Bahir Dar University
Bahir Dar Institute of Technology
Faculty of Computing
Department of Information Systems

Title: Fedora Operating System Documentation

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1. Introduction

An **Operating System (OS)** is system software that acts as an interface between computer hardware and the user. It controls and manages hardware resources such as the Central Processing Unit (CPU), memory, storage devices, and input/output peripherals, while providing a user-friendly environment for interaction with the computer system.

Fedora is a powerful, open-source, Linux-based operating system developed by the **Fedora Project** and sponsored by **Red Hat**, a subsidiary of IBM. Fedora is well known for its close alignment with upstream Linux development and for introducing cutting-edge technologies early. It serves as a platform for innovation, development, and experimentation while maintaining stability and security.

2. Virtualization Technology

Virtualization is a technology that enables the creation of multiple simulated environments or virtual machines from a single physical hardware system. It abstracts hardware resources and allows multiple operating systems to run simultaneously on one physical machine.

Fedora provides strong support for virtualization technologies, making it suitable for cloud computing, software testing, server consolidation, and educational purposes. Through virtualization, users can efficiently utilize system resources while maintaining isolation between different operating environments.

3. Background of Fedora Operating System

Fedora is designed to provide a modern, efficient, and user-friendly computing experience. It targets a wide range of users, including casual users, developers, system administrators, and researchers.

Key Characteristics of Fedora:

- **User Interface:** Fedora offers a clean and intuitive graphical user interface (GUI), primarily using the GNOME desktop environment, allowing users to perform tasks easily even with limited technical experience.
- **Performance:** Fedora includes performance optimizations and efficient resource management to ensure smooth operation across different hardware configurations.

- **Security:** Security is a core focus of Fedora, incorporating technologies such as SELinux, secure boot, frequent updates, and strong permission control mechanisms.
- **Compatibility:** Fedora supports a wide range of hardware devices and software applications, enabling users to work seamlessly with existing systems and peripherals.
- **Community Support:** Fedora has a strong global community that contributes to development, documentation, testing, and third-party software creation.

4. Evolution of Fedora Operating System

The evolution of Fedora has been marked by continuous innovation and regular release cycles.

Fedora began as **Fedora Core**, a community-driven project that emerged after Red Hat Linux was discontinued.

- **Fedora Core 1 (2003):** Introduced GNOME 2.4 and Linux Kernel 2.4, based on Red Hat Linux 9.
- **Fedora Core 2–6:** Transitioned from XFree86 to X.Org, introduced SELinux, and adopted Linux Kernel 2.6.
- **Fedora 7:** Unified repositories and removed the "Core" distinction.
- **Fedora 9 (2008):** Introduced encrypted file system support, KDE 4, and GNOME 2.22.
- **Fedora 11 (2009):** ext4 became the default file system with automated font and package installations.
- **Fedora 14 (2010):** Focused on virtualization and cloud computing improvements.
- **Fedora 15 (2011):** Introduced GNOME 3 and GNOME Shell.
- **Fedora 21 (2014):** Introduced distinct Workstation, Server, and Cloud editions.
- **Fedora 22–25:** Adopted Wayland as the default display server and replaced YUM with DNF.
- **Fedora 27–29:** Introduced modularity, allowing multiple software versions on one system.
- **Fedora Silverblue:** Introduced an immutable desktop OS using rpm-ostree.
- **Fedora CoreOS:** Designed for containerized workloads and small server deployments.
- **Fedora IoT:** Tailored for Internet of Things devices.
- **Fedora 33 (2020):** Switched to Btrfs as the default file system.
- **Fedora 35–37:** Improved hybrid GPU support and updated GNOME versions.
- **Fedora 38–40 (2023–2024):** Introduced GNOME 44–46, DNF5, AI/ML tooling, improved Wayland and NVIDIA support.

5. Motivation for Fedora Operating System

The motivation behind Fedora can be understood through the core principles that guide the Fedora Project:

1. **Customization and Control:** Fedora allows users to tailor their computing environments to meet specific needs.
2. **Performance Optimization:** Fedora is designed to deliver responsive and efficient system performance.
3. **Security and Privacy:** Strong security mechanisms protect user data and system integrity.
4. **Open-Source Philosophy:** Fedora promotes transparency, collaboration, and community-driven development.
5. **Support for New Technologies:** Fedora adopts new hardware and software technologies early.
6. **User Experience:** Fedora emphasizes accessibility, clean design, and efficient workflows.
7. **Educational Goals:** Fedora is widely used for learning operating systems, programming, and system administration.
8. **Niche and Professional Use Cases:** Fedora supports scientific computing, cloud infrastructure, and embedded systems.

6. Fedora's Impact and Relevance Today

Fedora plays a significant role in modern computing environments. It acts as an upstream distribution for Red Hat Enterprise Linux (RHEL), meaning many enterprise-grade technologies are first tested in Fedora.

Fedora is widely used in:

- Software development
- Research and education
- Cloud and container environments
- Virtualized infrastructures

Its rapid innovation cycle ensures relevance in emerging technologies such as AI, machine learning, and cloud-native applications.

7. Virtualization Capabilities in Fedora

Fedora supports advanced virtualization technologies, including:

- **KVM (Kernel-based Virtual Machine)**
- **QEMU**
- **libvirt**
- **virt-manager**

These tools allow users to create, manage, snapshot, and migrate virtual machines efficiently. Fedora also provides optimized images for cloud platforms such as AWS, Azure, and Google Cloud.

8. User Experience and System Usability

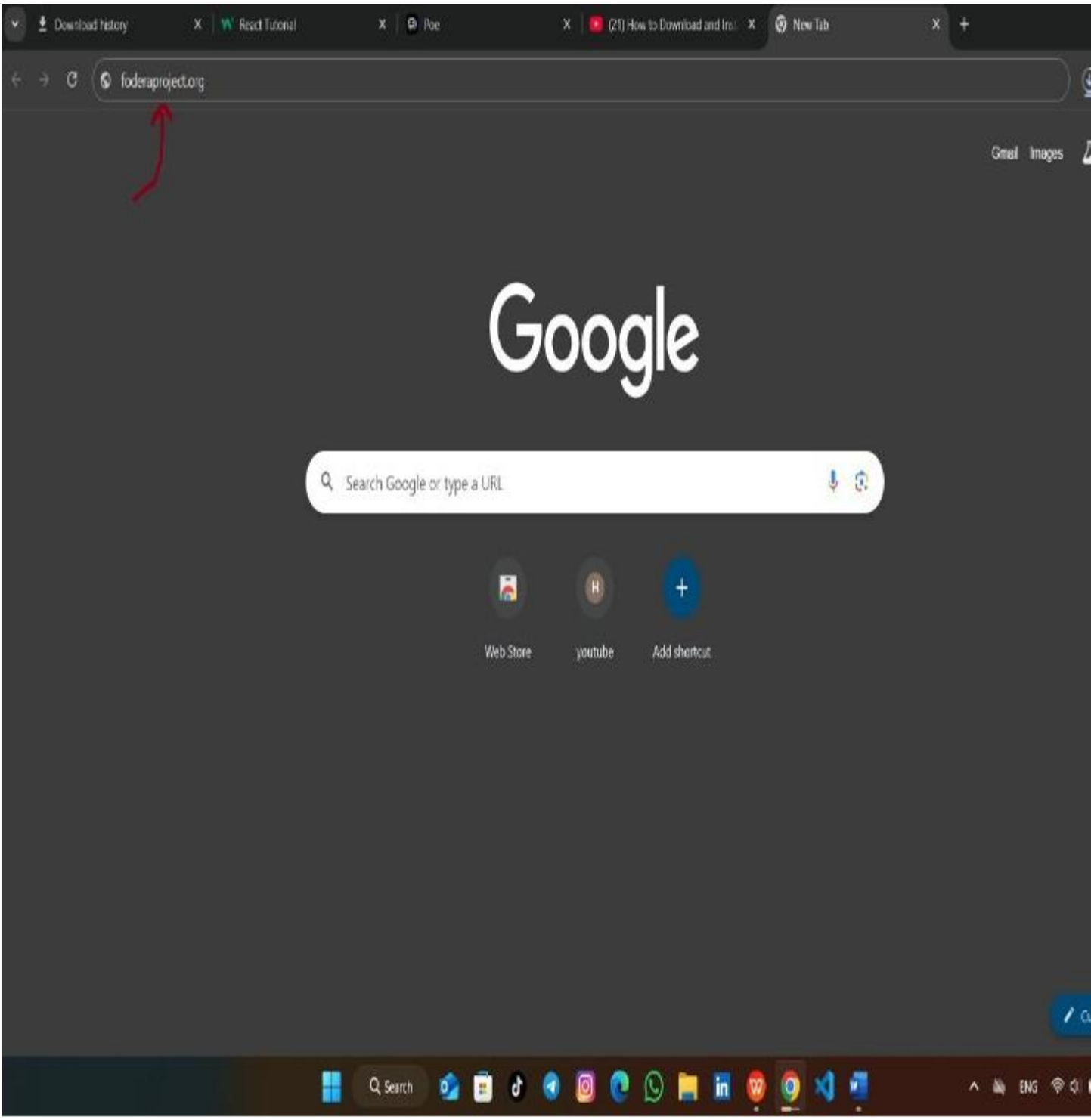
Fedora focuses on improving usability through:

- **Anaconda Installer:** A guided and customizable installation process.
- **Improved Hardware Detection:** Automatic detection and configuration of system components.
- **Post-installation Setup Tools:** Simplified system configuration after installation.
- **Documentation:** Extensive and regularly updated official documentation.

9. Developer and Community Support

Fedora encourages community participation and innovation through:

- Open contribution models
- Clear development guidelines
- Regular release schedules
- Fedora Labs for specialized use cases
- Community events such as Flock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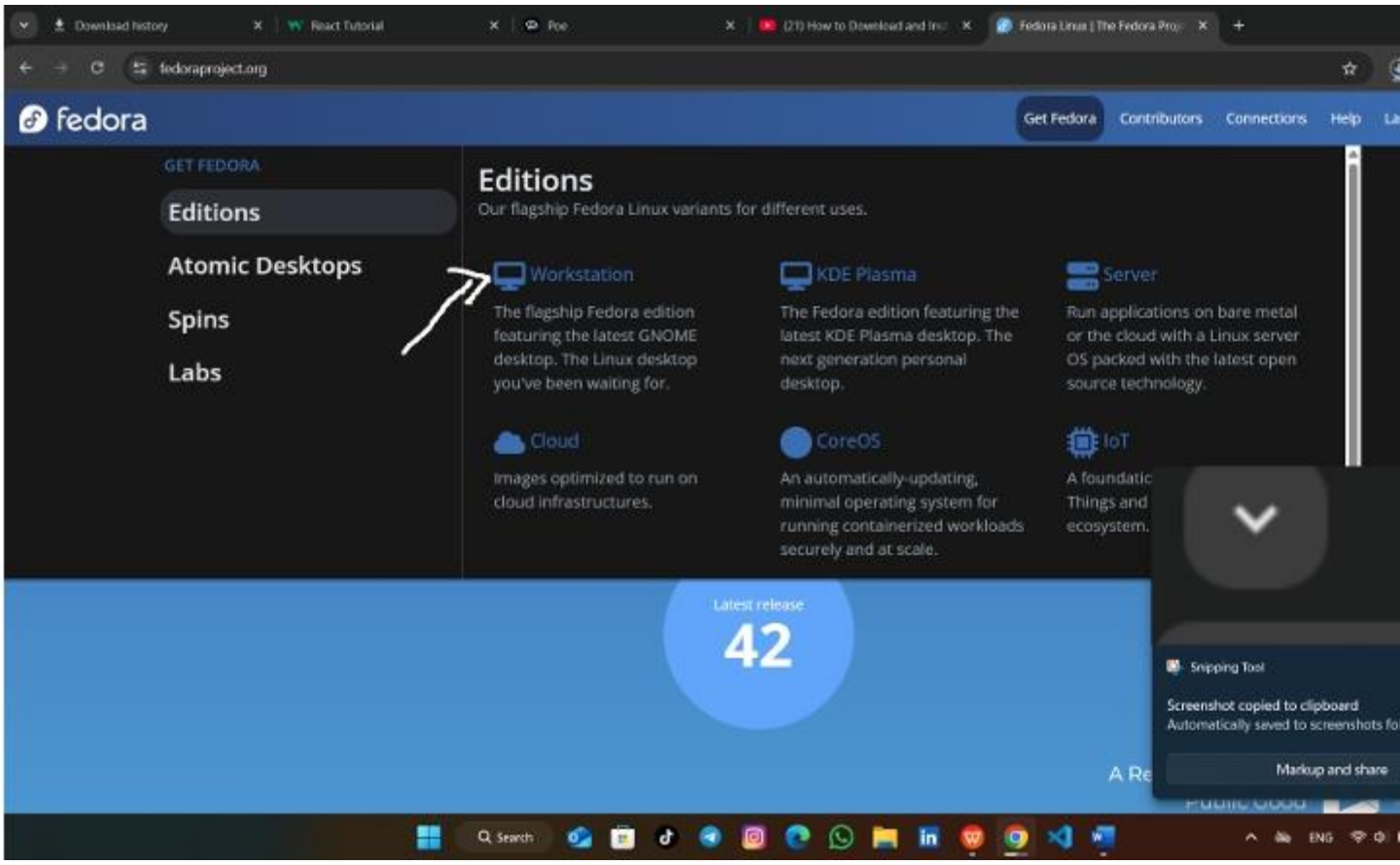
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Editions
Our flagship Fedora Linux variants for different uses.
Workstation
The flagship Fedora edition featuring the latest GNOME desktop. The Linux desktop you've been waiting for.
KDE Plasma
The Fedora edition featuring the latest KDE Plasma desktop. The next generation personal desktop.
Server
Run applications on bare metal or the cloud with a Linux server OS packed with the latest open source technology.
Cloud
Images optimized to run on cloud infrastructures.
CoreOS
An automatically-updating, minimal operating system for running containerized workloads securely and at scale.
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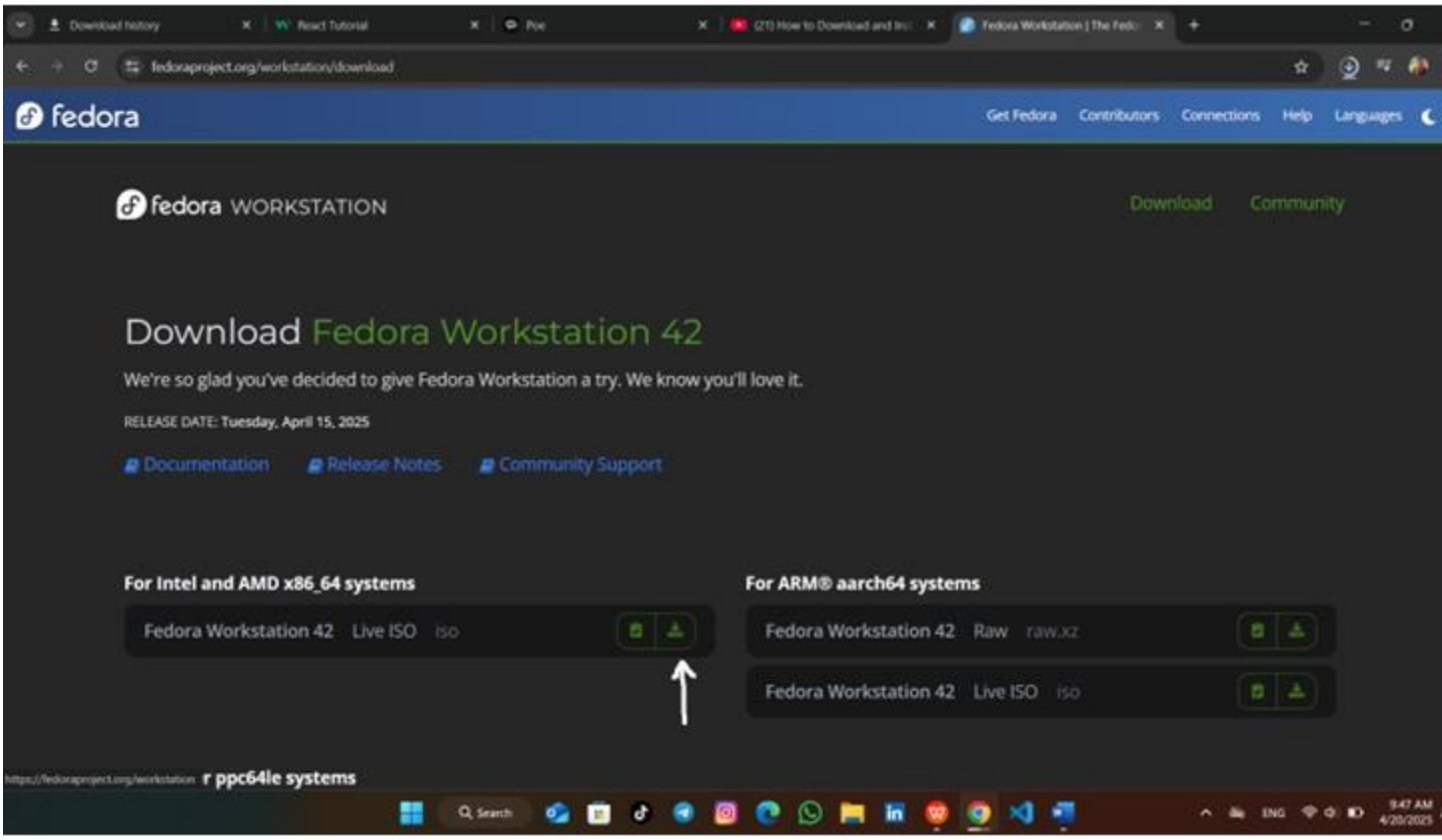
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Community
Download Fedora Workstation 42
We're so glad you've decided to give Fedora Workstation a try. We know you'll love it.
RELEASE DATE: Tuesday, April 15, 2025
Documentation
Release Notes
Community Support
For Intel and AMD x86_64 systems
Fedora Workstation 42 Live ISO iso
For ARM® aarch64 systems
Fedora Workstation 42 Raw raw.xz
Fedora Workstation 42 Live ISO iso
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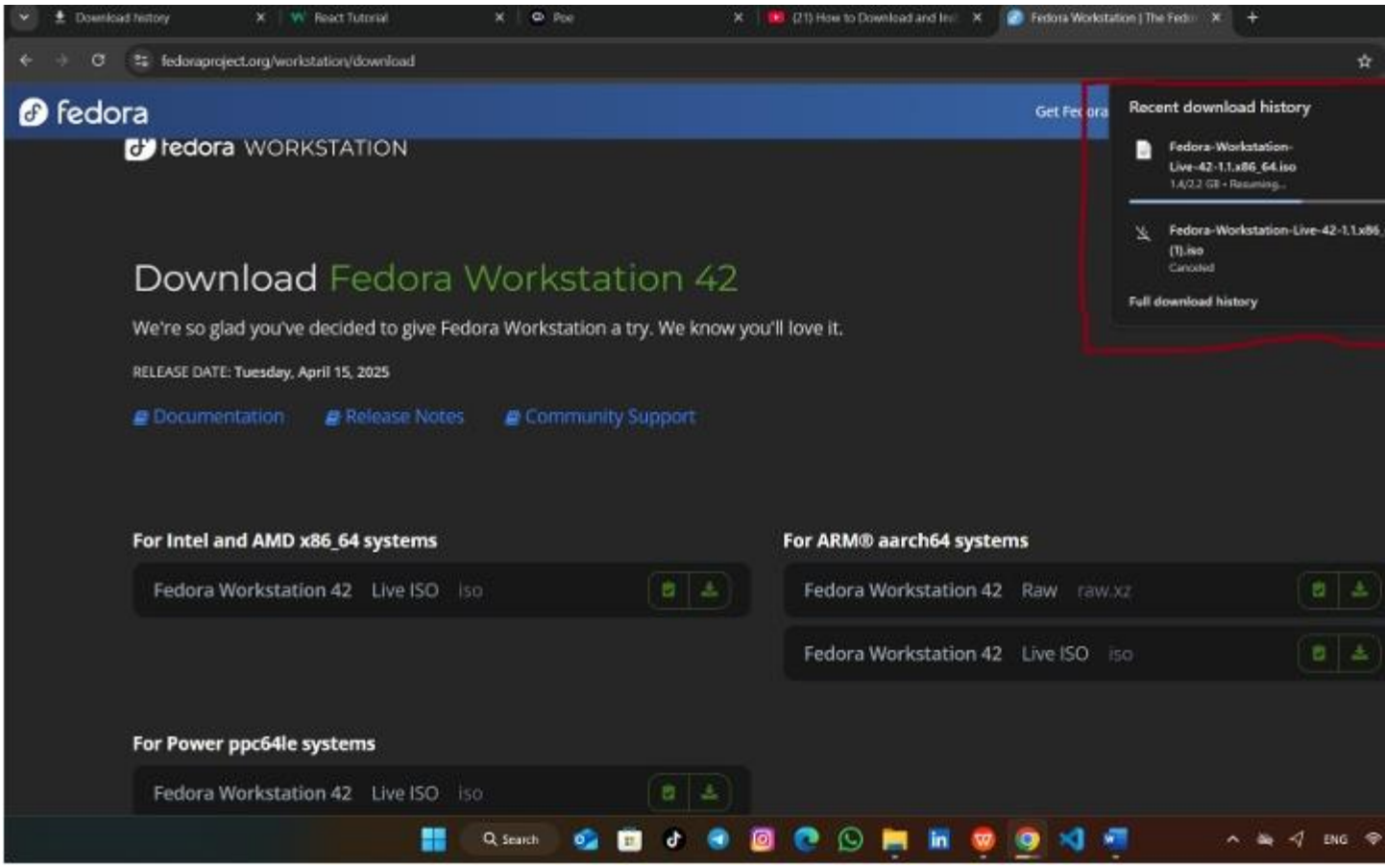
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1.4/2.2 GB • Resuming...
Fedora-Workstation-Live-42-1.1.x86_(1).iso
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Full download history
Download Fedora Workstation 42
We're so glad you've decided to give Fedora Workstation a try. We know you'll love it.
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Fedora Workstation 42 Live ISO iso
For Power ppc64le systems
Fedora Workstation 42 Live ISO iso
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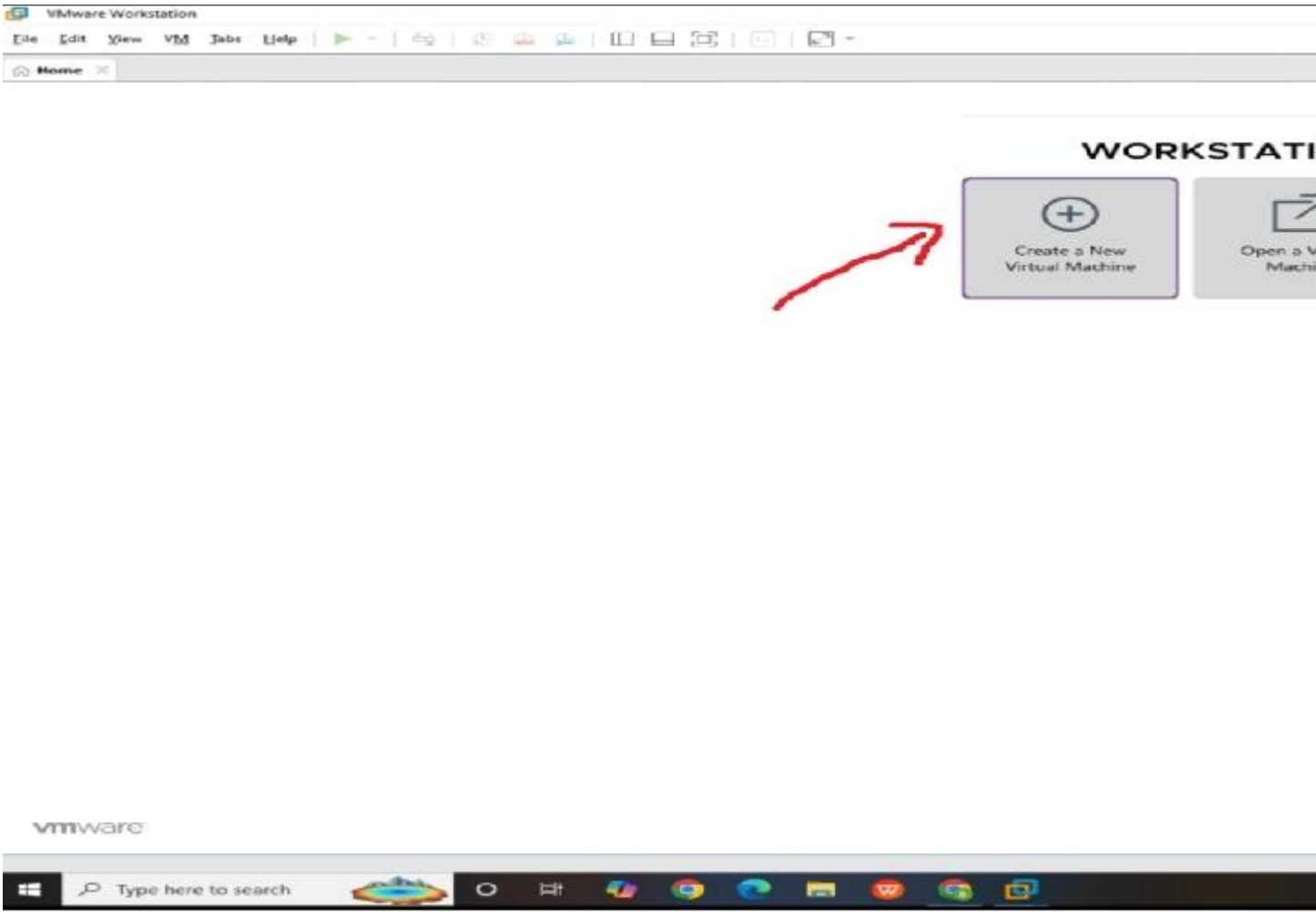
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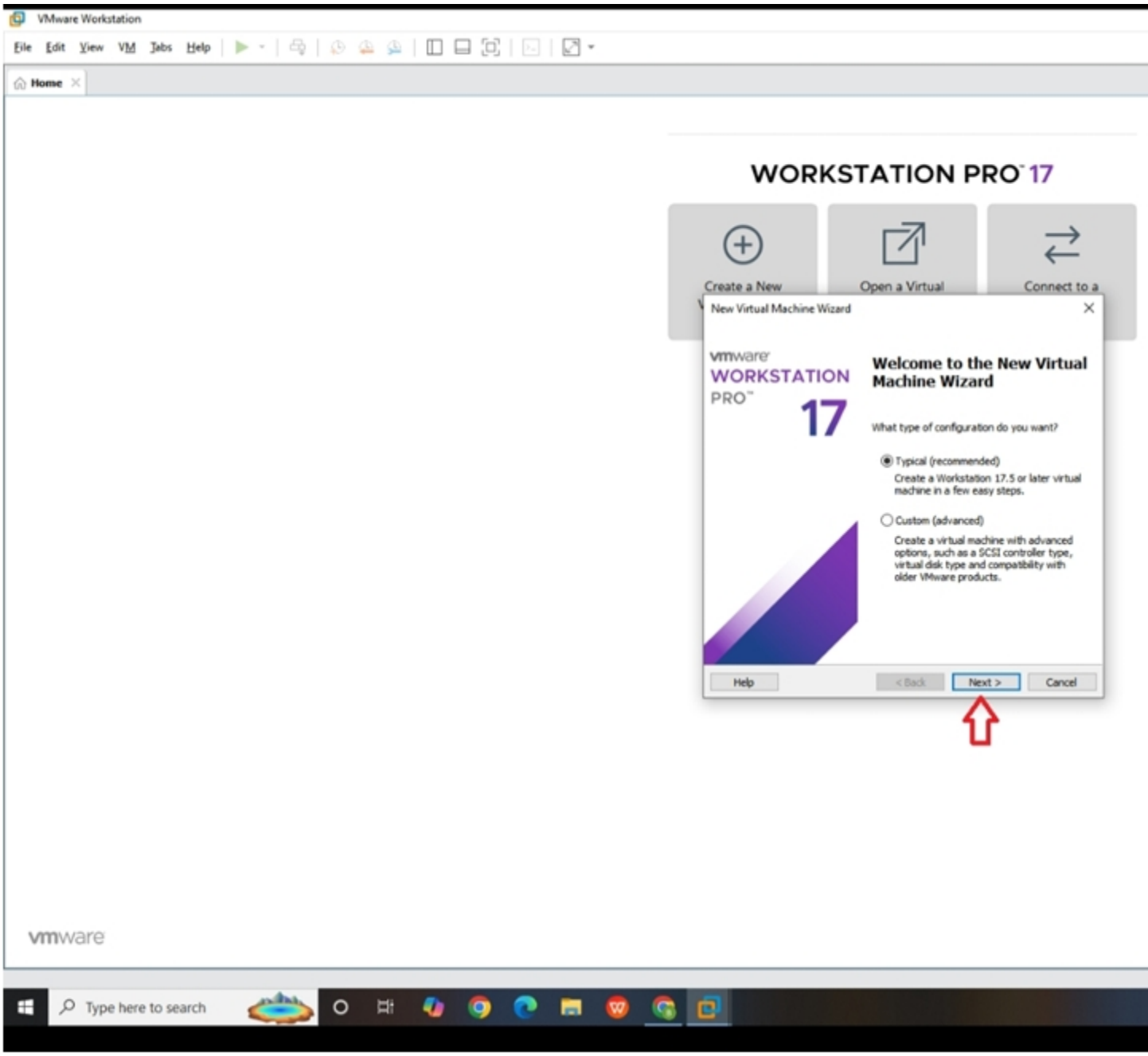
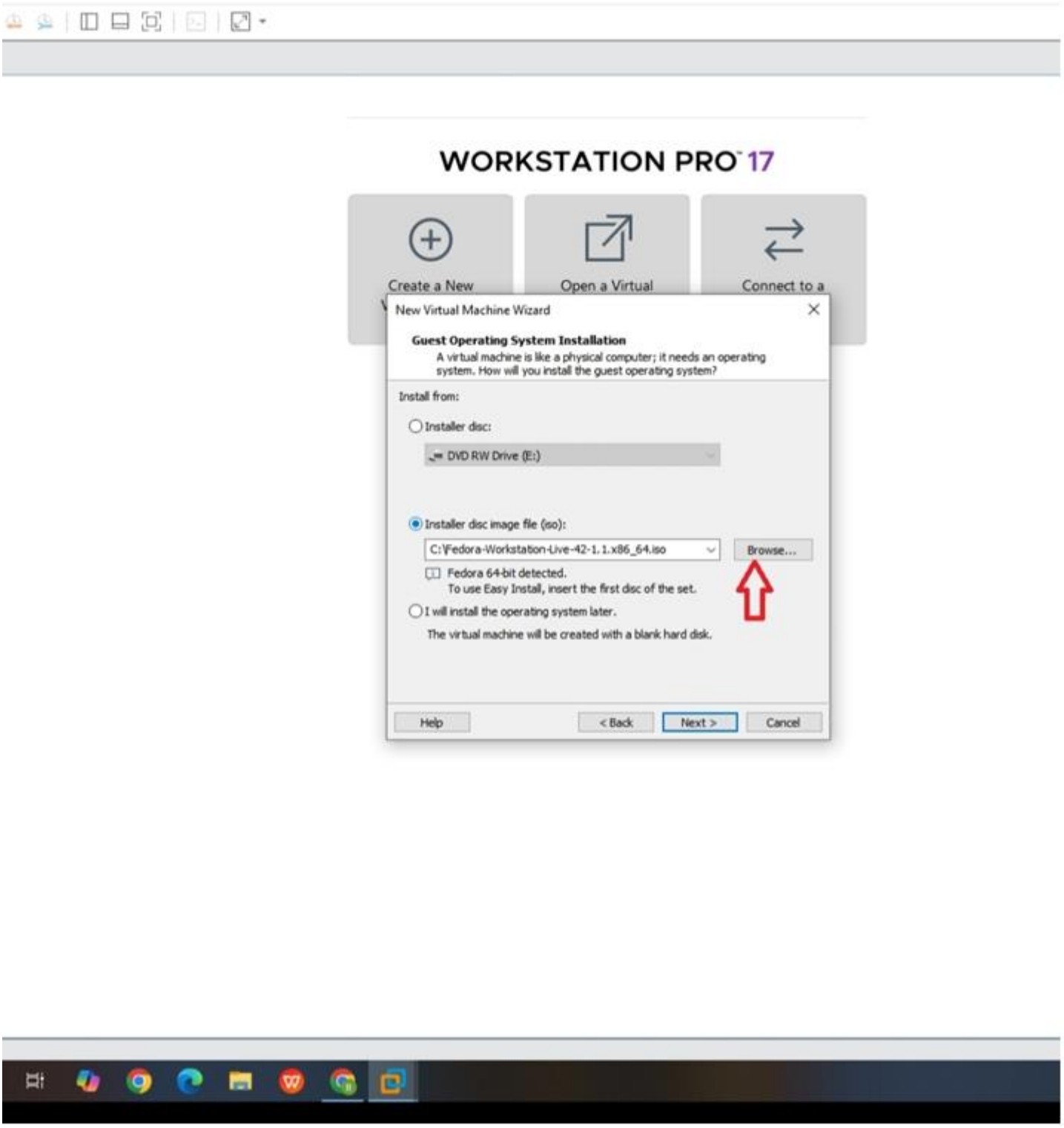
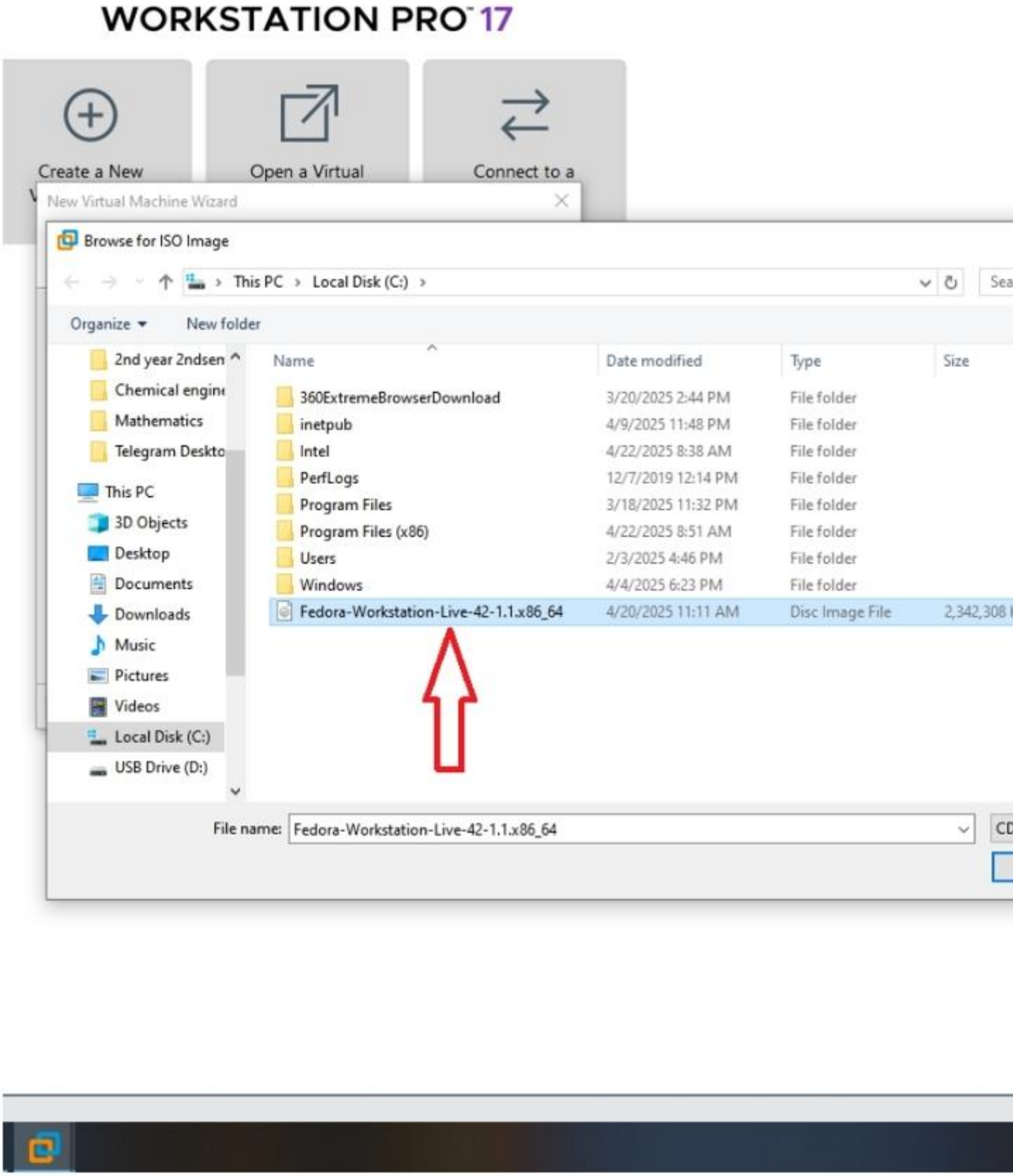

VMware Workstation
File Edit View VM Tabs Help
Home
WORKSTATION PRO 17
Create a New
Open a Virtual
Connect to a
New Virtual Machine Wizard
vmware
WORKSTATION
PRO
17
Welcome to the New Virtual Machine Wizard
What type of configuration do you want?
Typical (recommended)
Create a Workstation 17.5 or later virtual machine in a few easy steps.
Custom (advanced)
Create a virtual machine with advanced options, such as a SCSI controller type, virtual disk type and compatibility with older VMware products.
Help
< Back
Next >
Cancel
vmware
Type here to search


WORKSTATION PRO 17
Create a New
Open a Virtual
Connect to a
New Virtual Machine Wizard
Guest Operating System Installation
A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?
Install from:
Installer disc:
DVD RW Drive (E:)
Installer disc image file (iso):
C:\Fedora-Workstation-Live-42-1.1.x86_64.iso
Browse...
Fedora 64-bit detected.
To use Easy Install, insert the first disc of the set.
I will install the operating system later.
The virtual machine will be created with a blank hard disk.
Help
< Back
Next >
Cancel


WORKSTATION PRO 17
Create a New
Open a Virtual
Connect to a
New Virtual Machine Wizard
Browse for ISO Image
This PC › Local Disk (C:) ›
Organize
New folder
2nd year 2ndsen
Chemical engine
Mathematics
Telegram Deskto
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
USB Drive (D:)
Name
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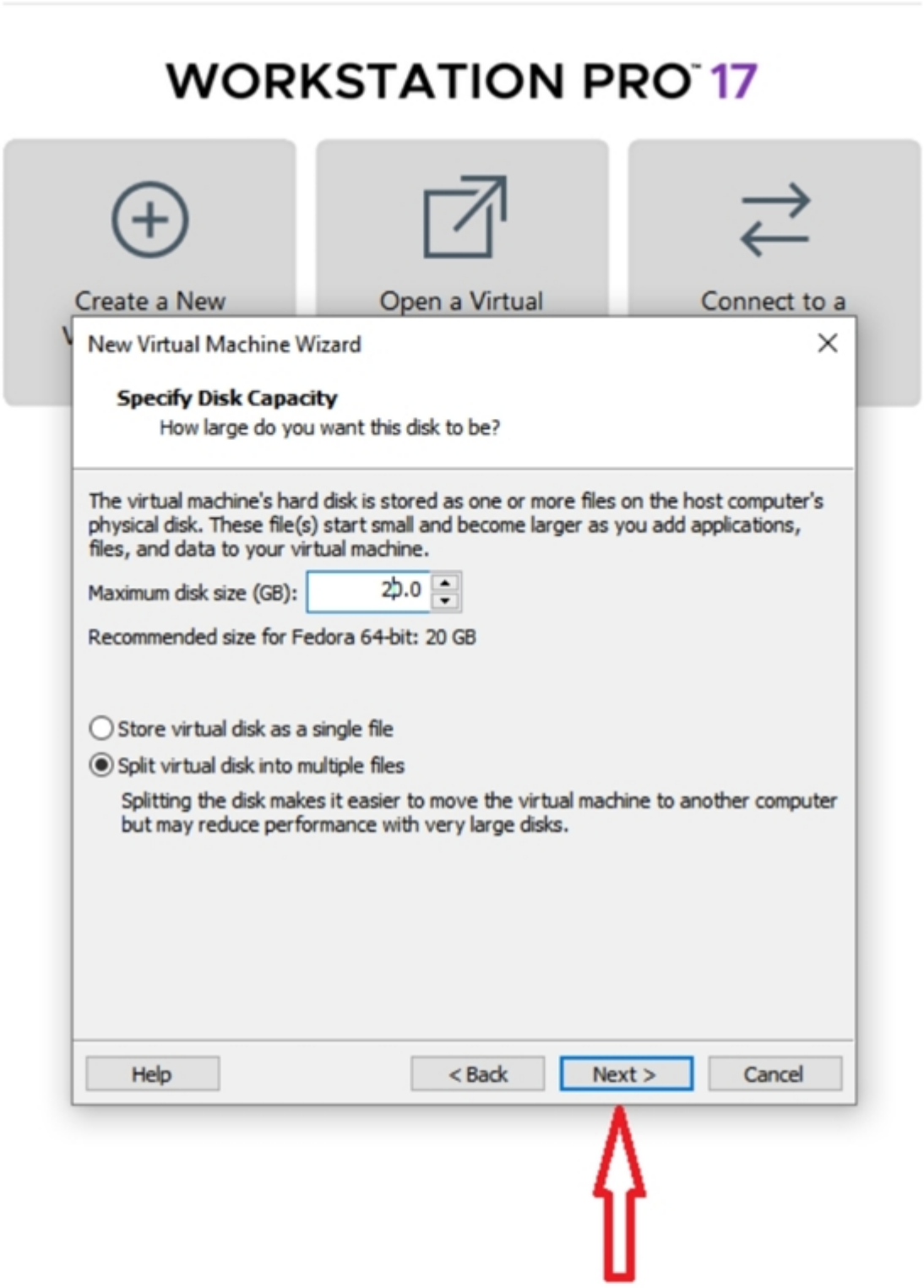
360ExtremeBrowserDownload 3/20/2025 2:44 PM File folder
inetpub 4/9/2025 11:48 PM File folder
Intel 4/22/2025 8:38 AM File folder
PerfLogs 12/7/2019 12:14 PM File folder
Program Files 3/18/2025 11:32 PM File folder
Program Files (x86) 4/22/2025 8:51 AM File folder
Users 2/3/2025 4:46 PM File folder
Windows 4/4/2025 6:23 PM File folder
Fedora-Workstation-Live-42-1.1.x86_64 4/20/2025 11:11 AM Disc Image File 2,342,308
File name: Fedora-Workstation-Live-42-1.1.x86_64


WORKSTATION PRO 17
Create a New
Open a Virtual
Connect to a
New Virtual Machine Wizard
Specify Disk Capacity
How large do you want this disk to be?
The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.
Maximum disk size (GB): 20.0
Recommended size for Fedora 64-bit: 20 GB
Store virtual disk as a single file
Split virtual disk into multiple files
Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.
Help
< Back
Next >
Cancel


WORKSTATION PRO 17
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Help
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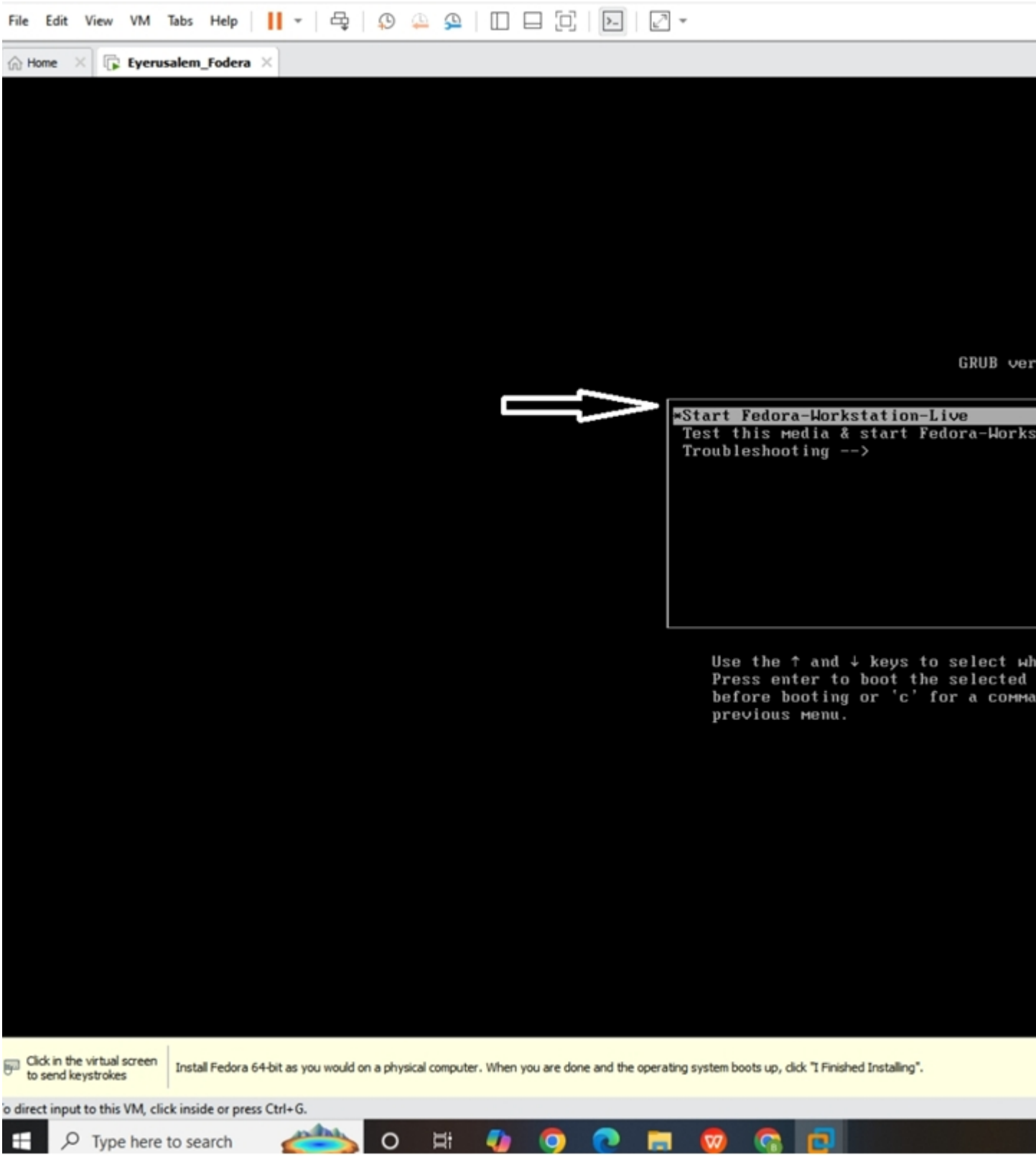
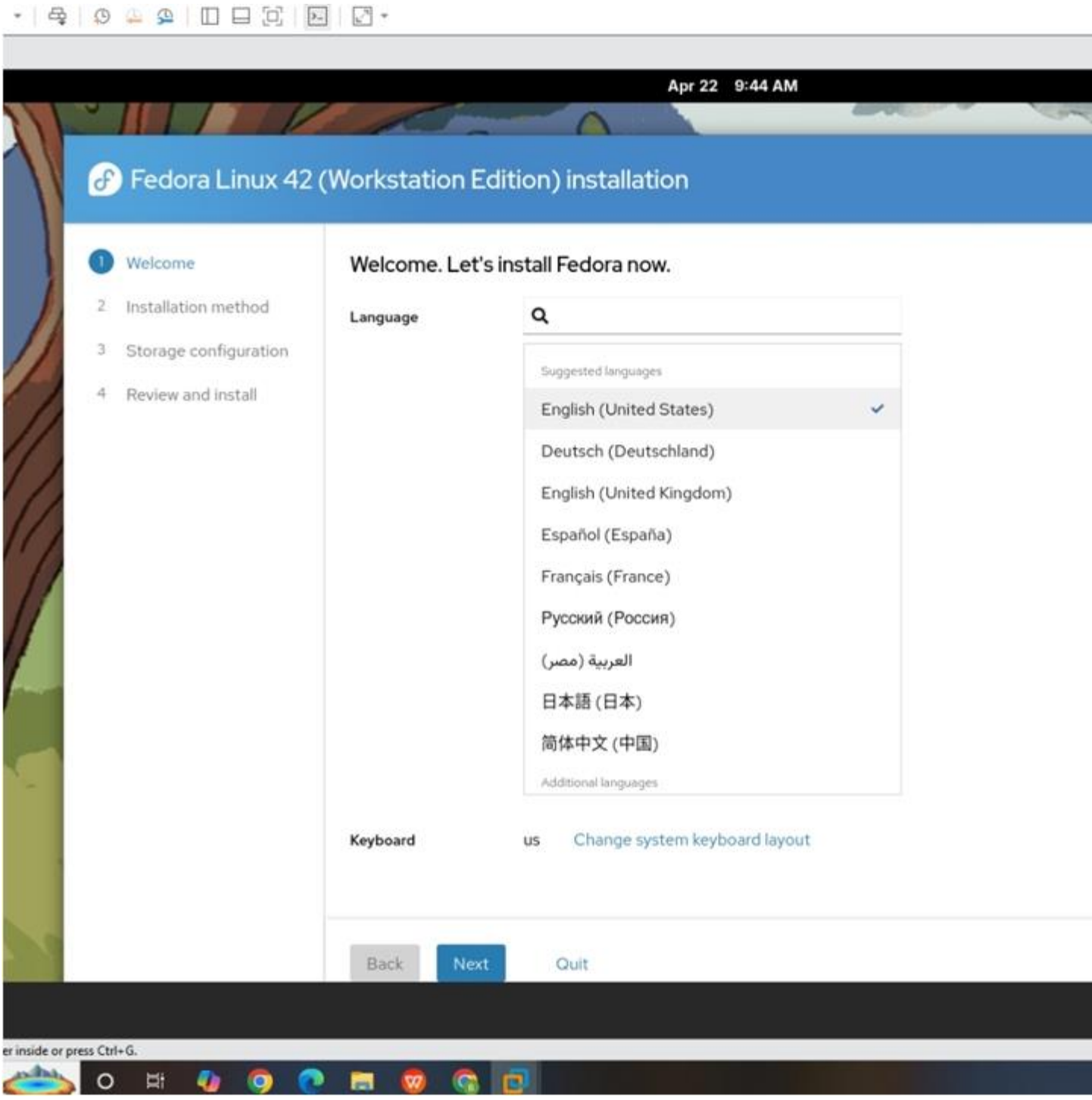
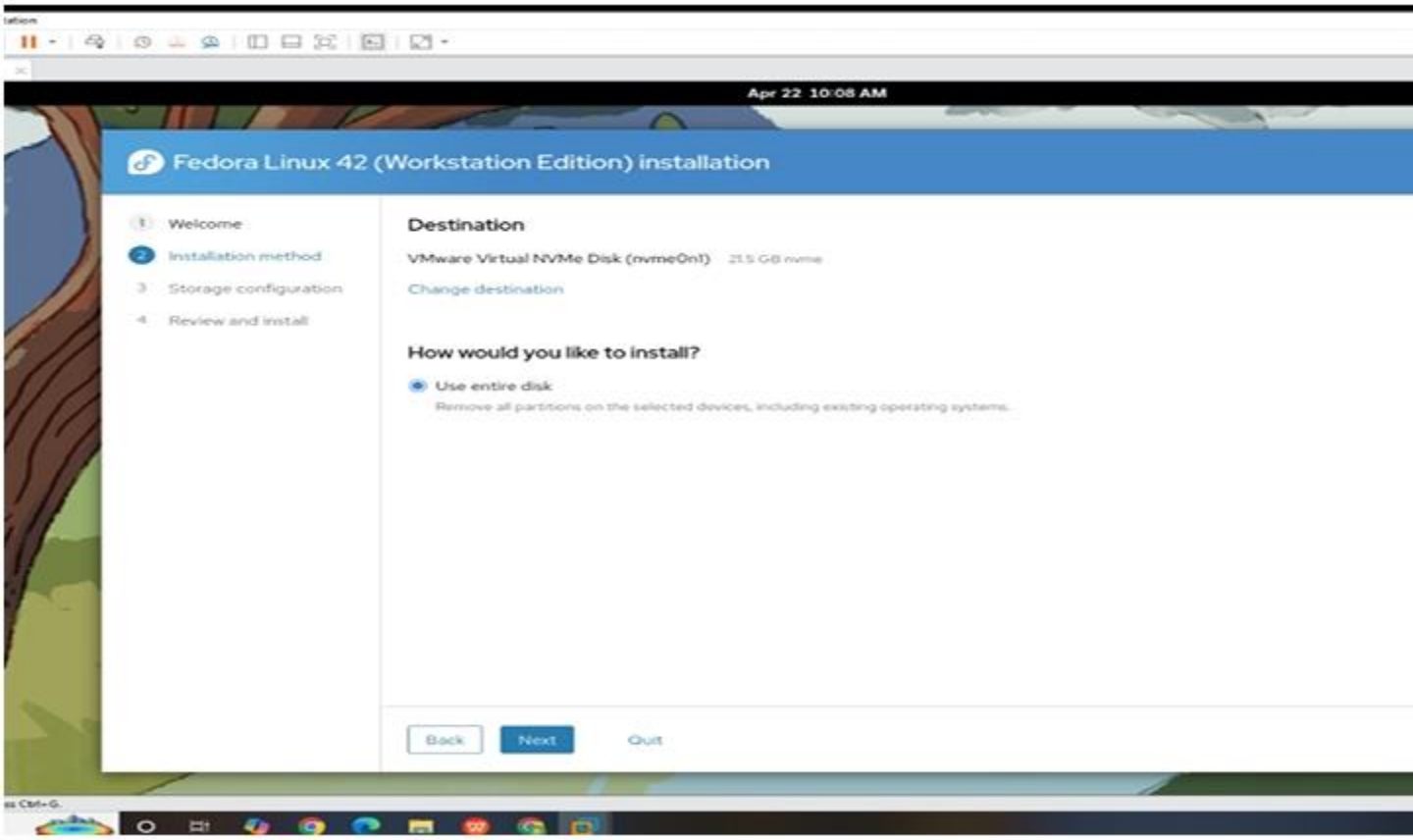
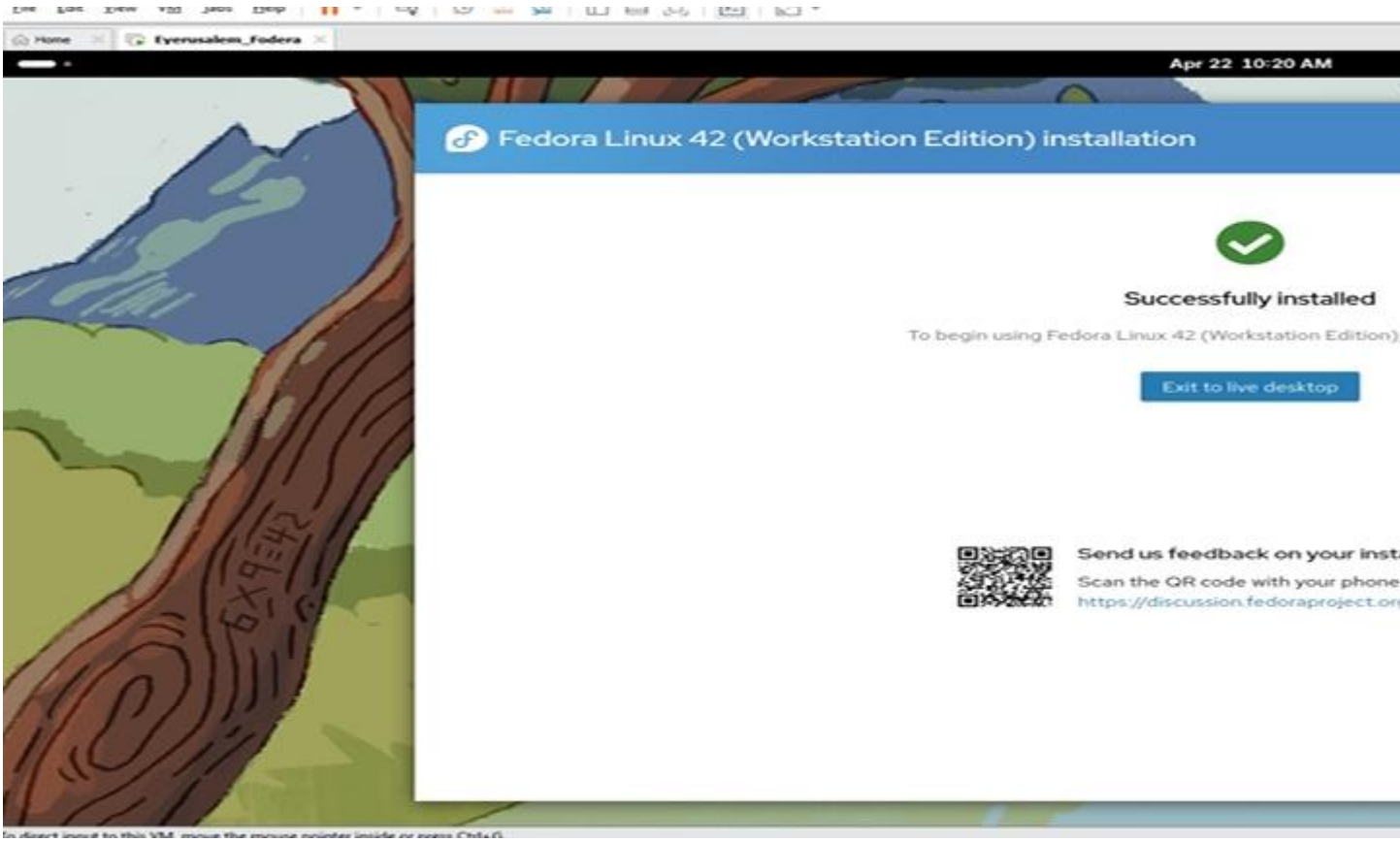
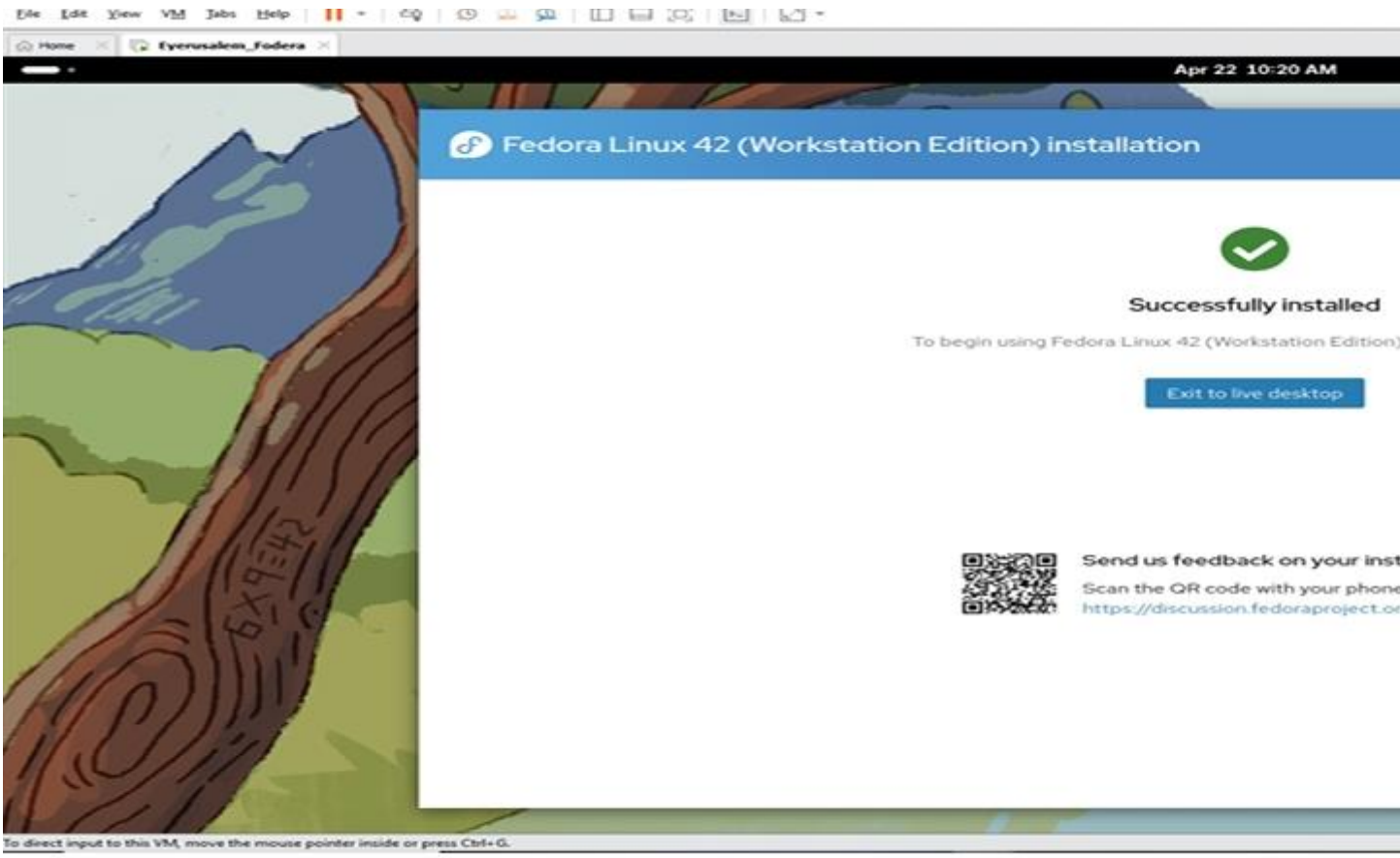
Cancel


File Edit View VM Tabs Help
Home
Eyerusalem_Fodera
GRUB ver
*Start Fedora-Workstation-Live
Test this media & start Fedora-Works
Troubleshooting -->
Use the ↑ and ↓ keys to select wh
Press enter to boot the selected
before booting or 'c' for a comma
previous menu.
Click in the virtual screen to send keystrokes
Install Fedora 64-bit as you would on a physical computer. When you are done and the operating system boots up, click "I Finished Installing".
o direct input to this VM, click inside or press Ctrl+G.
Type here to search


Apr 22 9:44 AM
Fedora Linux 42 (Workstation Edition) installation
1 Welcome
2 Installation method
3 Storage configuration
4 Review and install
Welcome. Let's install Fedora now.
Language
Suggested languages
English (United States)
Deutsch (Deutschland)
English (United Kingdom)
Español (España)
Français (France)
Русский (Россия)
العربية (مصر)
日本語 (日本)
简体中文 (中国)
Additional languages
Keyboard
us
Change system keyboard layout
Back
Next
Quit
er inside or press Ctrl+G.


Apr 22 10:08 AM
Fedora Linux 42 (Workstation Edition) installation
1 Welcome
2 Installation method
3 Storage configuration
4 Review and install
Destination
VMware Virtual NVMe Disk (nvme0n1)
Change destination
How would you like to install?
Use entire disk
Remove all partitions on the selected devices, including existing operating systems.
Back
Next
Quit


Home
Eyerusalem_Fedora
Apr 22 10:20 AM
Fedora Linux 42 (Workstation Edition) installation
Successfully installed
To begin using Fedora Linux 42 (Workstation Edition)
Exit to live desktop
Send us feedback on your inst
Scan the QR code with your phone
https://discussion.fedoraproject.or


File Edit View VM Tabs Help
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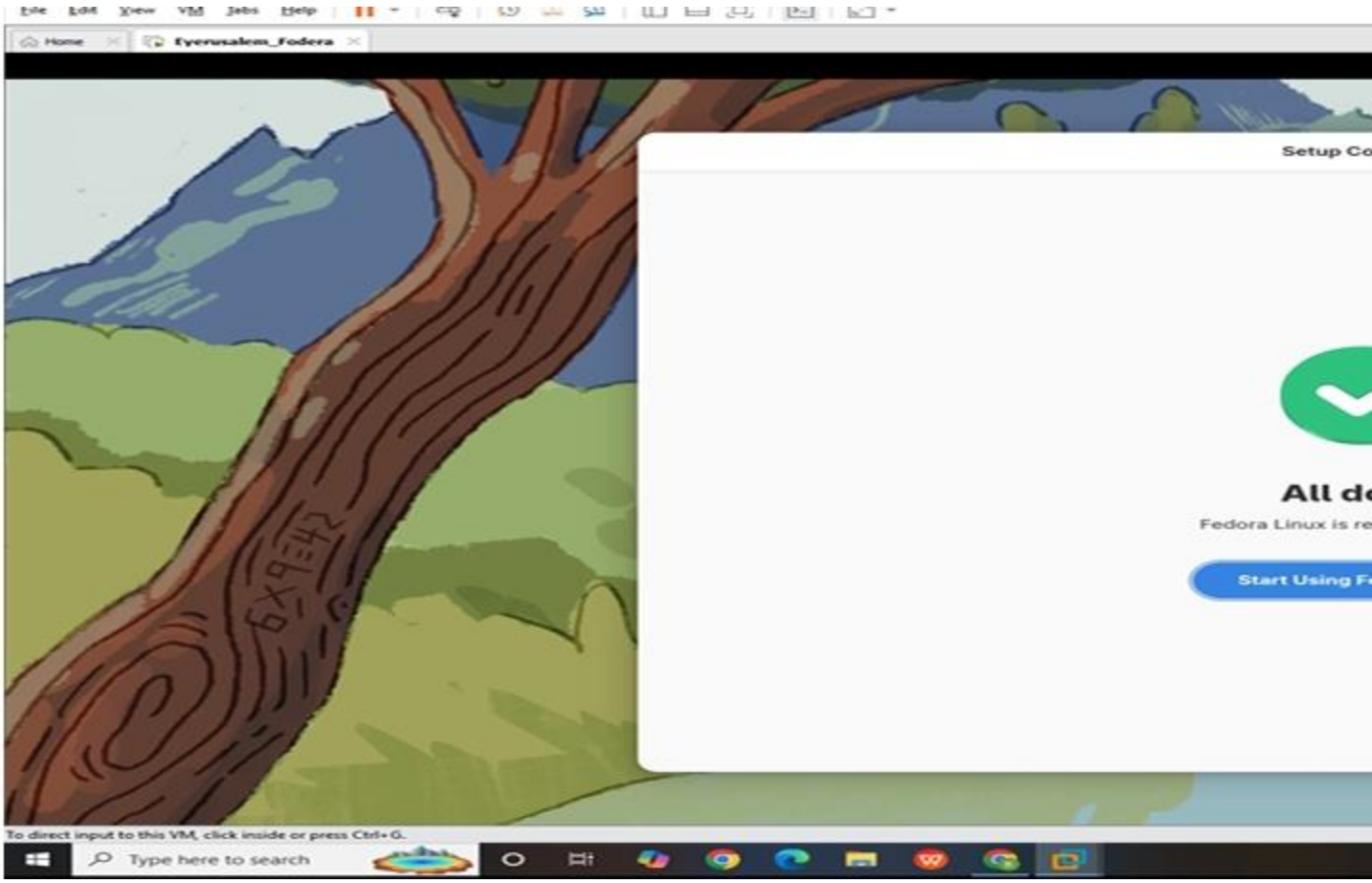
Eyerusalem_Fedora
Apr 22 10:20 AM
Fedora Linux 42 (Workstation Edition) installation
Successfully installed
To begin using Fedora Linux 42 (Workstation Edition)
Exit to live desktop
Send us feedback on your inst
Scan the QR code with your phone
https://discussion.fedoraproject.or
To direct input to this VM, move the mouse pointer inside or press Ctrl+G.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To direct input to this VM, click inside or press Ctrl+G.
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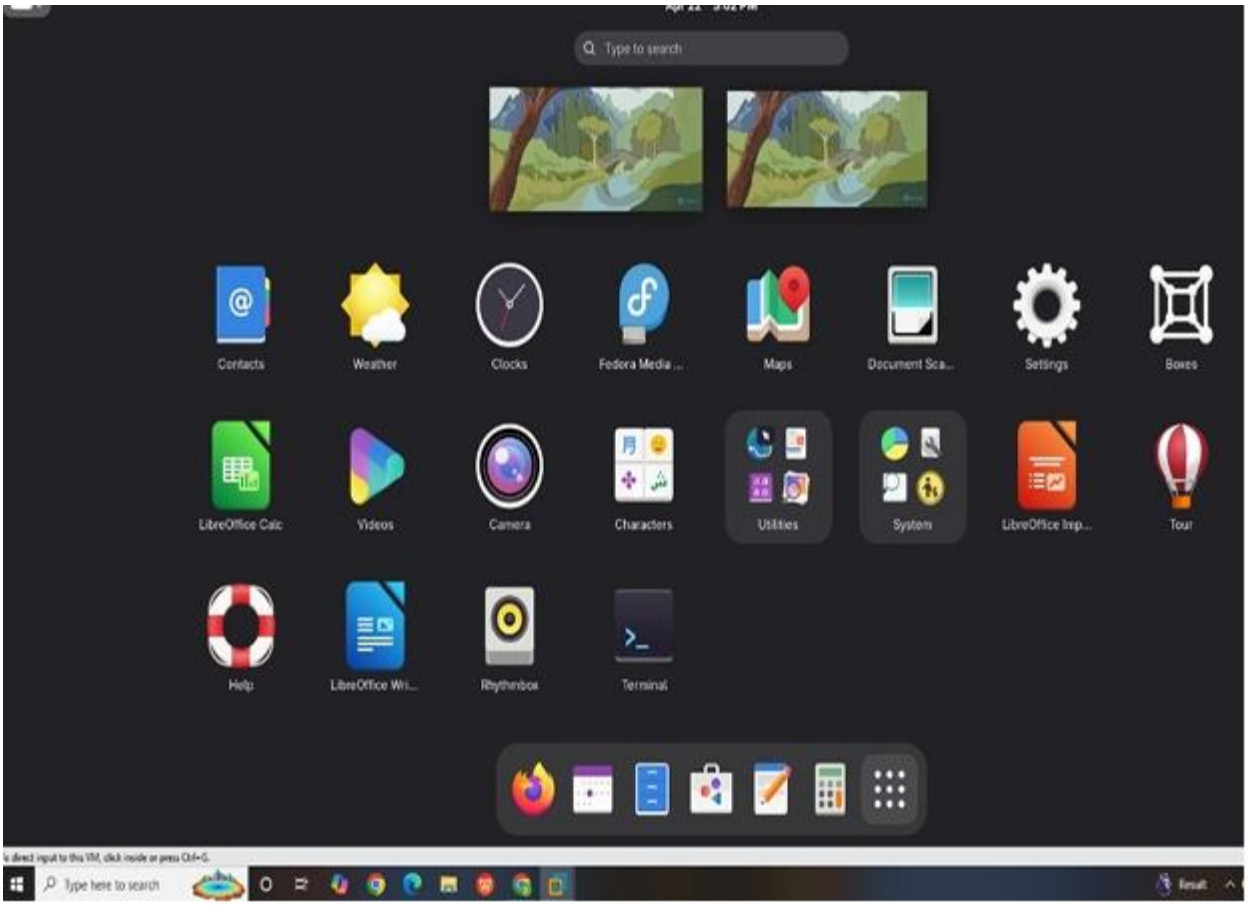
Type to search
Contacts
Weather
Clocks
Fedora Media ...
Maps
Document Sca...
Settings
Boxes
LibreOffice Calc
Videos
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Utilities
System
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Tour
Help
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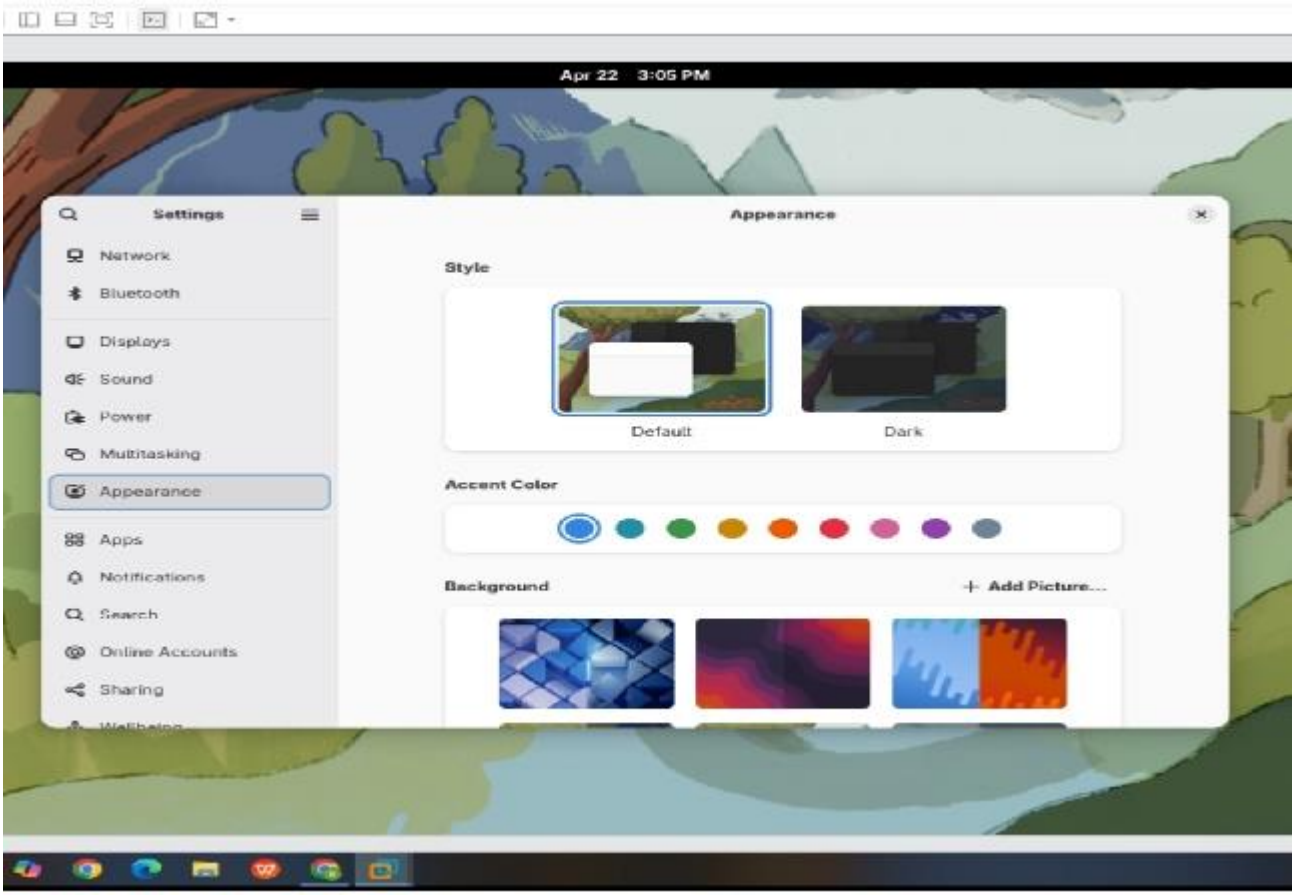
Type here to search



Issues (Problems Faced) During Fedora OS Installation on VMware

When installing **Fedora Operating System** on **VMware**, users may encounter both general Fedora-related issues and VMware-specific virtualization challenges. The exact problems experienced often depend on the VMware version, host system hardware, and the Fedora edition being installed (such as Fedora Workstation or Fedora Server). The most commonly encountered installation problems and their corresponding solutions are discussed below.

1. Hardware Virtualization Not Enabled

Symptom:
The virtual machine fails to start or freezes at the message *"Booting from CD/DVD..."*.

Cause:
Hardware virtualization features such as **Intel VT-x** or **AMD-V (SVM)** are disabled in the host system's BIOS or UEFI firmware.

Solution:
Restart the host machine, enter the BIOS/UEFI settings, and enable **Intel Virtualization Technology (VT-x)** or **AMD SVM (AMD-V)**. Save the changes and reboot the system before starting the virtual machine again.

2. Incorrect Virtual Machine Firmware Type (BIOS vs. UEFI)

Symptom:
The Fedora installer cannot detect the virtual disk or reports missing EFI variables.

Cause:
The virtual machine was configured to use **BIOS firmware**, while recent Fedora ISO images expect **UEFI firmware** by default.

Solution:
Edit the virtual machine settings in VMware and change the firmware type from BIOS to UEFI (or vice versa if legacy support is required). Restart the virtual machine and boot the Fedora installation media again.

3. VMware Compatibility Issues

A. Unsupported VMware Version

Symptom:
The virtual machine fails to boot the Fedora ISO or crashes during early installation stages with errors such as *"Boot device not found"* or kernel panic messages.

Cause:
An outdated version of VMware Workstation or Player that does not support newer Fedora kernels and virtual hardware.

Solution:
Upgrade to a VMware version that officially supports the installed Fedora release (for example, VMware Workstation 16 or later for Fedora 34 and above), and apply all available updates and patches.

B. Incorrect Guest Operating System Selection

Symptom:
The Fedora installer fails to detect the virtual disk, networking does not work, or VMware displays *"Unsupported operating system"* warnings.

Cause:
An incorrect guest OS type was selected during VM creation (for example, choosing CentOS or "Other Linux" instead of **Fedora 64-bit**).

Solution:
Modify the virtual machine settings and select **Fedora Linux 64-bit** as the guest operating system. Restart the VM to allow VMware to apply the correct virtual hardware configuration.

4. Networking Issues

Symptom:
During installation, messages such as *"Device ens33 not managed"* appear, or the installer fails to download packages due to lack of internet connectivity.

Cause:
The virtual network adapter is either disconnected or configured with an unsupported mode (such as Host-only without DHCP). Fedora's NetworkManager marks such interfaces as "unmanaged" and does not activate them automatically.

Solution:
Ensure that the network adapter is connected and configured as **NAT** (for internet access) or **Bridged** (to join the local network). Inside Fedora, execute the following commands:

```
sudo nmcli device connect ens33
sudo systemctl restart NetworkManager
```

Alternatively, edit `/etc/NetworkManager/NetworkManager.conf` to remove unmanaged device entries so that all interfaces are controlled by NetworkManager.

5. Storage Disk Issues

Storage-related problems are among the most common challenges during Fedora installation on VMware.

A. Disk Not Recognized

Symptom:
The Anaconda installer displays *"No disks detected"*, preventing installation.

Cause:
The virtual hard disk is missing, disconnected, or attached to an unsupported controller such as BusLogic or an improperly configured NVMe controller.

Solution:
Attach or reconnect a virtual disk using a supported controller (SATA or LSI Logic SAS), ensure the disk is marked as connected, and mount the appropriate VirtIO driver ISO if required.

B. Partitioning Errors

Symptom:
Errors such as *"Failed to write to disk"* or *"Could not create filesystem"* occur during partitioning.

Cause:
Residual RAID metadata, incompatible partition tables (e.g., GPT with BIOS firmware), or read-only disk flags.

Solution:
Clear old disk metadata using:

```
sudo dd if=/dev/zero of=/dev/sdX bs=1M count=10
```

Ensure firmware mode matches the partition scheme, and verify the disk is not marked read-only in VMware settings.

Filesystem Support in Fedora Operating System

The filesystem is the foundation of any operating system, determining how data is organized, accessed, and protected. Fedora supports a wide variety of in-kernel and user-space filesystems,

offering both modern features and proven stability for desktop, server, and embedded environments.

1. Default and Traditional Linux Filesystems

XFS

Significance: High-performance journaling filesystem optimized for large files and parallel I/O.
Use Cases: Fedora Workstation and Server root filesystems, virtualization storage, multimedia workloads.

ext4

Significance: Mature and widely supported filesystem with excellent compatibility.
Use Cases: Smaller disks, dual-boot systems, removable storage.

2. Advanced and Copy-on-Write Filesystems

Btrfs

Significance: Snapshotting, checksumming, compression, and multi-device pooling.
Use Cases: Experimental environments, rollback-capable desktops.

Stratis

Significance: User-space storage management with pooling and snapshots.
Use Cases: Flexible storage management for servers and containers.

3. Flash-Optimized Filesystem

F2FS

Significance: Optimized for flash-based storage, reducing write amplification.
Use Cases: Embedded systems, SD cards, NVMe SSDs.

4. Logical Volume Management and Encryption

LVM

Significance: Dynamic resizing and logical volume management.
Use Cases: Servers requiring scalable storage.

LUKS / dm-crypt

Significance: Full-disk encryption integrated with LVM.
Use Cases: Laptops and systems storing sensitive data.

5. Third-Party and Experimental Filesystems

ZFS on Linux

Significance: Enterprise-grade filesystem with RAID-Z and data integrity.
Use Cases: High-reliability storage servers.

exFAT, NTFS, HFS+

Significance: Cross-platform interoperability via native or FUSE drivers.
Use Cases: Accessing Windows and macOS drives.

6. Network and Distributed Filesystems

NFS

Use Cases: Shared directories across Linux/UNIX systems.

CIFS/SMB

Use Cases: Accessing Windows network shares.

CephFS and GlusterFS

Use Cases: Cloud-native and distributed storage solutions.

Advantages and Disadvantages of Fedora Operating System

Advantages

- Cutting-edge software and kernel updates
- Strong security through SELinux
- Strict open-source policy
- Modular package management
- Excellent container support
- Strong community and documentation

Disadvantages

- Short release lifecycle
- Proprietary software not included by default
- Steeper learning curve for beginners
- Potential instability from bleeding-edge updates
- Limited commercial support for non-enterprise editions

Virtualization

Virtualization enables multiple operating systems to run on a single physical machine by abstracting hardware resources. It improves efficiency, scalability, security, and resource utilization.

Types of Virtualization

- Hardware virtualization
- Operating system (container) virtualization
- Server virtualization
- Storage virtualization
- Network virtualization
- Desktop virtualization
- Application virtualization

System Call Implementation in Fedora Linux

A **system call** allows user-space applications to request services from the Linux kernel, such as file operations and process control.

Implementation Steps

1. Prepare the environment
2. Download and configure kernel source
3. Add a custom system call
4. Recompile and install the kernel
5. Test the system call using a user-space program

Conclusion

Fedora is a modern, community-driven Linux distribution that emphasizes innovation, security, and open-source purity. Its rapid release cycle, strong virtualization support, advanced filesystem capabilities, and active community make it ideal for developers, system administrators, and learners who value cutting-edge technology and flexibility.

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