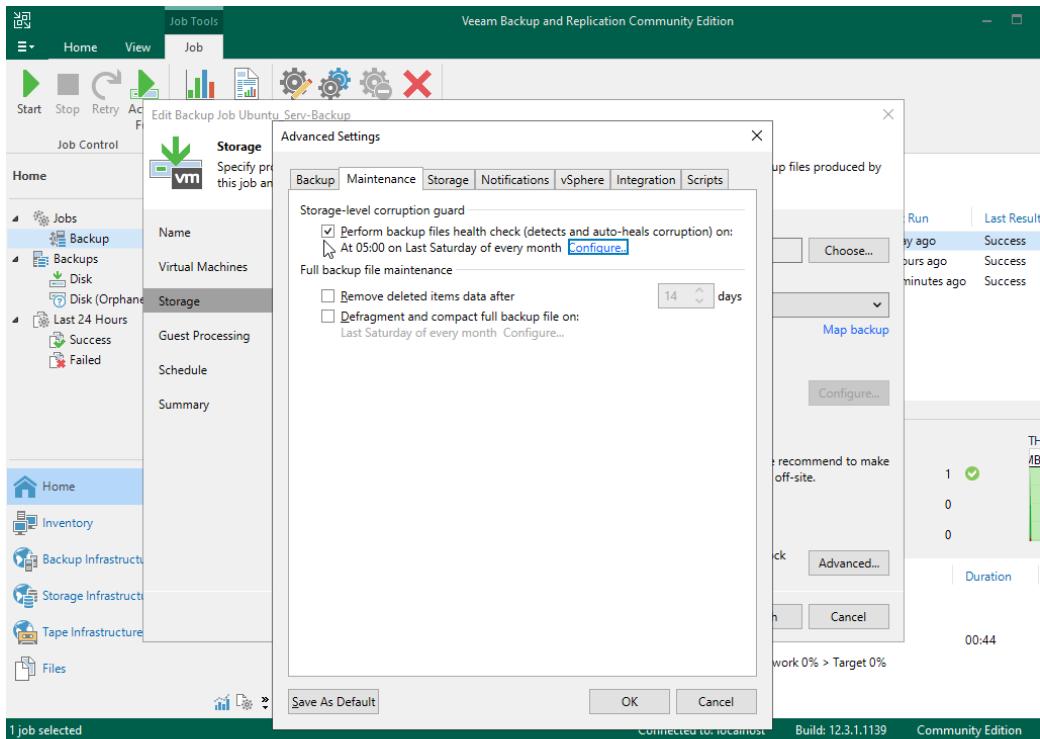
● **Figure 71 – Compression level selection (Optimal)**



● **Figure 72 – Post-job script configuration section**



- **Figure 73 – Health Check option in Storage > Maintenance**



5.5.6 Features Not Executed in This Lab

Due to license or resource limitations, the following features could not be executed, though they are documented as reference:

- **SureBackup**: automated backup validation in an isolated environment. Reviewed theoretically, not executed as it requires Virtual Lab and Application Group.
- **Immutability**: immutable backup retention to protect against accidental deletion or ransomware. Not available in this environment as it requires Linux Hardened or S3 repositories.
- **Veeam ONE**: centralized monitoring and reporting of the backup environment. Not implemented in this lab due to resource limitations.

6. Conclusions, Lessons Learned, and Possible Improvements

6.1 General Conclusions

This lab allowed the deployment and validation of a backup and recovery solution based on **Veeam Backup & Replication 12.3.1.1139** on a virtualized environment with **VMware ESXi**.

Throughout the project, the following milestones were achieved:

- Installation and configuration of Veeam from scratch on a Windows server
- Incorporation of the ESXi host as protected infrastructure
- Creation and execution of backup policies on different virtual machines
- Full, instant, and granular restores of individual files
- Execution of job cloning tests and virtual disk restores
- Validation of best practices in repository storage management

Beyond the technical aspect, the lab demonstrated a business continuity-oriented approach: simulating data loss scenarios, recovering services in a controlled manner, and documenting a repeatable procedure provide direct value to any organization.

6.2 Key Lessons Learned

The project provided both technical and methodological insights:

- Deployment and basic operation of **Veeam Backup & Replication 12.3.1.1139**
- Integration of a VMware environment with a professional backup solution
- Backup and restore types (full, incremental, granular, instant) and their use cases
- Backup integrity verification and its importance in contingency planning
- Strategies to optimize space and performance in backup environments
- Relevance of technical documentation as part of a **Disaster Recovery Plan (DRP)**

6.3 Possible Improvements and Future Steps

The current environment meets the initial objectives, but there are clear lines of evolution that would add value in a corporate context:

- Implement a **Virtual Lab** to put **SureBackup** into practice
- Simulate adverse scenarios (attacks, data corruption) to validate system resilience
- Integrate **Veeam ONE** for advanced monitoring and compliance reporting
- Expand the lab with a second host and shared storage (NAS, iSCSI) to test high availability
- Extend the model to **cloud environments (Azure, AWS)** and validate hybrid backup policies
- Explore deployment automation with tools like **Ansible or Terraform**
- Design long-term retention and regulatory compliance tests (e.g., GDPR)

6.4 Final Closure

The project demonstrated that even in a lab with limited resources, it is possible to realistically simulate critical backup and recovery processes in an enterprise environment.

The experience gained validates both the technical capability to deploy and operate **Veeam Backup & Replication**, and the business continuity-oriented vision:

- **Risk reduction**: full and granular restores ensure recovery from VM failures or accidental deletions
- **Operational efficiency**: repository and backup policy configuration optimizes use of available storage
- **Future scalability**: unexecuted features (SureBackup, Immutability, Veeam ONE) are identified as the natural evolution toward corporate environments

This lab therefore constitutes a solid foundation to transfer the practices learned to production scenarios, where the direct impact translates into greater resilience, service continuity, and confidence in enterprise data protection.

7. Index of Screenshots and Final References

7.1 Lab Screenshots

This section groups the numbered screenshots referenced throughout the project.

- **Figure 1–10:** Environment preparation, folder structure, and creation of initial VMs
- **Figure 11–20:** Creation of the Veeam-BKP01 VM and deployment of the ESXi host
- **Figure 21–30:** Veeam installation and initial configuration
- **Figure 31–50:** Repository creation and backup job execution
- **Figure 51–65:** Full VM Restores, Instant Recovery, and File-Level Restore (FLR)
- **Figure 66–73:** Advanced features (job cloning, Virtual Disk Restore, encryption, compression, and scripts)

Note: screenshots are already integrated in their respective sections; this index serves only as a general reference.

7.2 Resources Used

Main Software

- Veeam Backup & Replication 12.3.1.1139 (Community Edition)
- Windows Server 2022 (Evaluation Edition)
- VMware ESXi 8.0 and VMware Workstation Pro
- Ubuntu Server 22.04 LTS

Documentation and Community

- Official Veeam documentation (Helpcenter and Knowledge Base)
- Technical forums (Veeam Community, r/Veeam, r/sysadmin)
- YouTube – technical channels (e.g., Veeam Software, Homelab Academy)

7.3 Additional Notes

- The lab was built on a personal computer, optimizing resources (CPU, RAM, storage).
- Some advanced features could not be executed due to license limitations (SureBackup, Immutability, Veeam ONE), but were documented to demonstrate theoretical knowledge.
- The importance of snapshots and disk space management was confirmed to avoid lockups during testing.