Installing Proxmox VE on Lenovo ThinkSystem Servers

Planning / Implementation

Overview

Proxmox Virtual Environment (VE) is a comprehensive, open-source server platform for enterprise virtualization, built to address the performance and scalability demands of modern IT environments. When deployed on Lenovo ThinkSystem infrastructure, it delivers tight integration of the KVM hypervisor for running Windows and Linux virtual machines (VMs), alongside Linux OS Containers (LXC) for lightweight container-based workloads. It also includes built-in software-defined storage via Ceph and virtualized networking capabilities consolidated within a single management framework.

The integrated, web-based user interface provides centralized control, allowing administrators to manage compute resources, configure high availability (HA) resources, and perform backup and disaster recovery operations with ease.

Lenovo ThinkSystem servers enhance Proxmox VE deployments through Lenovo XClarity Controller (XCC), which delivers integrated out-of-band hardware-level management features such as remote power control, remote control & administration, advanced monitoring & alerting, and OS watchdog functionality. This enables a complete, end-to-end solution from bare-metal to full virtualization management.

Use Cases for Proxmox on Lenovo ThinkSystem

Proxmox VE is well-suited to a variety of enterprise and institutional IT environments. When deployed on Lenovo ThinkSystem infrastructure, it offers a powerful combination of reliability, performance, scalability, and cost-efficiency.

Small and Medium-Sized Enterprises (SMEs)

Organizations seeking a high-value virtualization solution with minimal licensing overhead will benefit from Proxmox VE's integrated hypervisor, storage management, container support, and backup capabilities, all delivered through an intuitive management interface.

Educational Institutions and Research Labs

Ideal for teaching, development, and testing environments, Proxmox VE provides a flexible platform for rapid deployment of virtual machines and containers. Its open-source model supports cost-sensitive institutions requiring advanced functionality without proprietary constraints.

Enterprises with a focus on Open-Source

Enterprises with in-house Linux expertise or a preference for open-source ecosystems will find Proxmox VE aligns well with their IT strategy.

Hardware used for this installation guide

The Lenovo ThinkSystem SR630 V3 server was used for this installation guide and is one of many Lenovo ThinkSystem servers tested for use with Proxmox VE. For the current complete list of Lenovo servers tested with Proxmox, refer to the Lenovopress OS Interoperability Guide (OSIG).

The Lenovo ThinkSystem SR630 V3 is an ideal 2-socket 1U rack server for small businesses up to large enterprises that need industry-leading reliability, management, and security, with maximum performance and flexibility for future growth. The SR630 V3 is designed to handle a wide range of workloads, such as databases, virtualization and cloud computing, virtual desktop infrastructure (VDI), infrastructure security, systems management, enterprise applications, collaboration/email, streaming media, web, and HPC. The server also offers onboard NVMe PCIe ports that allow direct connections for up to 16x NVMe SSDs, for high performance internal storage.

Figure 1. ThinkSystem SR630 V3 Server

The following server hardware configuration was used:

- **Server:** SR630 V3 Machine type 7D73
- **Processor:** Two 5th Generation Intel® Xeon® 6526Y 16C Scalable Processors
- **Memory:** 256GB RAM (8 x 32GB DIMMs p/n# 4X77A88051)
- **Boot Adapter:** M2. SATA/x4 NVMe adapter (p/n# 4Y37A79663, No HW RAID)
- **Boot Drives:** Two M.2 960GB SSD boot drives (p/n# 4XB7A82288)
- **Storage:** Six 3.2TB U.2 NVMe drives (p/n# 4XB7A93128)
- **Networking:** OCP Intel E810-DA4 4 port 10/25GbE NIC (p/n# 4XC7A80269)

Firmware versions:

- UEFI Version: 3.50 ESE132C
- BMC Version: 6.20 ESX344O
- LXPM Version: 4.11 EAL112D

Software version:

- Proxmox VE version 8.4-1

Storage considerations

- Do not use ZFS on top of a hardware RAID controllers which have their own cache management. ZFS needs to communicate directly with the disks.
- For the M.2 boot drives, if HW RAID is desired, it is recommended to use the ThinkSystem M.2 NVMe 2-Bay RAID Adapter or the ThinkSystem M.2 RAID B540i-2i SATA/NVMe Adapter along with a pair of M.2 SATA or NVMe drives.
- Non-boot drives may also be configured with HW RAID controllers such as the 940-8i/16i/32i series and others.
- Generally, Proxmox has a robust SW RAID subsystem with ZFS, therefore HW RAID is optional

Prerequisites and System Requirements

Before deploying Proxmox Virtual Environment (VE) on Lenovo ThinkSystem infrastructure, ensure the following hardware, firmware, and software requirements are met for optimal performance and compatibility.

Hardware Requirements

The following Lenovo ThinkSystem configurations are recommended:

- Server Platform: Lenovo ThinkSystem V3 or higher servers such as the SR630 V3 and SR650 V3
- Processor: Intel Xeon Scalable (3rd Gen or newer) or AMD EPYC processors with virtualization support (VT-x/AMD-V)
- Memory: Minimum 8 GB RAM (16 GB or more recommended, 32GB if using ZFS))
- Storage: One or more SATA, SAS, or NVMe drives; RAID optional
- Network Interface: At least 1x 1GbE NIC (2 or more 10GbE recommended)

Firmware and Management

- Lenovo XClarity Controller (XCC): With Platinum/Premier license key for remote control and virtual media capabilities.
- Update to the latest firmware from Lenovo support (XCC, UEFI, LXPM)

UEFI Setup

- The following settings can be accessed through LXPM by pressing F1 during the initial system boot (UEFI POST Setup)

- UEFI Setup: Recommended boot mode; disable Secure Boot during installation

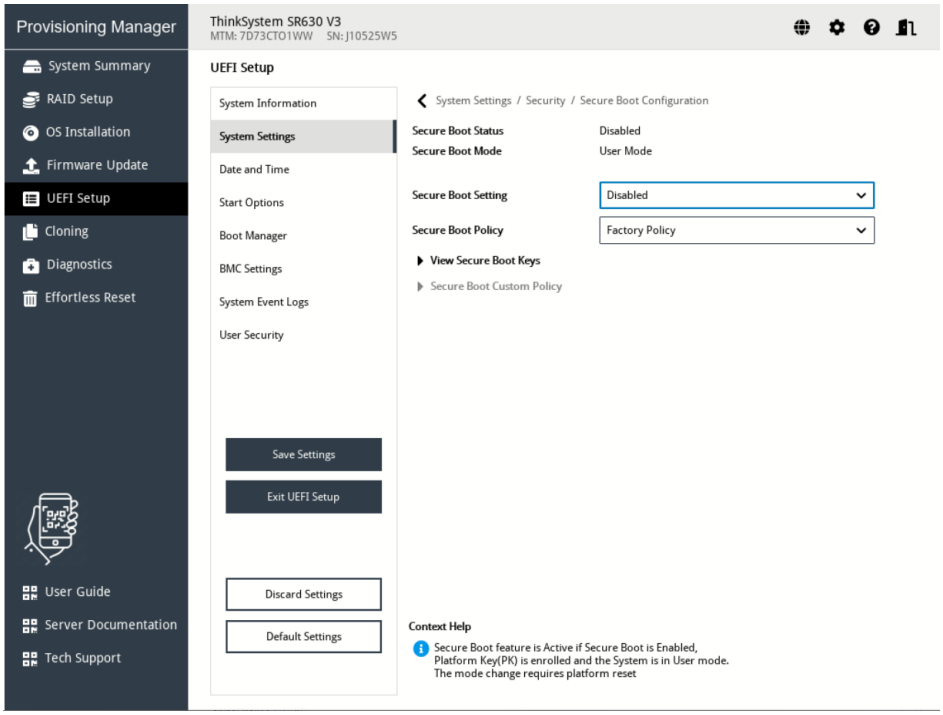

Figure 2. Secure Boot

- UEFI Setup: Set Operating Mode to Maximum Performance

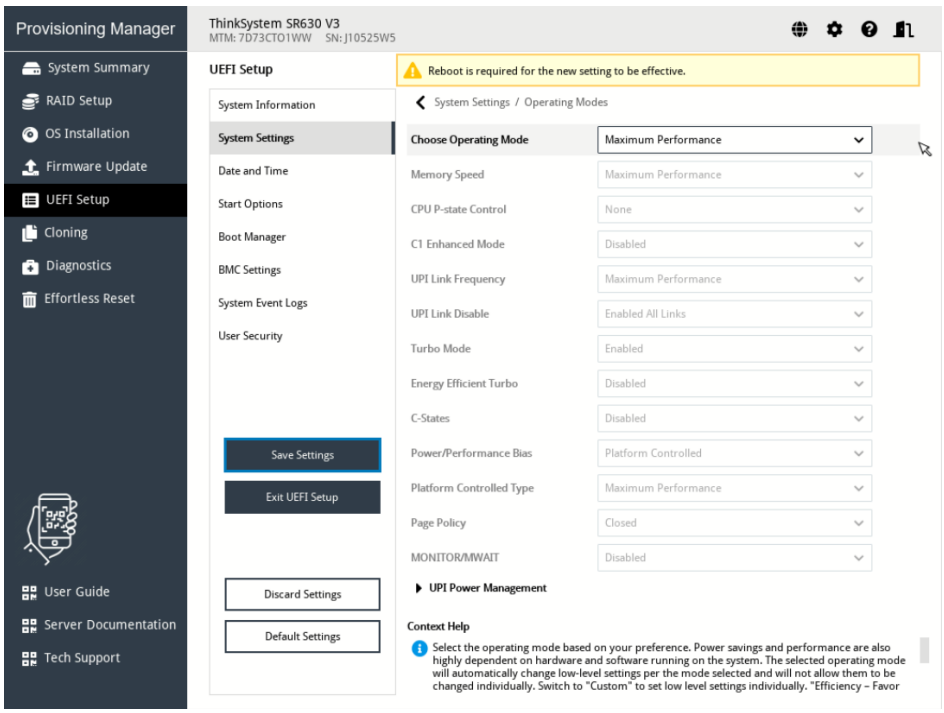

Figure 3. UEFI Operating Mode

- UEFI Setup: Ensure Virtualization (VT-x/AMD-V) is enabled. (Default setting)

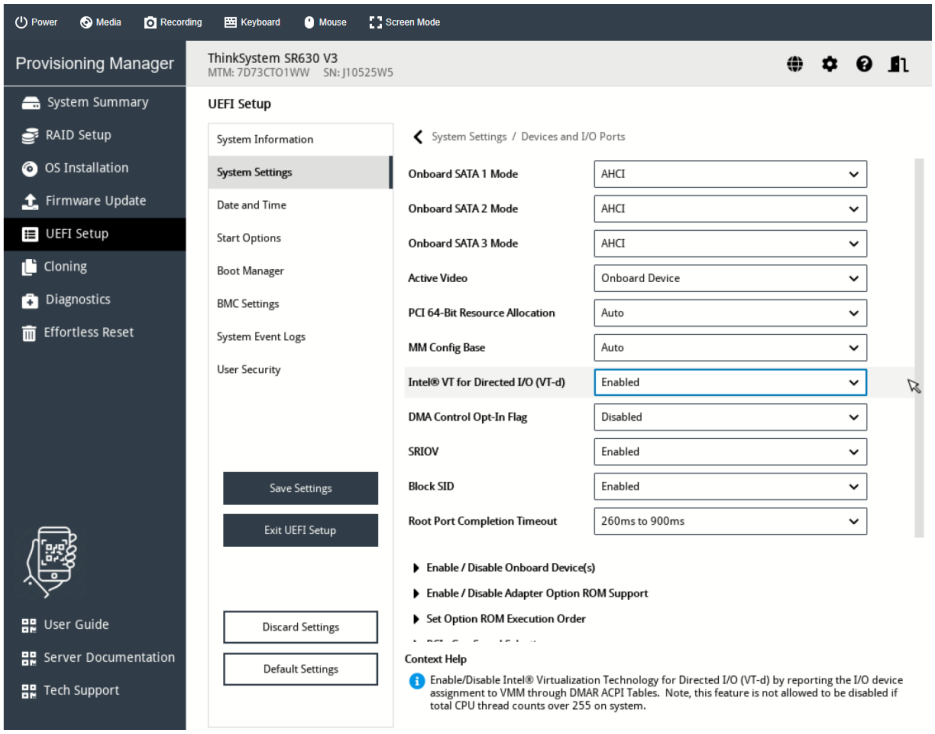

Figure 4. UEFI VT-d setting

Software Requirements

- Installation Media: Latest Proxmox VE ISO image
- Bootable USB Utility: Use Rufus or dd
  Or mount the ISO via XCC
- Web Browser Support: Chrome, Firefox, or Edge

Networking and Access

- Static IP address: For Proxmox VE management
- Hostname, DNS and gateway information
- Optional internet access for updates
- XClarity Controller (XCC): Static IP for remote access, provisioning and troubleshooting

Prepare installation Media

Option 1: Bootable USB

1. Download Proxmox ISO.
2. Create bootable USB media using Rufus in Windows.

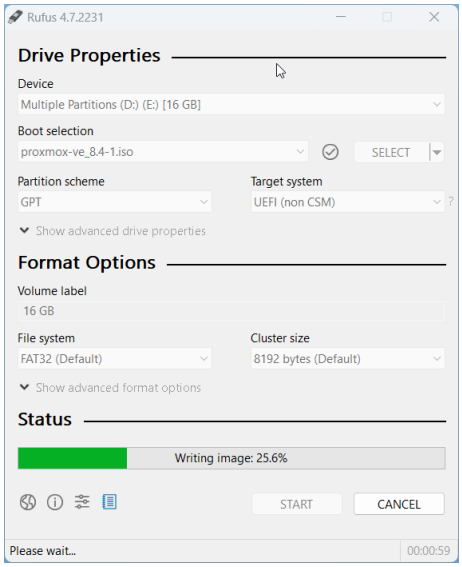

Figure 5. Rufus Utility

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Note: Note: It's normal for Windows to not be able to access the USB drive letter after it completes.

3. Boot from USB via F12: One Time Boot Device

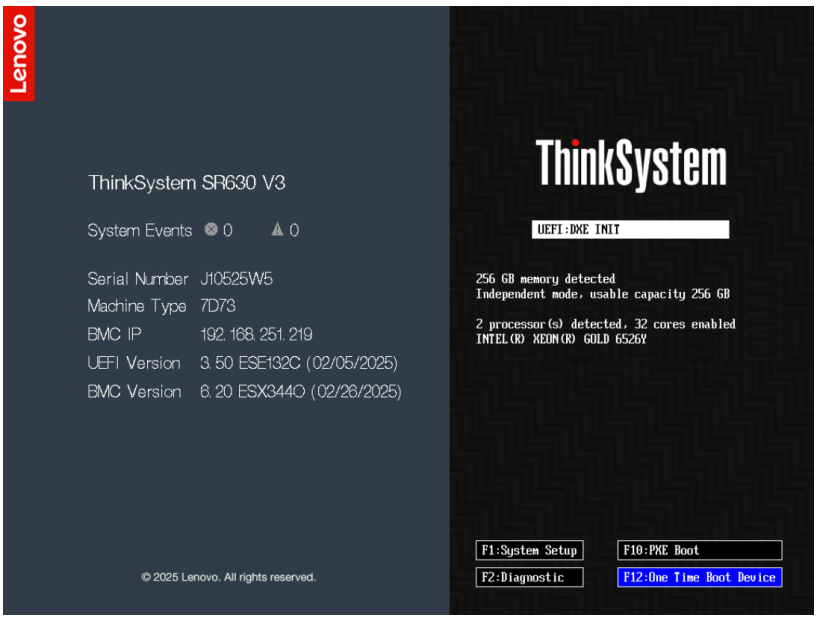


Figure 6. ThinkSystem UEFI Boot screen

4. Select the USB Boot device

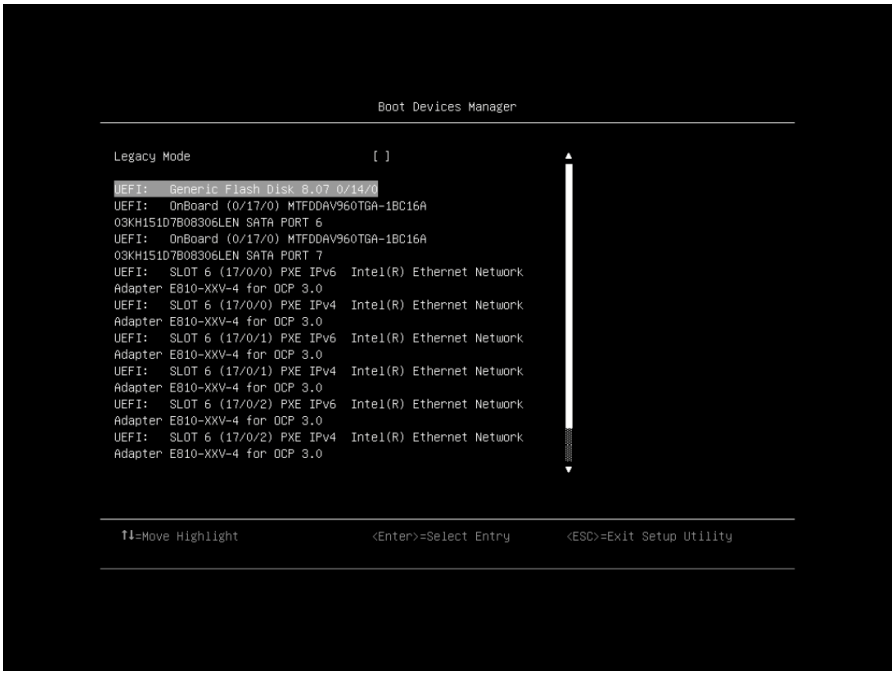


Figure 7. ThinkSystem UEFI Boot Devices Manager

Option 2: XCC Boot via Virtual Media

1. Log into the XCC via web browser at the configured IP. If a static IP has not been defined, the XCC will use a DHCP assigned address. If no DHCP server is present, the default XCC IP will be 192.168.70.100 and the login defaults will be USERID/PASSW0RD

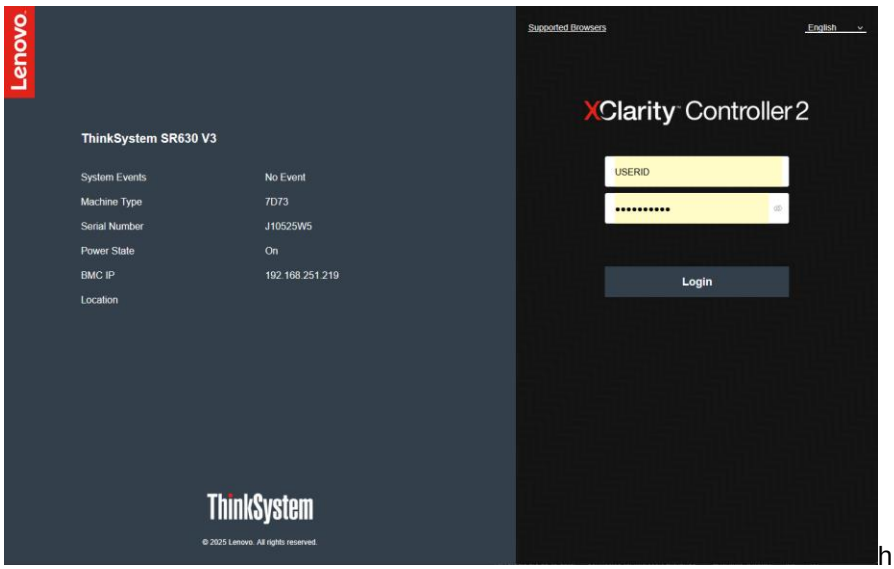


Figure 8. XClarity Controller login interface

2. Launch Remote Console.

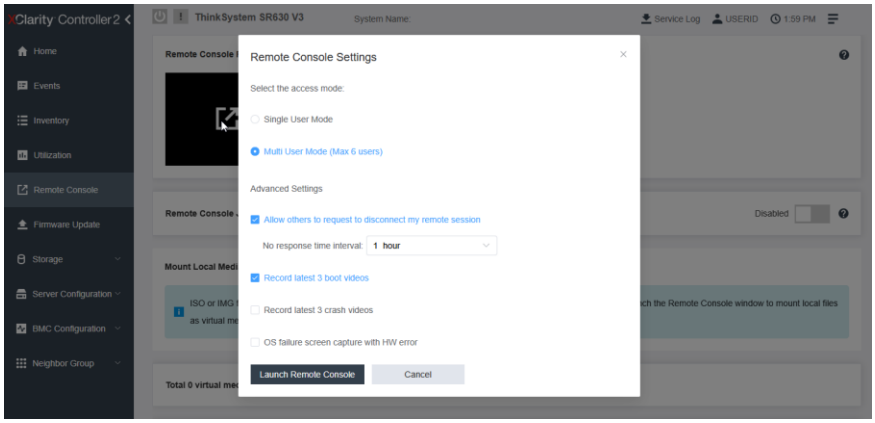


Figure 9. XClarity Controller Remote Control launch

3. In the remote console click ‘Media’.
4. Click ‘Activate’ to enable the remote media mount.
5. Select Browse to select the downloaded Proxmox ISO image.

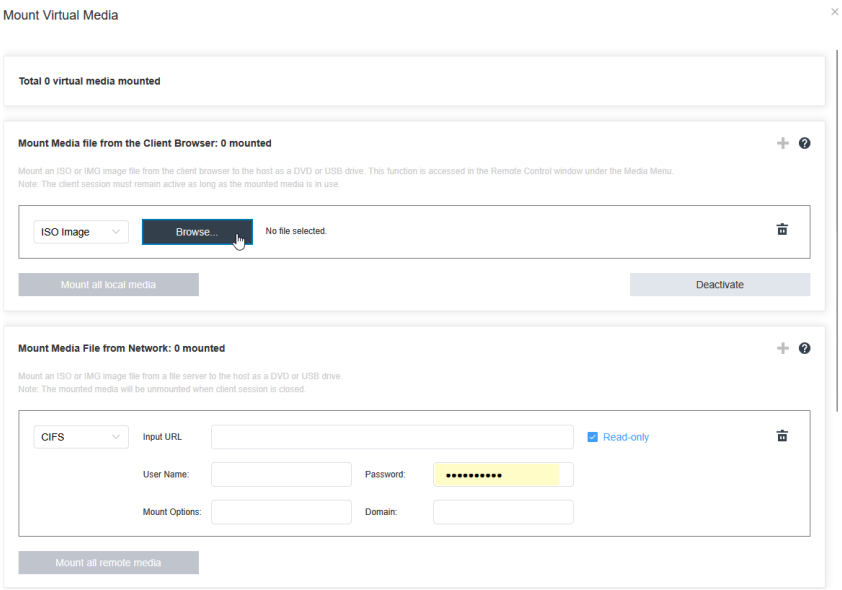


Figure 10. Mount Virtual Media

6. Click ‘Mount all local media’

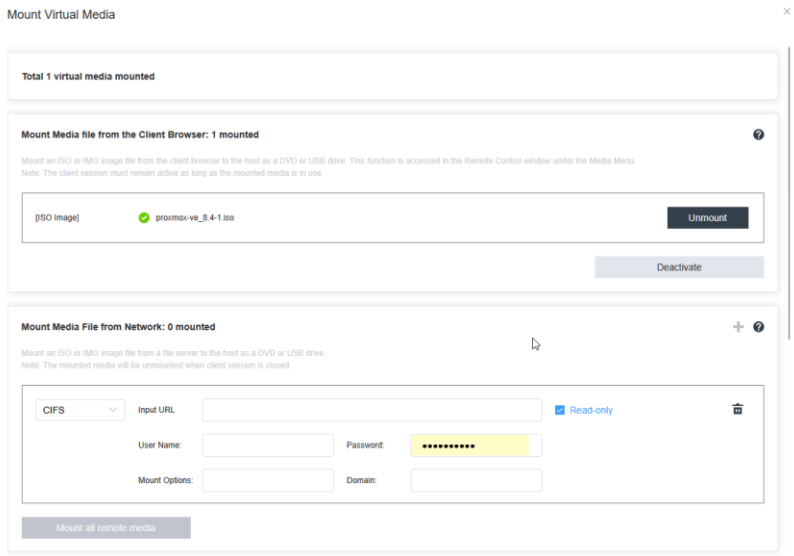


Figure 11. Mounted virtual media

7. Return to the Remote Control session and Power on the server

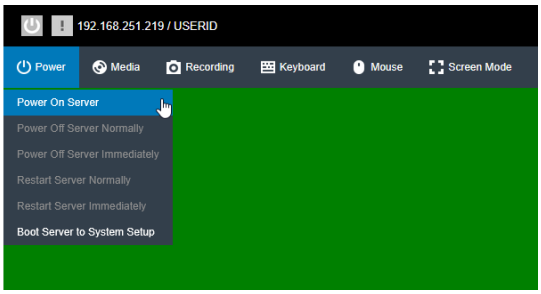


Figure 12. Remote Control Power menu

8. Wait for the prompt at the bottom right of the screen and press F12 for ‘One Time Boot Device’

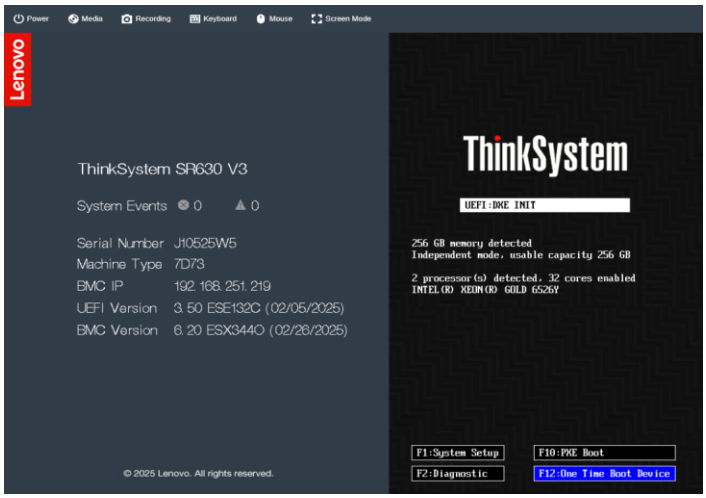


Figure 13. UEFI POST Screen

9. Select the ‘XCC Virtual Media’ to boot from the virtual CD/DVD.

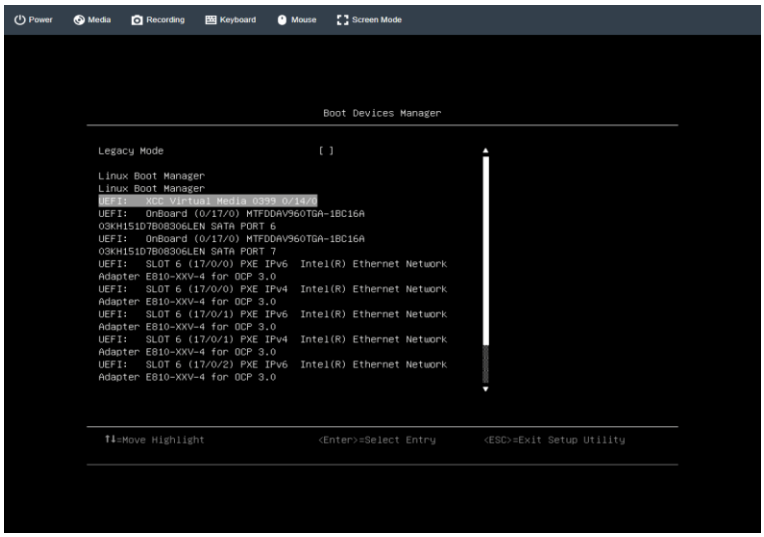
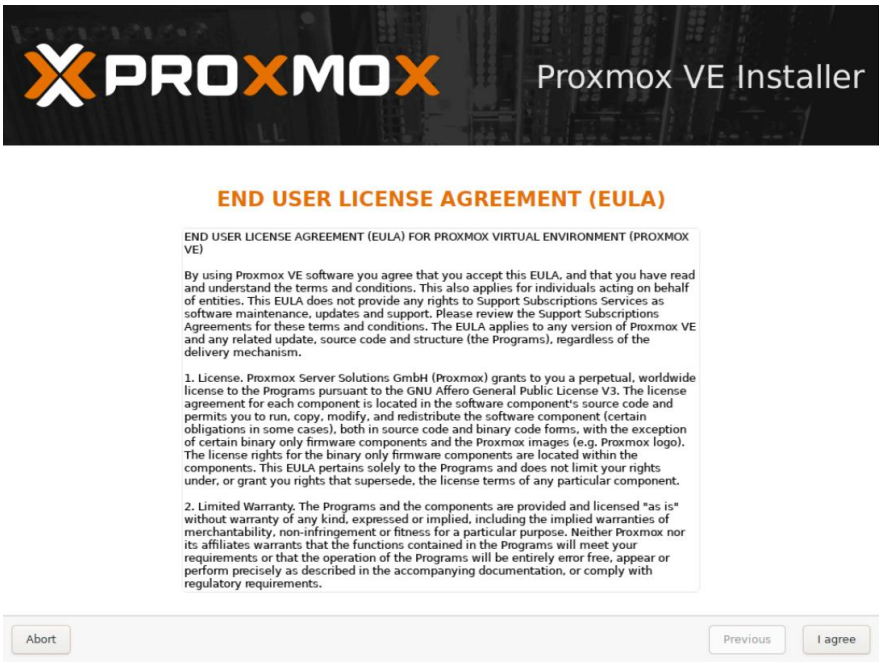


Figure 14 ThinkSystem UEFI Boot Devices Manager

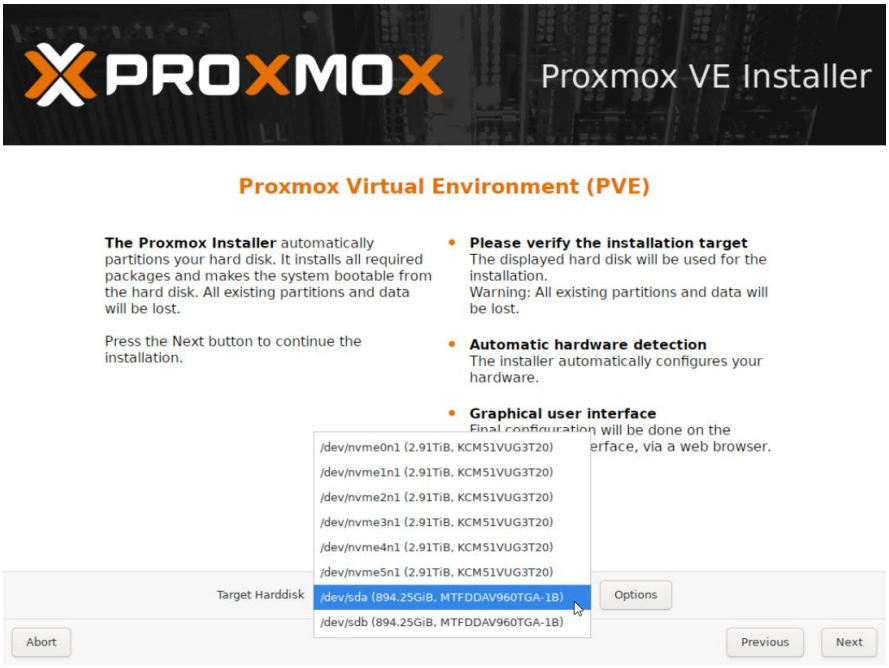
Proxmox VE Installation

1. Select ‘Install Proxmox VE (Graphical)’

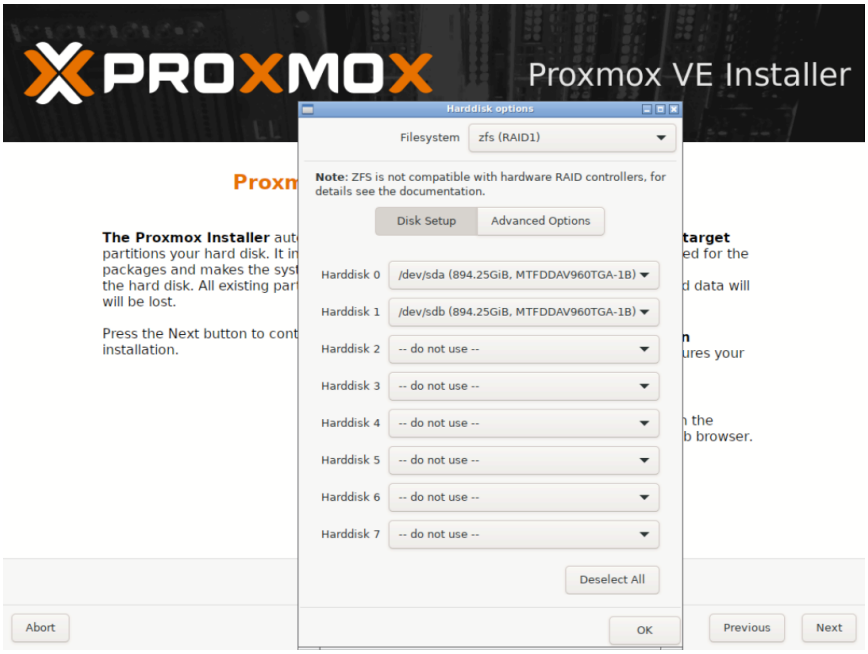
2. Accept the End User License Agreement (EULA)



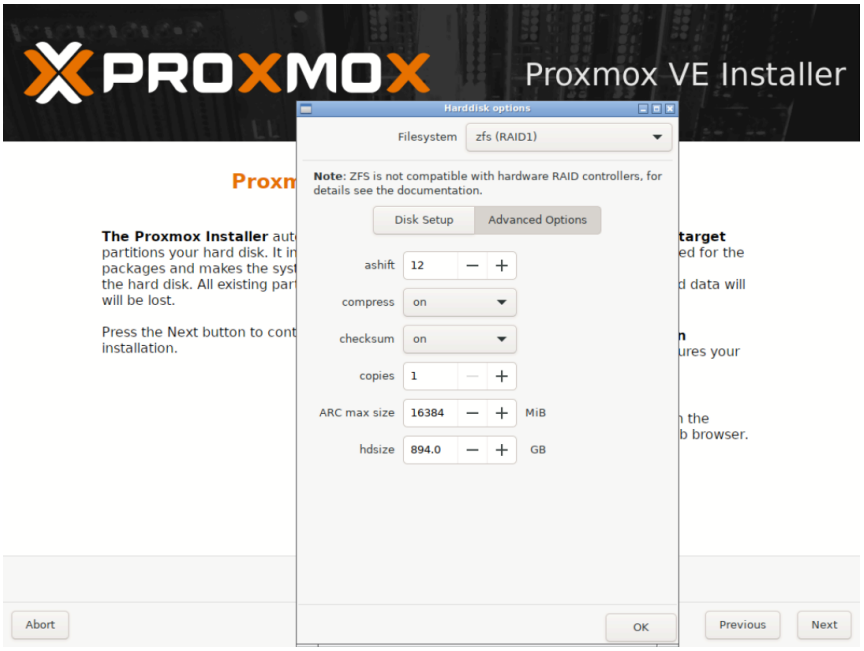
3. Select your Target installation media and click Options to configure your ZFS RAID



4. At this time, although there are additional drives, we will only setup the 2 boot drives and form a RAID1 mirror through ZFS for the Proxmox installation.

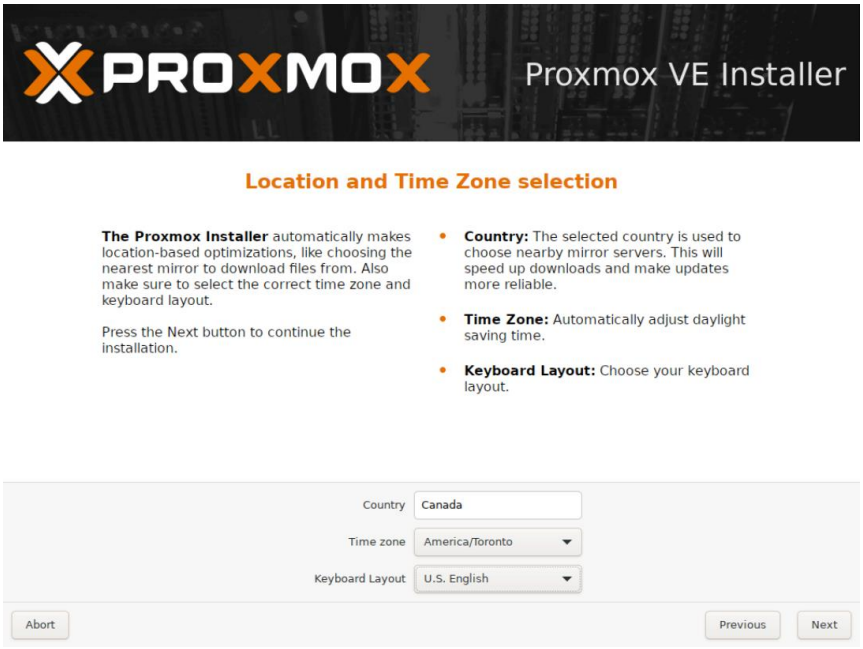


5. Under Advanced options, the defaults are acceptable unless you have a constrained RAM server. As shown below, the ZFS ARC cache is 16GB. If you have 32GB or lower RAM, consider reducing the cache to 4096 MB or 8192 MB to allow more memory for running your Proxmox server.

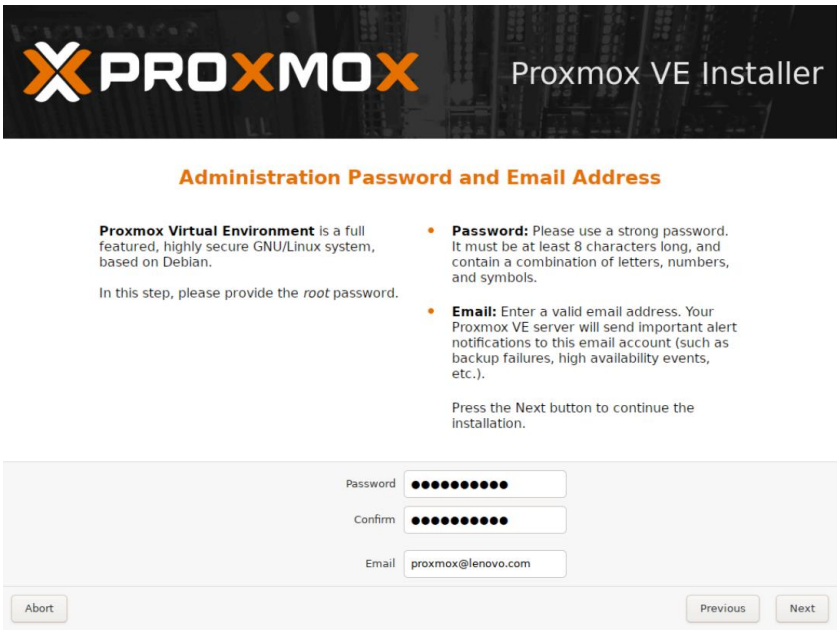


6. Click OK to return to the installation screen and click Next to continue.

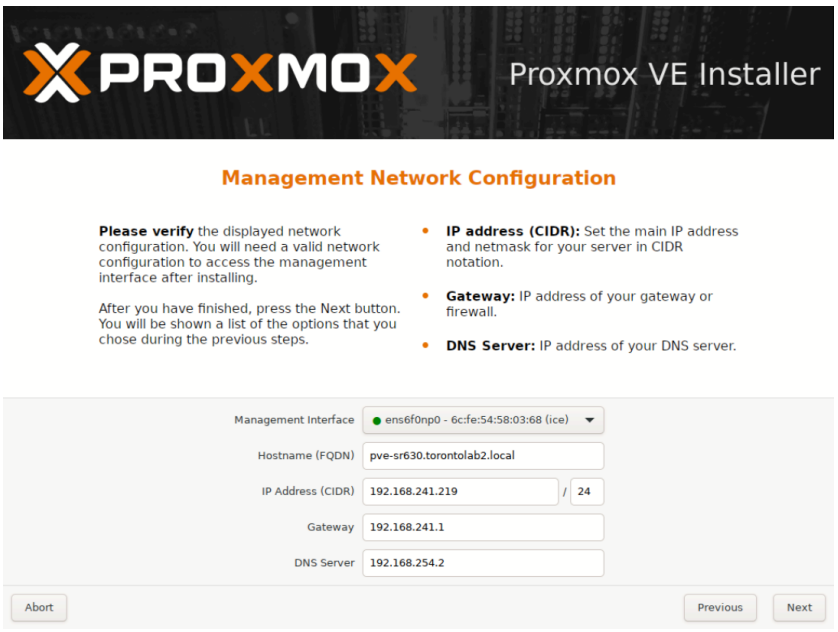
7. Set your location, Time Zone and Keyboard Layout settings.



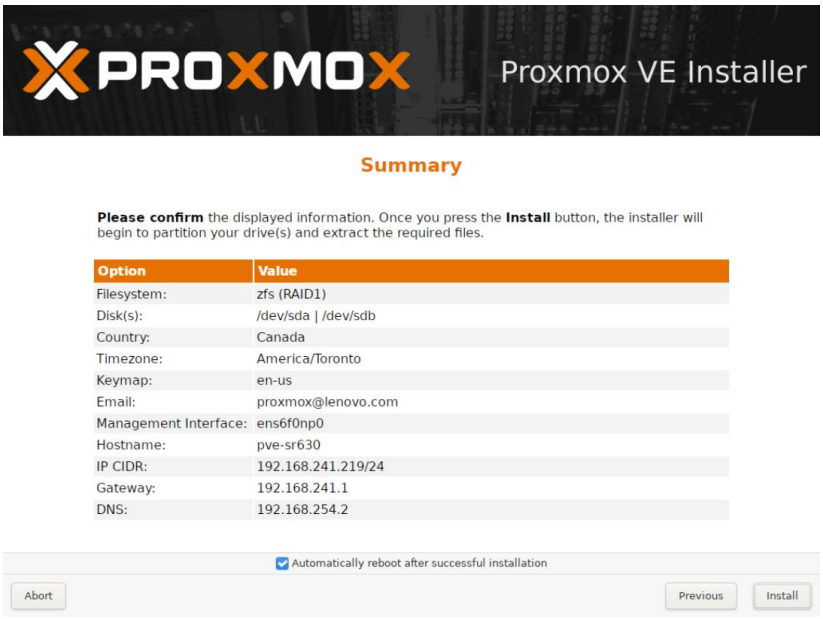
8. Set your administrative password and contact email.



9. Select your primary network interface and set your hostname and IP information.

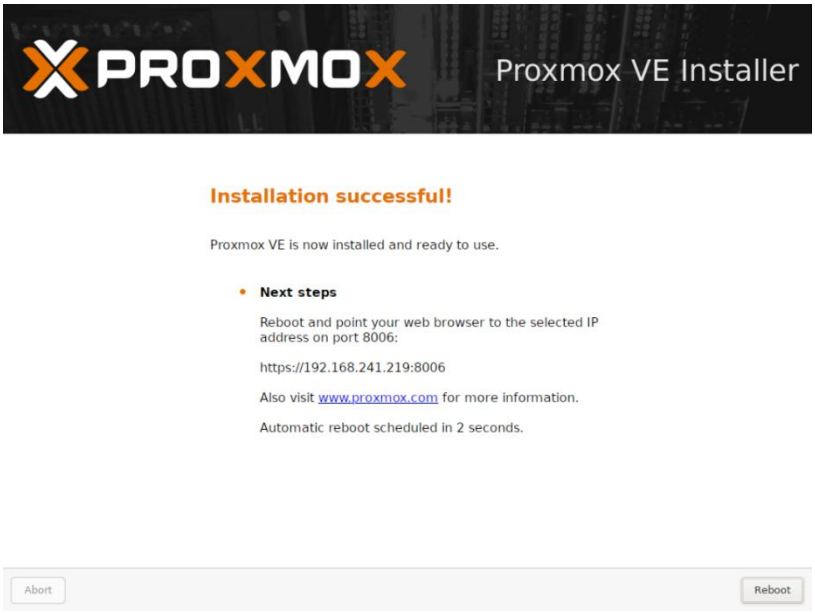


10. At the Summary screen, review your settings and proceed with the install.



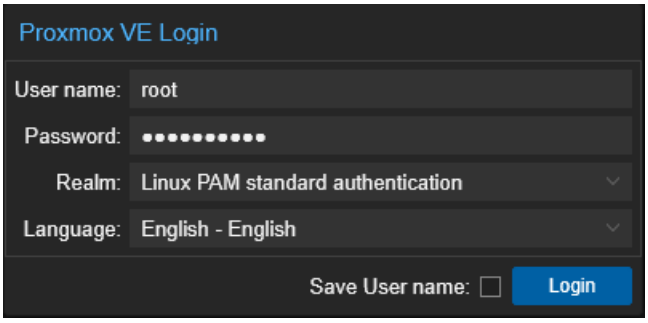
11. Installation commences.

12. After the installation, take note of the Proxmox management IP and port. The default management port is 8006



Post Installation Tasks

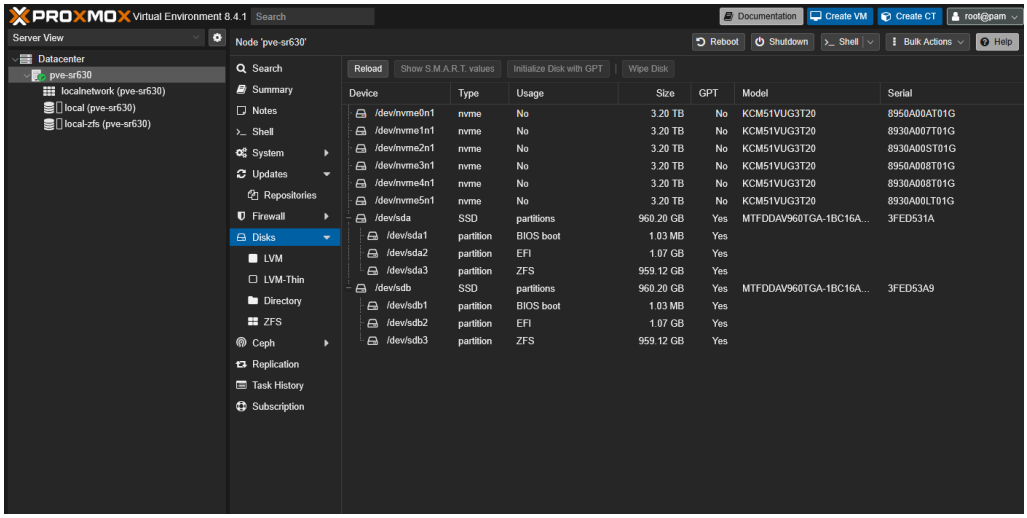
- From your web browser, enter the IP and port for your new Proxmox VE server: Example: https://<ip>:8006/ and log in with root and your configured password



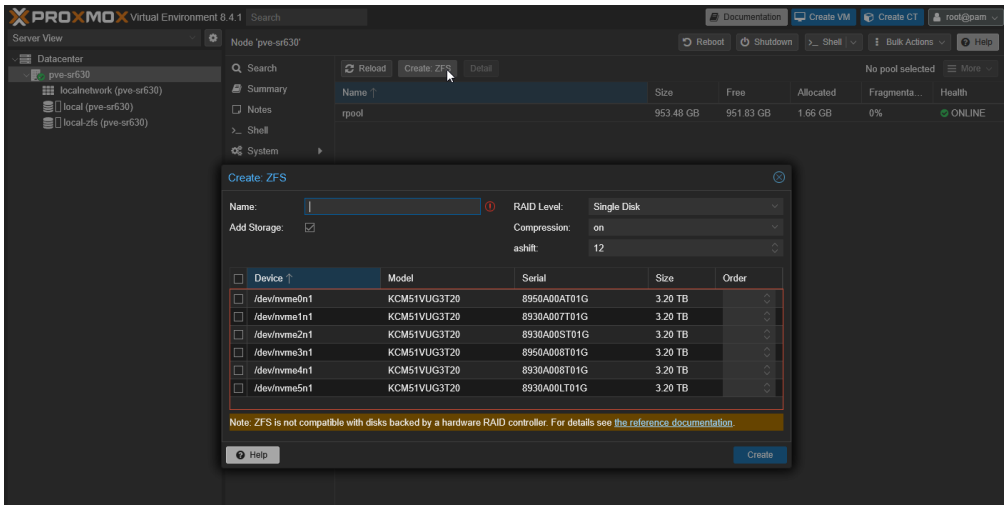
- Apply system updates: Use the built-in Proxmox Updates in the Web GUI or via command-line using ‘apt update && apt full-upgrade -y’

- Configure additional storage disks

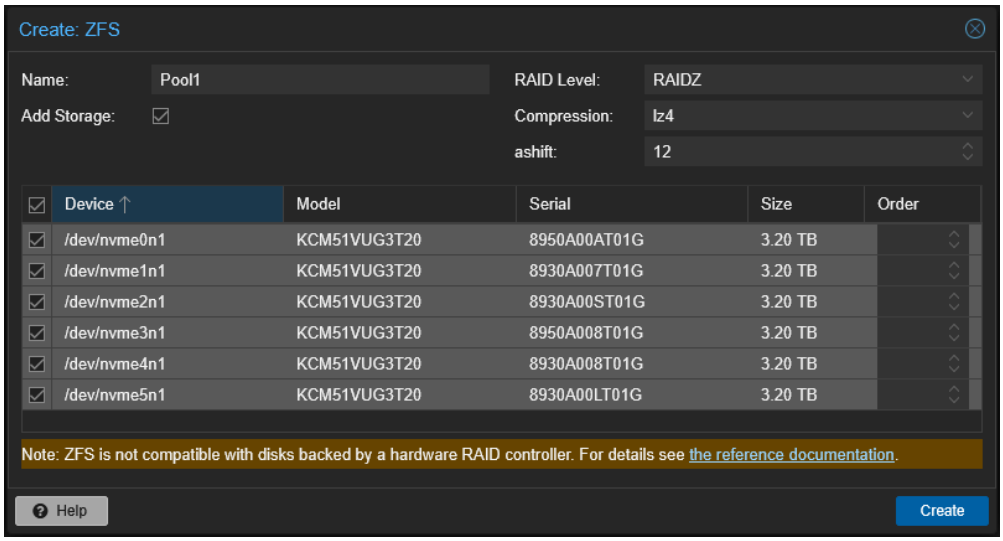
1. Navigate to Disks to view your unconfigured local disks



2. Under Disks / ZFS select ‘Create: ZFS’



3. Select the drives to form the new ZFS Pool



4. Assign your pool name, select the RAID level, and compression. Enable the ‘Add Storage’ checkbox and select ‘Create’

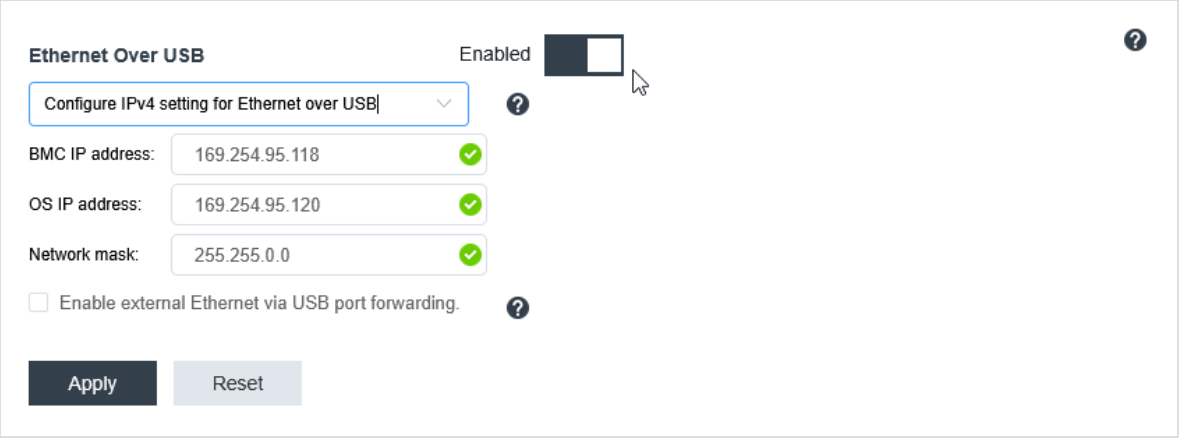
5. The new pool is ready to be used for VM and Container storage.

6. To view the current ZFS pools via CLI use ‘zpool status’

```
root@pve-sr630:~# zpool status
  pool: Pool1
 state: ONLINE
config:

        NAME                                    STATE     READ WRITE CKSUM
        Pool1                                   ONLINE       0     0     0
          raidz1-0                              ONLINE       0     0     0
            nvme-KCM51VUG3T20_8950A00AT01G      ONLINE       0     0     0
            nvme-KCM51VUG3T20_8930A007T01G      ONLINE       0     0     0
            nvme-KCM51VUG3T20_8930A00ST01G_1    ONLINE       0     0     0
            nvme-KCM51VUG3T20_8950A008T01G_1    ONLINE       0     0     0
            nvme-KCM51VUG3T20_8930A008T01G      ONLINE       0     0     0
            nvme-KCM51VUG3T20_8930A00LT01G_1    ONLINE       0     0     0

errors: No known data errors

  pool: rpool
 state: ONLINE
config:

        NAME                                                    STATE     READ WRITE CKSUM
        rpool                                                   ONLINE       0     0     0
          mirror-0                                              ONLINE       0     0     0
            ata-MTFDDAV960TGA-1BC16A_03KH151D7B08306LEN_3FED531A-part3  ONLINE       0     0     0
            ata-MTFDDAV960TGA-1BC16A_03KH151D7B08306LEN_3FED53A9-part3  ONLINE       0     0     0

errors: No known data errors
root@pve-sr630:~#
```

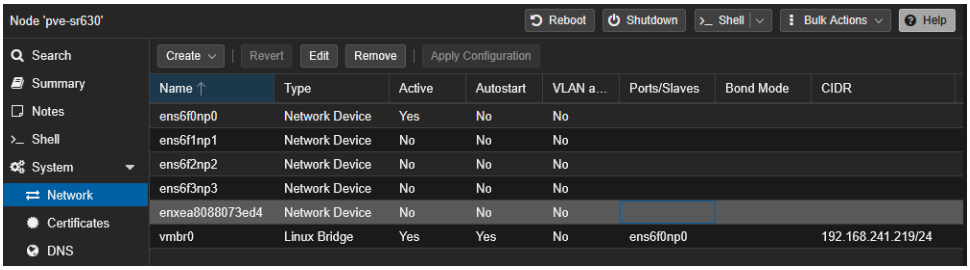
- **Setup XCC OS Watchdog**
  This allows the built-in XCC to monitor the OS state and perform an automatic restart if the Proxmox instance is no longer responding. (Fail state or hang scenarios)

  1. In the XCC web GUI, navigate to BMC Configuration and Network.
  2. Enable the Ethernet over USB option, choose ‘Configure IPv4 setting for Ethernet over USB’, if required change the IPs and network mask (defaults should be used) and click Apply.

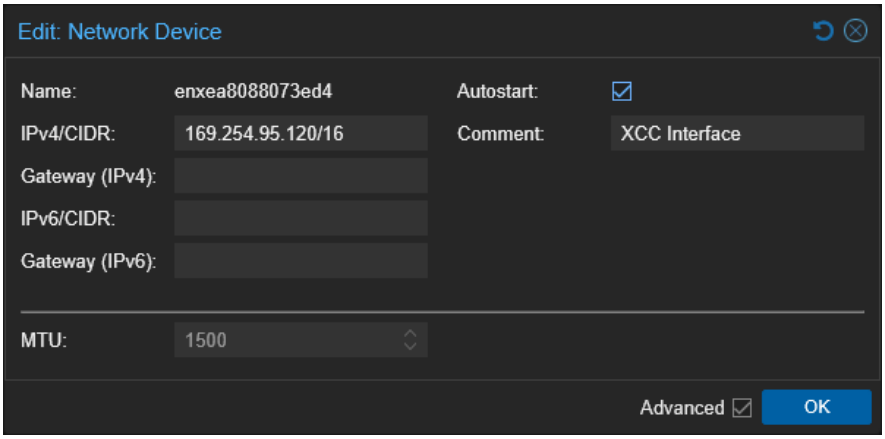


  3. Make note of the ‘OS IP address’

  4. In the Proxmox web console, under System / Network, select the new network interface for configuration and select ‘Edit’. The NIC name will usually start with enx followed by several other alphanumeric characters. This is your new XCC BMC interface that builds an internal connection between the XCC BMC and Proxmox.



5. Add the ‘OS IP address’ obtained in the XCC Web interface and add it to your XCC BMC NIC in Proxmox. Enable the Autostart checkbox and select OK.
Note: the /16 represents the 255.255.0.0 subnet

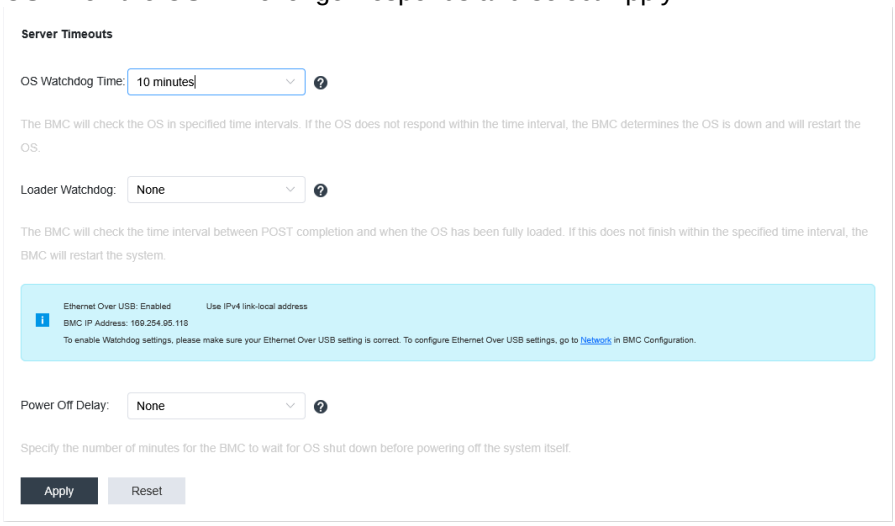


6. Apply the new Networking configuration

7. From your Proxmox host, ensure you can reach your BMC IP address.

```
root@pve-sr630:~# ping 169.254.95.118
PING 169.254.95.118 (169.254.95.118) 56(84) bytes of data.
64 bytes from 169.254.95.118: icmp_seq=1 ttl=64 time=0.515 ms
64 bytes from 169.254.95.118: icmp_seq=2 ttl=64 time=0.336 ms
64 bytes from 169.254.95.118: icmp_seq=3 ttl=64 time=0.426 ms
^C
--- 169.254.95.118 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2061ms
rtt min/avg/max/mdev = 0.336/0.425/0.515/0.073 ms
root@pve-sr630:~#
```

8. To enable the OS Watchdog, return to the XCC Web interface. Under ‘Server Configuration’ / ‘Server Properties’ choose how many minutes before the XCC BMC automatically reboots the OS when the OS IP no longer responds and select Apply.



- Other optional and recommended post-installation tasks
  - Create VMs and Containers
  - Setup Backups
  - Setup a Cluster
  - Setup Role-Based Access Control
  - Setup Email notifications

Summary

About the Author

Paul Santos is a Senior Lenovo Solutions Architect working in the Lenovo Infrastructure Solutions Group (ISG) based in Toronto Canada. He has more than thirty years of experience with Infrastructure solutions in his career at both IBM and Lenovo.

Why Lenovo

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For More Information

To learn more about Lenovo Data-Center solutions contact your Lenovo Business Partner or visit: https://www.lenovo.com/us/en/servers-storage/

References:

Lenovo ThinkSystem SR630 V3: https://lenovopress.lenovo.com/lp1600

Lenovo Operating System Interoperability Guide https://lenovopress.lenovo.com/osig

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