Bahir Dar University
Bahir Dar Institute of Technology
Faculty of Computing

Department of Software Engineering

Course: Operating Systems and Systems Programming

Title: Tinycore linux operating system(TCL)

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ACKNOWLEDGMENT

I would like to acknowledge Lec. Wondimu Baye for assigning this project, which has been significant in expanding my knowledge of operating systems, specifically Tiny Core Linux.This assignment has been a challenging but rewarding experience. Through this assignment, I gained practical experience in system configuration,the boot process, file system structure, system installation, package management, command-line usage etc.. within a resource-constrained environment. Thank you for your clear instructions, guidance and for providing an environment of inquiry that allowed me to dig in into the complexities and elaboration of Tiny Core

Introduction to Tiny Core Linux

In the operating systems history, Tiny Core Linux stands out as a remarkable example of minimalism and efficiency. Designed with the philosophy that "less is more," Tiny Core Linux is a lightweight distribution that plans to provide a functional and flexible computing environment while consuming minimal system resources. With a core system that is just a few megabytes in size, it is particularly well-suited for older hardware, embedded systems, and users who prioritize speed and simplicity over bloat.

This assignment focus into the key features and architecture of Tiny Core Linux, exploring its unique modular design that allows users to customize their installations according to specific needs. I will examine its boot process, package management system, and user interface options, highlighting how these components work together to create a versatile operating system. Furthermore, I will discuss the practical applications of Tiny Core Linux in various environments, from personal computing to server management, and consider its role in the broader context of lightweight operating systems.

By understanding Tiny Core Linux, we gain insights into the principles of efficient computing and the importance of resource management in modern technology. This exploration not only showcases the capabilities of Tiny Core Linux but also encourages a deeper appreciation for the diversity of operating systems available today.

Tiny Core Linux is a minimalist Linux distribution that represent the principles of efficiency, speed, and simplicity. Originally released in 2009, it was developed by Robert Shingledecker and is known for its incredibly small footprint—often cited as one of the smallest Linux distributions available. The core version of Tiny Core Linux is typically around 16 MB, making it an attractive option for users who need a lightweight operating system that can run on older hardware or in resource-constrained environments.

At the heart of Tiny Core Linux lies the philosophy that "less is more." This approach emphasizes the importance of minimalism in computing, allowing users to build a customized operating system tailored to their specific needs. Instead of bundling a large number of applications and services, Tiny Core provides a basic environment that users can expand upon by adding only the software they require. This modular design not only conserves system resources but also enhances performance, making Tiny Core Linux particularly appealing for users who prioritize speed and efficiency.

Tiny Core Linux is structured around a core system that includes only the essential components needed to boot and run the operating system. The architecture consists of three main versions:

1. Core: The base version, which includes the Linux kernel and a minimal set of system utilities. It does not come with a graphical user interface (GUI) or additional applications.
2. TinyCore: This version includes the core system along with a lightweight GUI (FLWM) and essential applications, making it suitable for everyday use while still maintaining a small footprint.
3. CorePlus: An extended version that includes additional drivers and support for wireless networking, allowing users to easily set up their systems in various hardware environments.

The boot process of Tiny Core Linux is designed to be fast and efficient. It can be booted from various media, including USB drives, CDs, and network booting options. The operating system loads into RAM, which allows for rapid access to files and applications, further enhancing performance. This RAM-based operation also means that users can run Tiny Core Linux on systems with very limited storage capacity.

One of the standout features of Tiny Core Linux is its unique package management system, known as "TCZ" (Tiny Core Zinc). Users can easily download and install additional software packages from the official repositories, which are designed to be lightweight and compatible with the core system. This modular approach ensures that users can maintain a clean and efficient environment by only installing the software they truly need.

While Tiny Core Linux can be operated entirely from the command line, it also offers a user-friendly graphical interface through its TinyCore version. The default window manager, FLWM (Fast, Light Window Manager), is designed to be simple yet functional, providing users with an intuitive way to interact with their system. Users can customize their desktop environments further by choosing from various available applications and settings.

Tiny Core Linux is versatile and can be used in various scenarios, including:

• Older Hardware: It breathes new life into aging computers by providing a modern operating system that requires minimal resources.

• Embedded Systems: Its small size makes it ideal for embedded applications where storage and processing power are limited.

• Live Environments: Tiny Core can run from USB drives or live CDs, allowing users to carry their operating system with them and use it on different machines without installation.
• Server Management: Its lightweight nature makes it suitable for running servers or virtual machines where resource efficiency is critical.

Introduction to Tiny Core Linux: Background and Motivation

- ✧ **What is Tiny core linux ?**
- ✧ **Background of Tiny core linux;**

Tiny Core Linux (TCore) is a minimalist, open-source Linux distribution designed for speed, simplicity, and flexibility. It was developed by Robert Shingledecker as a continuation of the **Damn Small Linux (DSL)** project, focusing on an ultra-lightweight system that can run on very old or resource-constrained hardware.It is known for its small size, efficiency, and speed. Tiny Core is designed to be modular, allowing users to build a customized system by selecting and installing only the components they need.

History of Tiny core linux

History of Tiny Core

- ✧ Tiny Core Linux, initiated by Robert Shingledecker, originated as a fork of the now-discontinued Damn Small Linux (DSL).
- ✧ The initial release occurred in 2009, garnering approve for its remarkably compact size. In 2011, the introduction of Tiny Core Plus brought community-packaged extension support. Subsequently, in 2012, Shingledecker unveiled dCore, a new distribution derived from Tiny Core.
- ✧ The year 2023 witnessed the release of Tiny Core version 14, built upon the Linux 6.1.2 Kernel. Presently, in 2024, Tiny Core remains vibrant and under active development, maintaining a dedicated community that actively contributes to its evolution.

Origins and Development of Tiny Core

- ➢ Predecessor: Damn Small Linux (DSL)
  - ✓ Tiny Core Linux was inspired by Damn Small Linux (DSL), a lightweight distro (~50MB) that was popular in the early 2000s.
  - ✓ When DSL's development slowed down, Robert Shingledecker (one of DSL's key developers) started working on a new project that would improve upon DSL's concepts.
- ➢ Initial Release (2009)
  - ✓ Tiny Core Linux 1.0 was released on January 5, 2009.
  - ✓ It was designed to be even smaller than DSL, with a base system of just 10–12 MB.

- ✓ The core philosophy was "micro core + extensions", meaning users could add only the software they needed.

- Key Innovations
  - ✓ Modularity: Unlike traditional Linux distros, TCL does not include many pre-installed packages. Instead, users download extensions (.tcz files) on demand.
- It has Three main Editions:
  - ✓ **Core (~10MB)**: Minimal command-line-only system.
  - ✓ **Tiny Core(~16MB)**: Includes a basic graphical environment (FLWM window manager).
  - ✓ **Core Plus(~106MB)**: A larger ISO with additional drivers and tools for easier installation.

- Major Milestones of Tiny core linux
  - ✓ Tiny Core 2.0 (2009): Improved hardware detection and package management.
  - ✓ Tiny Core 3.0 (2010): Introduced AppBrowser, a GUI tool for managing extensions.
  - ✓ Tiny Core 4.0 (2011): Switched to Linux 3.0 kernel and improved extension handling.
  - ✓ Tiny Core 5.0 (2012): Added 64-bit support.
  - ✓ Tiny Core 6.0 (2014): Introduced glibc replacement with musl (later reverted).
  - ✓ Tiny Core 7.0 (2015): Major kernel and core updates.
  - ✓ Tiny Core 8.0 (2016): Switched to BusyBox for more lightweight utilities.
  - ✓ Tiny Core 9.0 (2017): Updated kernel and improved security.
  - ✓ Tiny Core 10.0 (2018): Kernel upgrade and bug fixes.
  - ✓ Tiny Core 11.0 (2019): 10th-anniversary release with updated packages.
  - ✓ Tiny Core 12.0 (2021): Kernel 5.10 LTS and security updates.
  - ✓ Tiny Core 13.0 (2022): Continued updates and stability improvements.
  - ✓ Tiny Core 14.0 (2023): major release with kernel 6.1 and modernized components.
  - ✓ Tiny core 15.0 (2024): latest stable version realese kernel version 6.6.8, which brings performance improvements and bug fixes

Key Characteristics of Tiny Core Linux:

✧ **What is the key characteristics of Tiny Core Linux?**

1. Minimalist Design:
   - ✓Tiny Core Linux is designed to be extremely lightweight, with the core version typically around 16 MB. This minimalism allows for quick boot times and efficient use of system resources.

2. Modular Architecture:
   - ✓The operating system is built around a core system that includes only essential components. Users can customize their installations by adding additional software packages as needed, allowing for a tailored computing environment.

3. Multiple Versions:
   - ✓ Tiny Core Linux comes in three main versions:
   - ✓Core: The base version without a graphical user interface (GUI).
   - ✓TinyCore: Includes a lightweight GUI (FLWM) and essential applications.
   - ✓CorePlus: An extended version that adds support for wireless networking and additional drivers.

4. RAM-Based Operation:
   - ✓Tiny Core Linux runs primarily in RAM, which allows for fast access to files and applications. This design choice enhances performance and makes it suitable for systems with limited storage capacity.

5. Fast Boot Time:
   - ✓The operating system is optimized for quick booting, making it ideal for users who need to get up and running rapidly. It can boot from various media, including USB drives, CDs, and network sources.

6. Lightweight User Interface:
   - ✓The default window manager, FLWM (Fast, Light Window Manager), is simple and efficient, providing a user-friendly graphical interface without consuming excessive resources.

7. Package Management System (TCZ):
   - ✓Tiny Core Linux utilizes a unique package management system called TCZ (Tiny Core Zinc). Users can easily download and install additional software packages from official repositories, ensuring compatibility with the core system.

8. Extensive Repository:
   - ✓The distribution offers a wide range of software packages in its repositories, allowing users to expand their systems with various applications while maintaining a small footprint.

9. Customizability:
   - ✓Users have the freedom to customize their environments extensively. They can choose different window managers, desktop environments, and applications based on their preferences and needs.

10. Community Support:
   - ✓Tiny Core Linux has an active community that provides support through forums, documentation, and user-contributed resources. This community-driven approach helps users troubleshoot issues and share tips.

11. Persistence Options:
   - ✓Tiny Core Linux supports various methods for data persistence, allowing users to save changes and installed applications across reboots when running from live media.

12. Versatile Usage Scenarios:
   - ✓The distribution is suitable for a variety of use cases, including:
   - ✓Reviving older hardware by providing a modern OS experience.
   - ✓Creating embedded systems where space is at a premium.
   - ✓Running live environments for portable computing solutions.

✓Setting up lightweight servers or virtual machines.

13. Security Features:

✓Tiny Core Linux emphasizes security by providing a minimal attack surface. Users can enhance security further by carefully selecting software packages and configuring their systems according to best practices.

14. Documentation:

✓Comprehensive documentation is available, covering installation procedures, usage tips, and troubleshooting guides, making it easier for new users to get started.

15. Compatibility:

✓Tiny Core Linux is compatible with a wide range of hardware architectures, including x86 and ARM, making it versatile for different types of devices.

Motivation of using Tiny core Linux

✧ **What is the motivation of using Tiny Core Linux?**

Using Tiny Core Linux can be motivated by several factors, particularly its unique design and features. Here are some key motivations for choosing Tiny Core Linux as an operating system:

1. Lightweight and Fast

• Minimal Resource Usage: Tiny Core Linux is extremely lightweight, making it ideal for systems with limited resources or older hardware. Its small footprint allows it to run efficiently without consuming excessive CPU or RAM.

• Quick Boot Times: The operating system is optimized for fast booting, allowing users to get to their desktop and applications quickly.

2. Customizability

• Modular Architecture: Users can build their system by adding only the components they need. This flexibility allows for a highly personalized computing environment tailored to individual preferences and requirements.

• Choice of Software: With a wide range of available packages, users can install specific applications that suit their needs without unnecessary bloat.

3. Performance
• RAM-Based Operation: Running primarily from RAM enhances performance, providing faster access to applications and files compared to traditional disk-based systems.
• Efficiency: The lightweight nature of Tiny Core Linux means that it can run smoothly on older or less powerful hardware, making it suitable for various use cases.

4. Reviving Old Hardware
• Breathes New Life into Legacy Systems: Tiny Core Linux is an excellent choice for revitalizing older computers that may struggle with modern operating systems. It allows users to continue using their hardware effectively.

5. Portable Computing
• Live Environment: Tiny Core can be run from USB drives or other portable media, making it easy to carry a complete operating system and personal workspace wherever you go.
• Persistence Options: Users can save their settings and installed applications even when running from live media, enhancing portability.

6. Learning Opportunity
• Understanding Linux Internals: The minimalist approach encourages users to learn more about how Linux works, as they will often need to configure and manage their systems more manually than with larger distributions.
• Community Engagement: Engaging with the Tiny Core community can provide valuable learning experiences and insights into Linux usage and system customization.

7. Security
• Reduced Attack Surface: The minimal installation reduces vulnerabilities, making it a more secure option than larger distributions that come with many pre-installed applications and services.
• Control Over Installed Software: Users have complete control over what software is installed, allowing them to avoid unnecessary risks associated with unneeded applications.

8. Versatile Use Cases

• Embedded Systems: Tiny Core Linux's small size makes it suitable for embedded systems, IoT devices, and specialized applications where space is a premium.

• Lightweight Servers: It can be used to set up lightweight servers that perform specific tasks without the overhead of a full-fledged server operating system.

9. Community Support

• Active Community: Tiny Core Linux has a supportive user community that contributes to forums, documentation, and shared knowledge, making it easier for new users to find help and resources.

10. Learning Minimalist Linux Systems

• Ideal for understanding how Linux works at its core without unnecessary bloat.

•Helps users learn manual package management, kernel modules, and system customization.

11. Running on Low-End Hardware

• Can revive old computers (even Pentium III or early Pentium 4 systems).

• Useful for embedded systems, IoT devices, and lightweight servers.

12. Fast and Secure Environment

• Since it loads into RAM, it leaves no traces on the host system (good for security testing).

• Useful for live USB rescue disks or temporary workstations.

13. Customizability

- Users can build their own system by selecting only the needed extensions (e.g., Wi-Fi drivers, GUI tools).
- Developers can create lightweight virtual machines or containers.

✧ **What is the Objectives of Tiny Core Linux?**

Tiny Core Linux (TCore) is designed with specific goals in mind, making it unique among Linux distributions. Below are its primary objectives:

1. Minimalism & Lightweight Design

- **Ultra-small footprint** (Base ISO ~16 MB) to run on very old or low-resource hardware.
- **Avoid bloatware**—only essential components are included by default.
- **Fast boot times** since the system loads entirely into RAM.

2. Flexibility & Customizability

- **Modular approach**—users install only the extensions (.tcz files) they need.
- **Multiple editions** (Core, TinyCore, CorePlus) to suit different use cases.
- **No forced updates**—users control when and what to upgrade.

3. Portability & Compatibility

- **Runs on x86, x86_64, ARM, and Raspberry Pi** (depending on the edition).
- **Works as a live CD/USB** with optional persistence.
- **Suitable for embedded systems, virtualization, and recovery tools.**

4. Educational & Experimental Use

- **Ideal for learning Linux internals** (kernel, filesystems, boot process).
- **Great for testing software in a clean environment.**
- **Useful for sysadmins and developers** who need a minimal OS for debugging.

5. Security & Stability

- **Small attack surface** (fewer packages = fewer vulnerabilities).
- **Run entirely in RAM** (leaves no traces on disk unless configured).
- **No unnecessary background services** running by default.

6. Community-Driven Development

- **Encourages user contributions** (extensions, scripts, and optimizations).
- **No corporate backing**—keeps the project independent and open.

Tiny Core Linux: Hardware & Software Requirements

✧ What the Hardware & Software Requirements of Tiny Core Linux?

Tiny Core Linux (TCore) is one of the most lightweight Linux distributions, allowing it to run on very old or low-power hardware. Below are the **minimum** and **recommended** requirements for running TCore efficiently.

1. Minimum & Recommended Hardware Requirements

A. Core (Minimal CLI Edition)

- CPU: Intel/AMD i486 or compatible (x86 32-bit)
- RAM:
  - ✓ Minimum: 46 MB (for booting into CLI)
  - ✓ Recommended: 64 MB (for basic operations)
- Storage:
  - ✓ ISO Size: ~11 MB
  - ✓ Installation (Frugal): 16–32 MB
  - ✓ Persistent Storage: 50+ MB (for extensions)
- Graphics: No GUI (text mode only)
- Boot Options: CD, USB, HDD, or PXE network boot

B. TinyCore (Default with FLWM GUI)

- CPU: Intel/AMD i486 or compatible (x86 32-bit)
- RAM:
  - ✓ Minimum: 64 MB (barely usable)
  - ✓ Recommended: 128 MB (for smooth operation)

- Storage:
  - ✓ ISO Size: ~16 MB
  - ✓ Installation (Frugal): 32–64 MB
  - ✓ Persistent Storage: 100+ MB (for apps and extensions)
- Graphics:
  - ✓ Minimum: 640×480 (VESA-compatible)
  - ✓ Recommended: 800×600 or higher
- Boot Options: CD, USB, HDD, or PXE

C. CorePlus (Extended Edition with Wi-Fi & Extras)

- CPU: Intel/AMD i486 or compatible (x86 32-bit)
- RAM:
  - ✓ Minimum: 128 MB
  - ✓ Recommended: 256 MB (for Wi-Fi and additional tools)
- Storage:
  - ✓ ISO Size: ~106 MB
  - ✓ Installation (Frugal): 200+ MB
- Persistent Storage: 500 MB–1 GB (for full functionality)
- Graphics:
  - ✓ Supports multiple window managers (FLWM, JWM, IceWM)
  - ✓ Recommended: 1024×768 for better usability
- Boot Options: CD, USB, HDD, or PXE

1. Detailed Hardware Requirements

1, Processor (CPU)

- ✓ Minimum: Intel/AMD i486 or compatible (x86 32-bit)
- ✓ Recommended: Pentium III or newer (for better performance)
- ✓ 64-bit Version: x86_64 CPU (for Tiny Core Pure 64)

2, Memory (RAM)

- Core (CLI only):
  - ✓ Minimum: 46 MB
  - ✓ Recommended: 64 MB
- TinyCore (GUI with FLWM):
  - ✓ Minimum: 64 MB
  - ✓ Recommended: 128 MB
- CorePlus (Wi-Fi & Extras):
  - ✓ Minimum: 128 MB
  - ✓ Recommended: 256 MB
- Modern Browsers (Firefox/Chromium): 512 MB–1 GB

3, Storage (Hard Drive/USB)

- Core (CLI):
  - ✓ Minimum: 11 MB (ISO)
  - ✓ Installation: 16–32 MB (frugal)
- TinyCore (GUI):
  - ✓ Minimum: 16 MB (ISO)
  - ✓ Installation: 32–64 MB (frugal)

- CorePlus (Extended):
  - ✓ Minimum: 106 MB (ISO)
  - ✓ Installation: 200+ MB (frugal)
- Persistent Storage (for apps & data): 500 MB–1 GB

4, Graphics

- Minimum: VESA-compatible (640×480)
- Recommended: 800×600 or higher (1024×768 for better usability)
- GUI Options: FLWM (default), JWM, IceWM (via extensions)

5, USB Port or Optical Drive

- USB: Required for booting from a USB flash drive
- Optical Drive: Required for booting from a CD/DVD
- Network Boot (PXE): Supported

6, Internet Connection

- Required for:
- Downloading extensions (post-installation)
- Software updates
- Offline Installation: Possible (but limited functionality without extensions)

2. Software Requirements

1, Tiny Core Linux ISO File

- Download Options:
  - ✓ Core (CLI only) (~11 MB)
  - ✓ TinyCore (Default GUI) (~16 MB)
  - ✓ CorePlus (Wi-Fi & Extras) (~106 MB)
  - ✓ 64-bit Version (Tiny Core Pure 64) (~20 MB)

2, USB Creation Tool (if installing from USB)

- Windows: Rufus, BalenaEtcher
- Linux: dd command, UNetbootin, BalenaEtcher
- macOS: BalenaEtcher, Terminal (dd command)

3, Burning Software (if installing from CD/DVD)

- Windows: ImgBurn, CDBurnerXP
- Linux: Brasero, K3b, wodim (command-line)
- macOS: Disk Utility

4, BIOS/UEFI Settings

- Legacy BIOS: Must be set to boot from USB/CD
- UEFI: Some versions support UEFI boot (check compatibility)

5, Optional Software (Post-Installation via Extensions)

- Web Browsers: Dillo (lightweight), Firefox, Chromium
- Office: AbiWord, Gnumeric
- Multimedia: MPlayer, VLC, Audacious
- Development: GCC, Python, Git
- Networking: Dropbear (SSH), wpa_supplicant (Wi-Fi)

➢ **If Running on Bare Metal (Direct Installation)**

✓ **No host OS needed** (boots directly from USB/CD).
✓ **BIOS/Legacy boot mode** (UEFI support is limited in older versions).

If Running in a Virtual Machine (Recommended for Testing)

Virtualization Software	**Notes**
Oracle VirtualBox	Free, supports Tiny Core well
VMware Workstation/Player	Better performance, good for advanced users
QEMU/KVM	Lightweight, good for Linux hosts

Virtualization Software	Notes
Hyper-V	Possible but may need manual driver setup

Installation of Tiny Core Linux

✧ **What is the installation step of Tiny core linux?**

Tiny Core Linux can be installed on physical hardware via USB boot, I strongly recommend using VMware Workstation for installation due to its simplicity and convenience. This approach eliminates hardware compatibility issues and provides a controlled environment ideal for testing and learning.

❖ **Why Choose VMware Workstation for Tiny Core Linux Installation?**

➢ **Advantages of using vmware workstation Over USB Installation**

■ No Hardware Risks

- ✓ Avoids potential issues with BIOS/UEFI settings on physical machines
- ✓ No risk of accidental data loss on host system drives

■ Simplified Process

- ✓ No need to create bootable USB media
- ✓ Easy to restart/reinstall if mistakes occur
- ✓ Built-in screenshot and snapshot capabilities

■ Better Control

- ✓ Adjustable virtual hardware (RAM, CPU, storage)
- ✓ Easy network configuration
- ✓ Simple file sharing between host and guest

■ Ideal for Testing

- ✓ Safe environment to experiment with Linux commands
- ✓ Ability to take snapshots before making changes

➢ **VMware Workstation Installation Requirements**

◆ VMware Workstation Versions

- ✓ Windows: VMware Workstation 16/17 Pro or Player
- ✓ Linux: VMware Workstation Pro or Player
- ✓ macOS: Not supported (use VirtualBox instead)

❖ Host System Requirements

component	Minimum	Recommended
CPU	X86-64 processor	Multi-core CPU VT-x/AMD-V
RAM	2GB+	4GB+
Disk Space	1GB free	5GB+free
OS	Window 10/11 or Linux	Latest version

✧ The Detailed installation steps:

1. Download Required Files

- Get Tiny Core Linux ISO:

- ✓ https://tinycorelinux.net/downloads.html
- ✓ For beginners: Choose CorePlus (includes GUI and Wi-Fi tools)
- ✓ For minimal setup: Choose TinyCore (GUI only)
- ✓ For experts: Choose Core (command-line only)

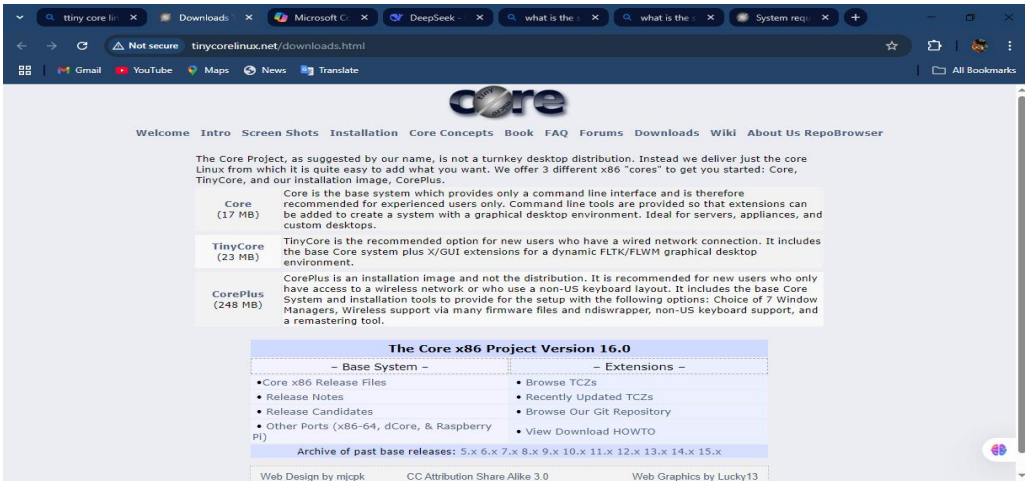


Fig1:different version of tinycore linux

2, Download VMware Workstation:

✓ Use the link https://www.vmware.com to download vmware

3. Create the Virtual Machine

Open VMware and select Create a New Virtual Machine

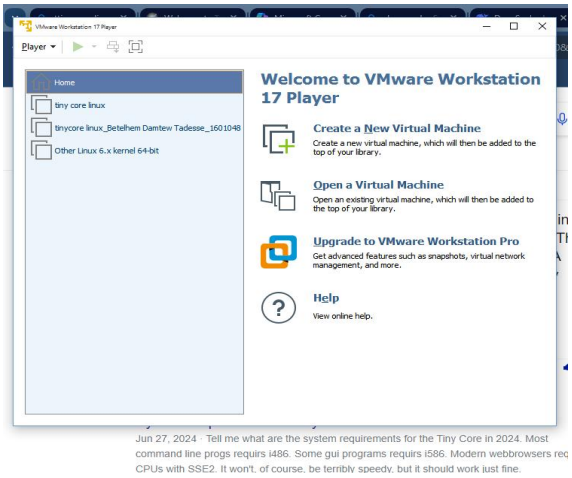


Fig 2:opening vmware

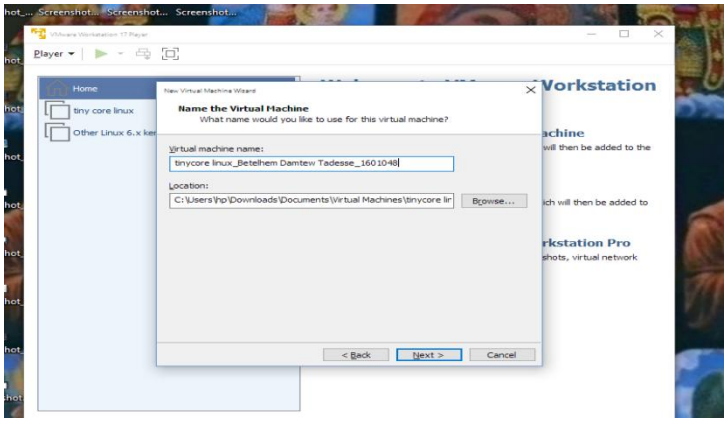


Fig 3:creating new vertual machine

4,Choose Typical configuration

- Select Installer disc image file (ISO) and browse to your Tiny Core ISO

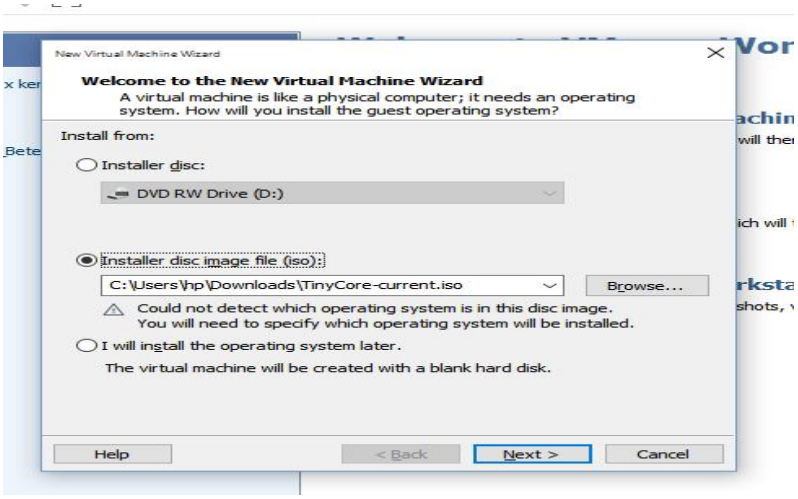


Fig .4: selection of tinycore iso file

- Set guest OS type:

  - ✓ For 32-bit: Other Linux 5.x kernel
  - ✓ For 64-bit: Other Linux 5.x kernel 64-bit

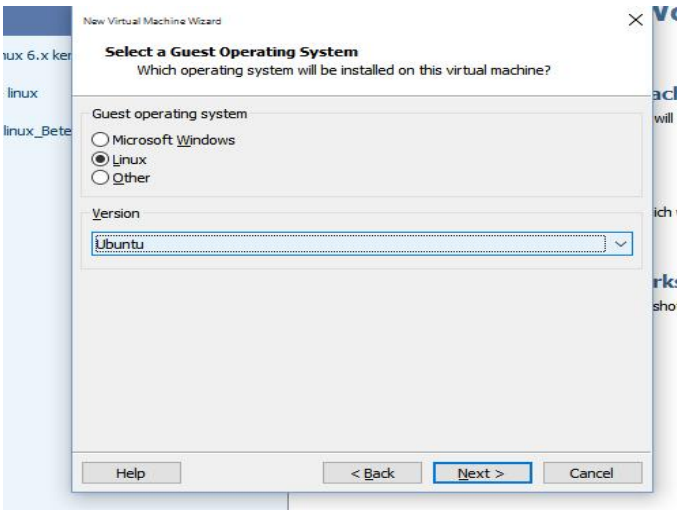


Fig 5:selecting guest operating system

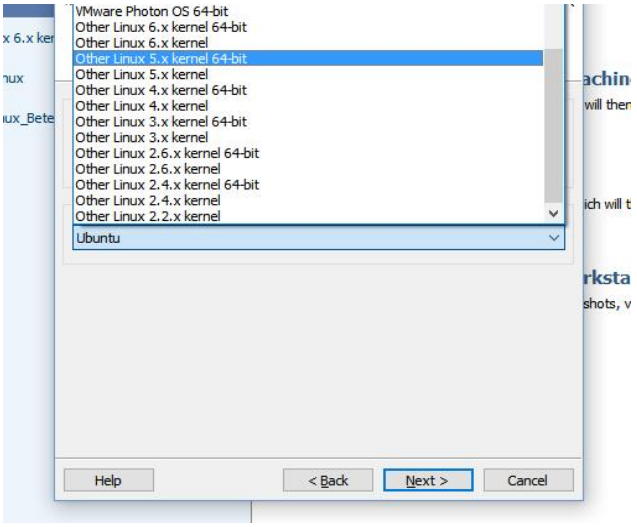
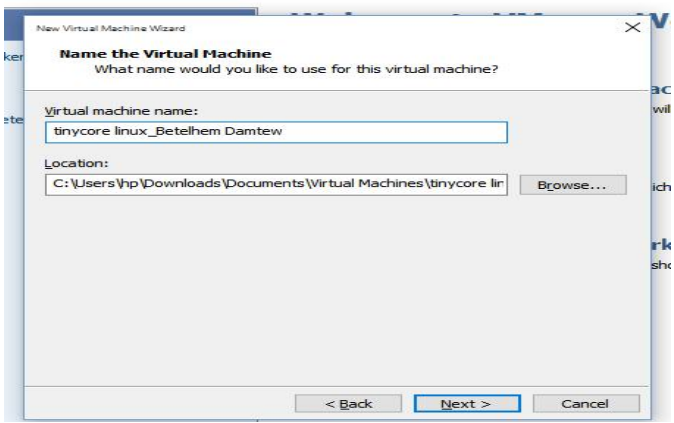


Fig 6:selecting other linux 5.x kernel 64-bit



- Name the VMware workstation (e.g., "TinyCore_Betelhem Damtew")
- Set disk size to 2GB (select "Split virtual disk into

multiple file")

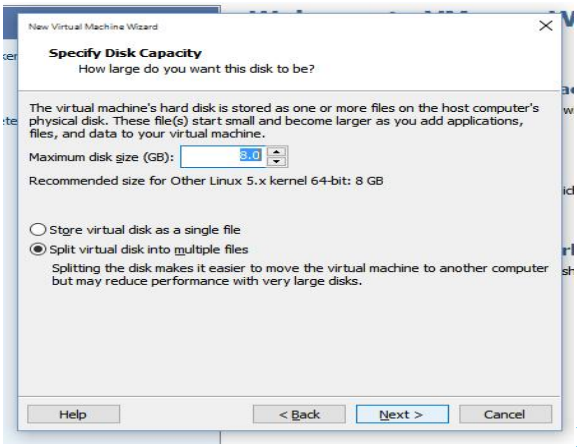
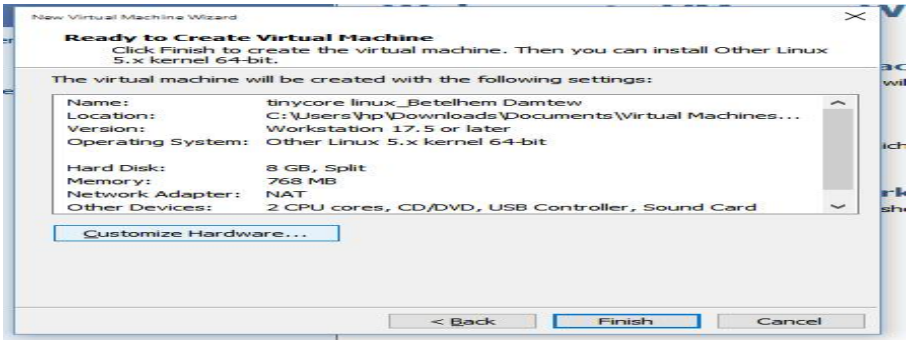


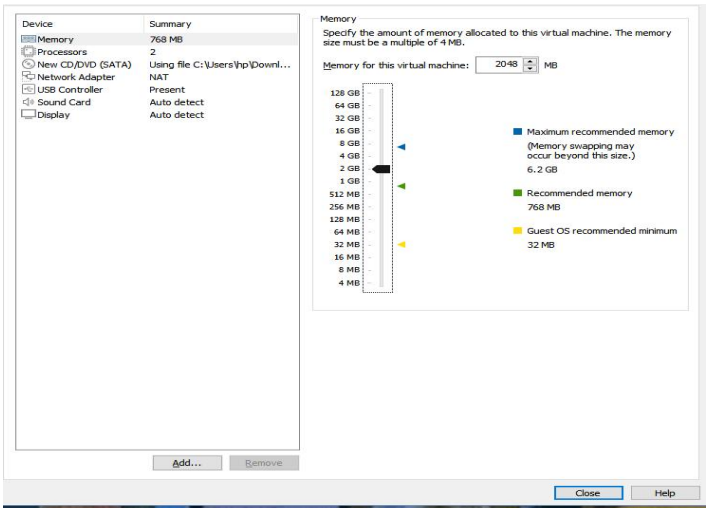
Fig 8:specifying disk capacity

Fig 7:naming the VMware machine

- **Customize Hardware**



- **Select the memory for the virtual machine 2GB**
- **Select the number of the processor cores to 2**
- **Enable virtualization: VT-x/AMD-V (in host BIOS if needed)**



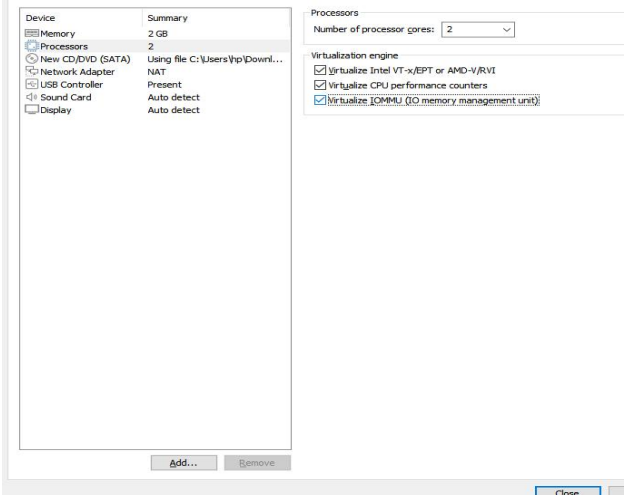
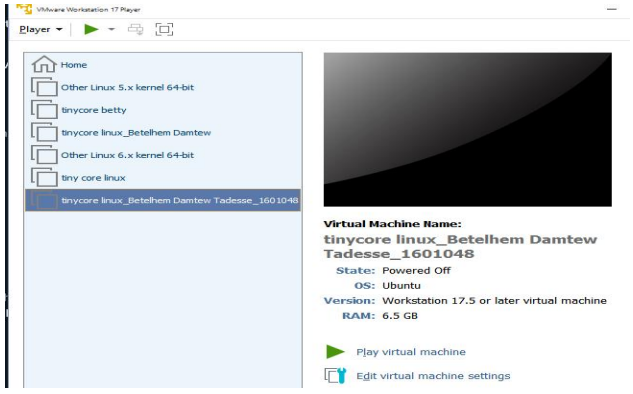
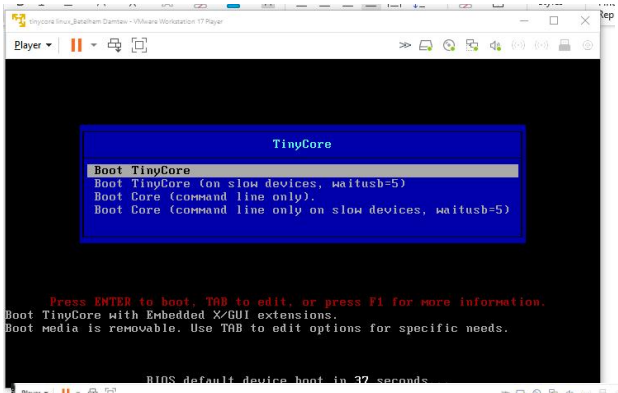
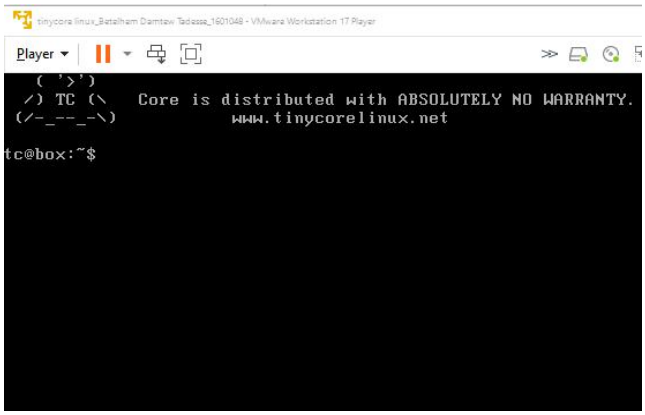


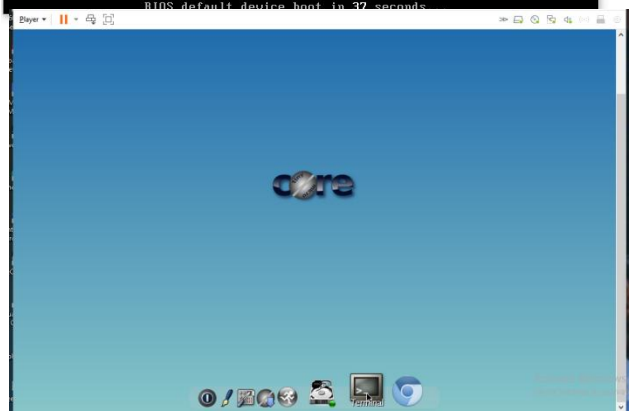
Fig 9:selecting virtual machine memory size to 2GB Fig 10:selecting processor to 2

- Then Click Finish
- After creating tiny core virtual machine lets play the virtual machine that we created

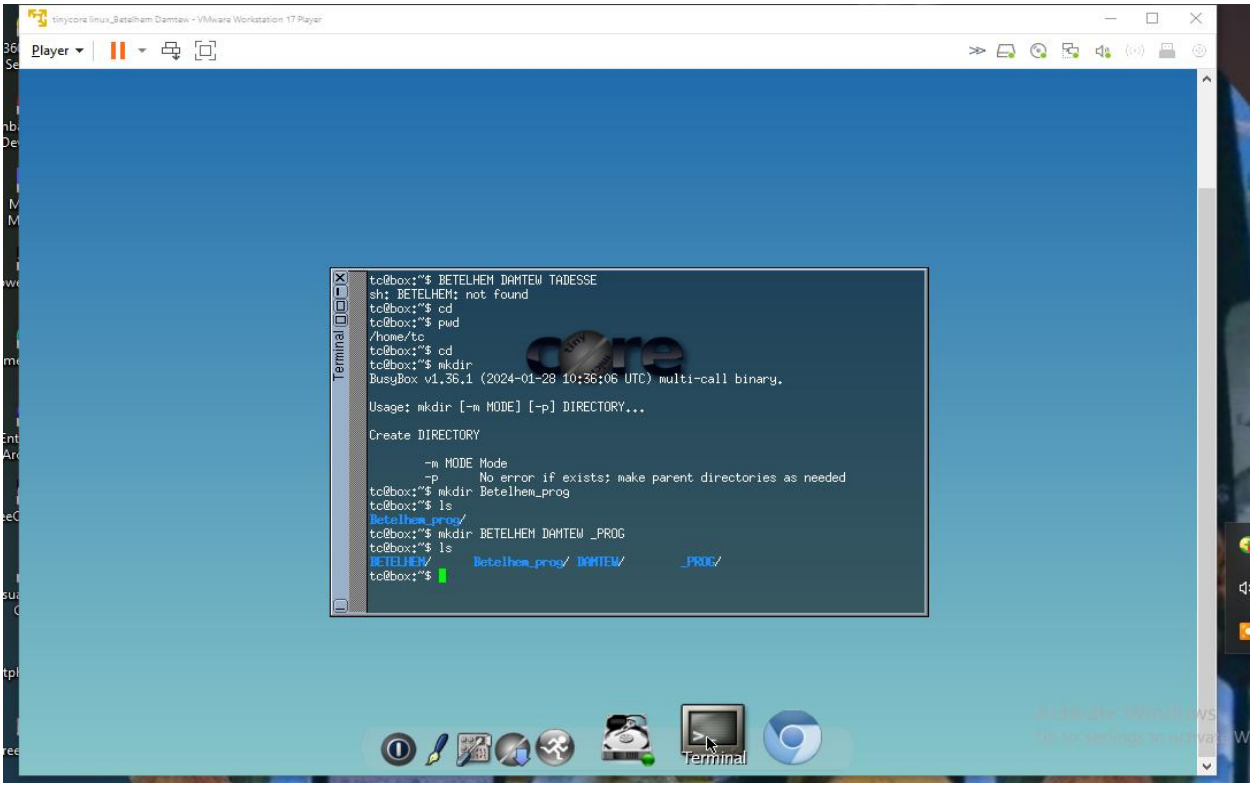




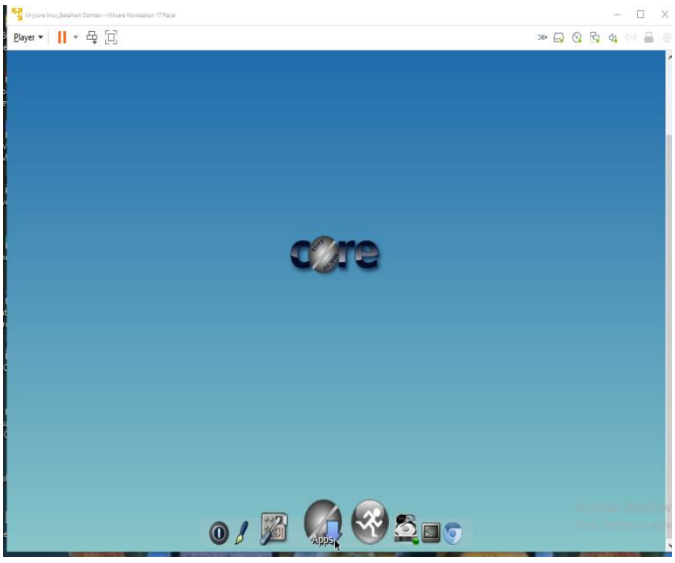


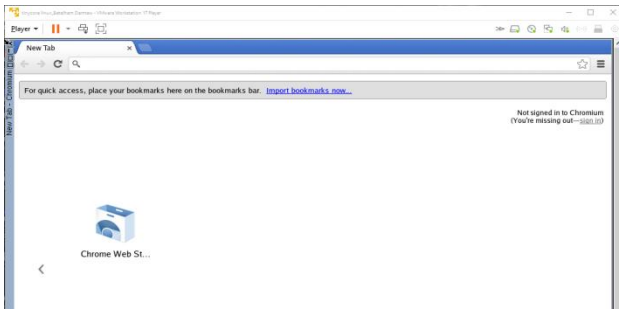


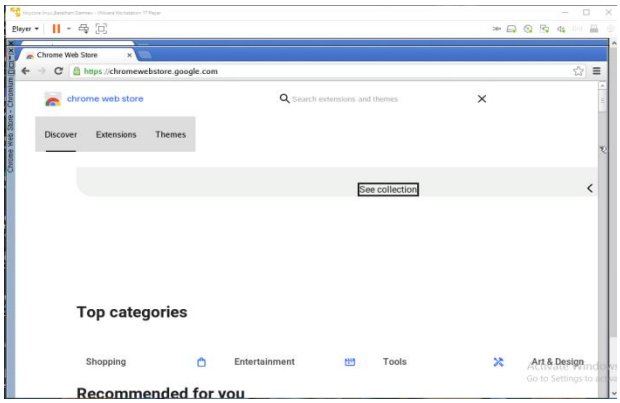
- ✧ We can access the terminal by clicking application the terminal or directly from the bottom of the tinycore linux as following



✧ Create application on tiny core linux







Issues (problem faced) when installing Tinycore os

✧ **What is the issues that faced during the installation of Tinycore Linux OS?**

- When I try to install Tinycore Linux I faced different issues .
  - ✓ E.g. I faced an Error while installing Tinycore Linux because on My Pcs ,in the BIOS setting the host supporter Intel VT-x was disabled.

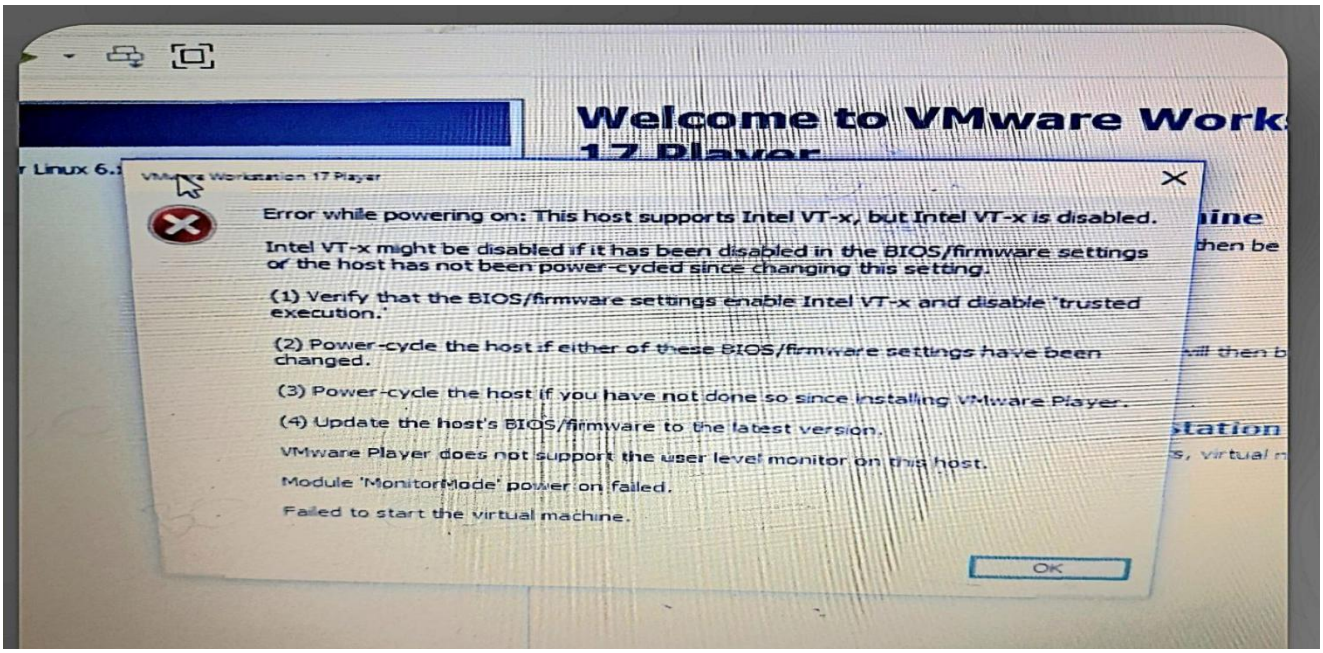


Fig : error occurred while installing Tinycore Linux on the Vmware workstation

solution of problem faced during the installation of TCL

✧ **What is the solution that we faced during the installation of Tinycore**

- ✓ As I mention earlier I faced an issues when i install Tinycore Linux on my Pcs.so to solve this problem I search this problem on different sites and I try To enable Intel VT-x in My Pcs BIOS settings and try to fix it as shown bellow.

➢ **Here's is the step that I follow to fixt the problem:**

- Step 1: Enter BIOS/UEFI Setup
  - ✓ Restart your PC.
  - ✓ As soon as it starts booting, press the BIOS key — usually one of these:
  - ✓ F2, Del, F10, ESC, or F12
  - ✓ It may say "Press [key] to enter setup" on screen.
- Step 2: Enable Intel VT-x
  - ✓ Look for a setting called:
  - ✓ Intel Virtualization Technology

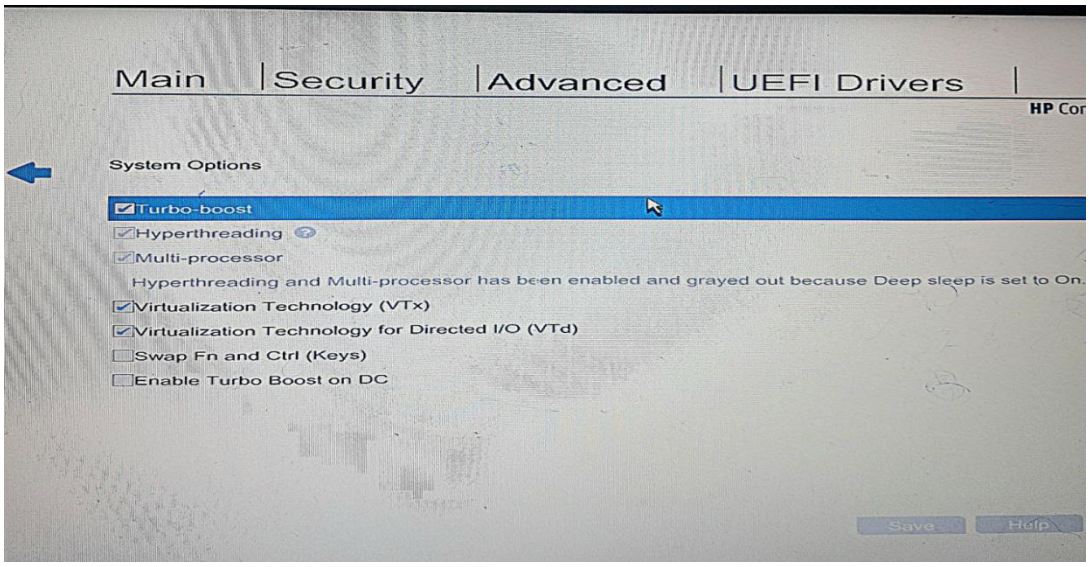


Fig : Enabling Intel VT-x on the BIOS setting

  - ✓ VT-x, Intel VT, or Virtualization
  - ✓ Set it to Enabled.
  - ✓ Also disable Trusted Execution, if you see it.
  - ✓ Save changes and exit BIOS (usually F10 to save and reboot).

- Step 3: Boot Back Into Windows

  ✓ Now try running your Tiny Core virtual machine again in VMware.

  ✓ It should now boot without showing that error.

Filesystem Support of Tinycore Linux

✧ What File system does Tinycore Linux support?

Tiny Core Linux supports a variety of filesystems, allowing it to be flexible and adaptable for different use cases. Here are the primary filesystem types that Tiny Core Linux can work with:

1. **NTFS**:
   - Supported via the ntfs-3g package (userspace driver).
   - **Why:** Mainly used for compatibility with Windows systems. It is helpful when accessing or sharing data with Windows.
2. **FAT32**:
   - Fully supported (built into most Linux kernels).
   - **Why:** FAT32 is simple and universally compatible, especially for USB drives and portable devices.
3. **exFAT**:
   - Supported through additional packages like exfat-utils and fuse-exfat.
   - **Why:** Preferred for large external drives or USB sticks that require cross-platform usage without the 4GB file size limit of FAT32.
4. **ext4**:
   - Fully supported and widely used.
   - **Why:** ext4 is the default filesystem for many Linux distributions. It is reliable, fast, and includes journaling, making it ideal for Linux-native storage.
5. **Btrfs**:
   - Supported through kernel modules.
   - **Why:** Offers advanced features like snapshots, compression, and subvolumes. It's suitable for more complex storage setups, though it might not align with Tiny Core's simplicity.
6. **ZFS**:
   - Requires installation of third-party modules.
   - **Why:** ZFS is powerful for managing large volumes and redundancy but adds complexity. It's not typically used with Tiny Core Linux due to its minimalistic nature.
   -

7. **HFS+**:
    - Supported with kernel modules but read/write support requires additional tools.
    - **Why:** Used primarily for interoperability with macOS systems.
8. **APFS**:
    - Limited or no support in Linux (experimental drivers exist).
    - **Why:** Proprietary to Apple and not commonly used outside macOS environments.

Recommendation:

For general use, **ext4** is the best fit for Tiny Core Linux due to its stability and performance. If you need compatibility with other operating systems, FAT32 or exFAT can be good options. More advanced filesystems like Btrfs or ZFS are less commonly used in a lightweight setup like Tiny Core Linux.

Tiny Core Linux (TCL) is a minimal Linux distribution designed to be lightweight and highly modular. Its filesystem support depends on the kernel modules and extensions loaded. Here's a breakdown of filesystem support in Tiny Core Linux:

Summary Table:

Filesystem	Support Level	Required Extension/Kernel Module
FAT32	Full (R/W)	vfat (built-in)
NTFS	Full (R/W)	ntfs-3g.tcz (FUSE)
exFAT	Full (R/W)	exfat.tcz or exfat-fuse.tcz
ext2/3/4	Full (R/W)	Built-in
Btrfs	Full (R/W)	btrfs.tcz (optional)
ZFS	No	Not available
HFS+	Read-only	hfsplus.tcz
APFS	No	Not supported

Why Some Filesystems Are Not Supported?

- **ZFS & APFS**: Complex licensing and kernel dependencies make them impractical for Tiny Core's minimal design.
- **HFS+ (write)**: Limited stable driver support in Linux.
- **Btrfs**: Available but not default due to size.

Advantages of Tiny Core Linux (TCL)

✧ **What is the Advantages of Tiny Core Linux (TCL)**

Tinycore Linux has many advantage that make it stand out among Linux distributions, especially for users seeking efficiency and flexibility. Here are its key advantage:

1. Extremely Lightweight & Fast

- ✓ TinyCore (Base): ~16 MB (command-line only).
- ✓ Core (GUI + Basic Tools): ~21 MB.
- ✓ orePlus (Extended ISO): ~106 MB (includes WiFi & more drivers).
- ✓ Runs entirely in RAM, making it blazing fast even on old hardware.

✓ Best for:

- ✓ Reviving old PCs (Pentium III/IV, <1GB RAM).
- ✓ Embedded systems (Raspberry Pi, routers, kiosks).
- ✓ Lightweight virtual machines (VMware, QEMU).

2. Runs Entirely in RAM (Persistence Optional)

- ✓ By default, TinyCore loads into RAM, meaning:
- ✓ Instant boot times (~5–10 seconds).
- ✓ No disk wear (ideal for USB live systems).

- Optional persistence via:
  - ✓ tce directory (for installed apps).
  - ✓ backup (saves system changes).

✅ Best for:

- ✓ Fast, disposable environments (security testing, recovery).
- ✓ Custom live USBs with saved settings.

3.Modular Design (Extensions)

- ✓ Instead of a bloated system, TinyCore uses .tcz extensions (like "app store" for Linux).
- ✓ Only install what you need (e.g., firefox.tcz, gparted.tcz).
- ✓ No dependency hell (self-contained packages).

✅ Best for:

- ✓ Custom lightweight setups (e.g., firewall, media player).
- ✓ Learning Linux internals (build your own distro).

4.Low Hardware Requirements

➢ The minimum hardware requirements of TinyCore Linux serve a specific purpose, making it ideal for stable use cases where other Linux distributions would struggle.

✅ Best for:

- ✓ Old laptops/netbooks (2000s-era hardware).
- ✓ Single-board computers (Raspberry Pi, BeagleBone).

5. Fast & Secure

- ✓ No unnecessary services → Fewer attack vectors.
- ✓ Run as non-root by default (reduces security risks).
- ✓ Easy to audit (small codebase).

✅ **Best for:**

- ✓ Privacy-focused users (minimal telemetry).
- ✓ Secure kiosks/digital signage.

6. Customizable & Developer-Friendly

- ✓ We can Build ours own TinyCore ISO with only the packages we need.

■ Supports:

- ✓ Python, Perl, C/C++ (via extensions).
- ✓ Docker (if kernel modules are added).

✅ **Best for:**

- ✓ Embedded developers (IoT, appliances).
- ✓ Linux hobbyists (learn how Linux works).

7. Supports Multiple Architectures

- ✓ x86 (32-bit) – Default.
- ✓ x86_64 (64-bit) – CorePure64.
- ✓ ARM (Raspberry Pi, etc.) – Community ports.

✅ **Best for:**

- ✓ Raspberry Pi projects.
- ✓ Legacy & modern PCs.

DisAdvantages of Tiny Core Linux (TCL)

✧ **What is the Disadvantages of Tiny Core Linux**

Tiny Core Linux, while highly efficient and lightweight, it does have some disadvantages that may not make it suitable for all users or use cases. Here are the key drawbacksof Tinycore linux:

1. Not User-Friendly for Beginners

❌ No Graphical Installer (CLI-based setup).

❌ Manual configuration (persistence, drivers, networking).

❌ Limited documentation compared to Ubuntu or Debian.

⚠ Best for: Advanced users comfortable with Linux commands.

2. Limited Hardware Support (Requires Manual Driver Setup)

❌ No auto-detection for WiFi, printers, or exotic hardware.

❌ Need to manually load kernel modules (e.g., modprobe).

❌ No proprietary drivers (NVIDIA, Broadcom WiFi) by default.

⚠ Workaround: Install extensions (tce-load -iw firmware-rtlwifi).

3. No Persistent Installed Apps by Default

❌ All changes reset on reboot (unless manually saved).

❌ Requires tce directory setup for app persistence.

❌ Backups (filetool.sh -b) must be done manually.

⚠ Best for: Disposable systems, not daily-driver PCs.

4. Small Software Repository

❌ Only ~1,000 extensions (vs. 60,000+ in Debian).

❌ No Snap/Flatpak support (limited app availability).

❌ Some apps outdated (e.g., Firefox ESR instead of latest).

⚠ Workaround: Compile from source or use static binaries.

5. No Systemd (Pros & Cons)

❌ No modern service management (uses busybox init).

❌ Harder to manage background services.

❌ Some software expects systemd (may not work).

⚠ Best for: Users who prefer simplicity over features.

6. Security Limitations

❌ No SELinux/AppArmor (minimal security hardening).

❌ Fewer security updates (smaller dev team).

❌ Runs as root by default (unless manually changed).

⚠ Workaround: Use sudo, limit network exposure.

7. No Multitasking or Heavy Workloads

❌ Not optimized for multitasking (single-core focus).

❌ Runs slowly with multiple apps (limited RAM).

❌ No native Docker/Kubernetes (without heavy tweaks).

⚠ Best for: Light tasks (browsing, CLI tools, servers).

8. No Official ARM Support (Raspberry Pi is Community-Maintained)

❌ No official builds for ARM (unofficial ports only).

❌ Limited driver support for Pi cameras, Bluetooth, etc.

⚠ Workaround: Use PiCore (community version).

❖ **Who Should Avoid TinyCore?**

Beginners (use Puppy Linux or Lubuntu instead).

Gamers (no GPU driver support).

Developers needing latest tools (limited repos).

Enterprise use (no long-term support).

❌ When to Avoid TinyCore?

- You need plug-and-play hardware support.
- You want a daily-driver OS.
- You rely on Snap/Flatpak apps.
- You prefer automatic updates/security.

TinyCore is best for:

✔ Old hardware revival

✔ Lightweight servers

✔ Privacy-focused live USBs

✔ Learning Linux internals

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Conclusion of Tinycore Linux

Tiny Core Linux stands out as a remarkably lightweight and efficient Linux distribution, designed with modularity and resource minimization at its core. Its background and motivation stem from the vision of creating an even smaller and more flexible system following Damn Small Linux. The objective of Tiny Core Linux is to provide users with a minimalist platform that can be customized to suit their needs, especially in resource-constrained environments.

With minimal requirements in terms of RAM, CPU, and storage, Tiny Core Linux is ideal for reviving old hardware. Its installation is straightforward, supporting various boot options like USB drives, CD/DVDs, and PXE network boot. It has comprehensive filesystem support, including ext3, ext4, and FAT32, ensuring compatibility across systems.

Tiny Core Linux offers several advantages, such as speed, flexibility, and open-source access, making it an excellent choice for lightweight applications. However, its disadvantages—including a steep learning curve and limited out-of-the-box functionality—highlight that it might not be suitable for all users or complex tasks.

Overall, Tiny Core Linux is a powerful tool for those seeking a minimal and efficient operating system, provided they are comfortable customizing and building their system from the ground up. Its strengths lie in its adaptability and performance in constrained environments.

Future Outlook of Tiny Core Linux

✧ **What will be the Future Outlook of Tiny Core Linux?**

TinyCore Linux occupies a unique position in the Linux ecosystem as one of the most minimalist distributions available. Looking ahead, several key factors will shape its trajectory:

- **Niche Survival in an Evolving Landscape**
  - TinyCore will likely maintain its status as a premier choice for ultra-lightweight applications, particularly in:
    - ✓ Legacy hardware revival (pre-2010 machines)
    - ✓ Embedded systems and IoT devices
    - ✓ Specialized use cases requiring RAM-based operation
  - However, its relevance may diminish for general computing as hardware becomes more powerful and energy-efficient
- **Technical Evolution Challenges**
  - The distribution faces pressure to:
    - ✓ Modernize its package base while maintaining minimalism
    - ✓ Improve ARM architecture support
    - ✓ Address growing security expectations (secure boot, modern encryption)
  - Balancing these needs with TinyCore's core philosophy will be crucial
- **Community and Development Sustainability**
  - As a primarily volunteer-driven project, TinyCore's future depends on:
    - ✓ Attracting new developers to maintain and expand the codebase
    - ✓ Growing its user community to sustain interest
    - ✓ Potentially establishing commercial support options

Recommendation for Tiny Core Linux

I recommend Tiny Core Linux for users who are comfortable with the command line, value extreme minimalism and customization, and need a lightweight operating system for resource-constrained environments (old hardware, embedded systems, minimal virtual machines/containers). If you are a Linux beginner or need a user-friendly, out-of-the-box experience, explore alternative lightweight distributions.

Target Audience:

- Experienced Linux users
- Embedded systems developers
- Users reviving older hardware
- Virtualization/containerization specialists

Use Cases:

- Running on old computers with limited resources
- Creating custom embedded systems
- Building minimal virtual machine images
- Running single-purpose applications
- Learning about Linux internals

Key Considerations:

- Command-line proficiency is essential.
- Requires manual configuration and extension installation.
- Not beginner-friendly.
- Excellent for resource-constrained environments.
- Offers extreme customization.
- Weigh against alternatives if ease of use is paramount.

✧ Recommendations FOR Tiny Core Linux (To make it better):

1. For the Project/Development Team:

• Improved Beginner-Friendly Documentation: While minimalism is core, a beginner's guide focusing on initial setup, extension installation, and basic troubleshooting could significantly broaden its appeal. Step-by-step guides with screenshots would be invaluable.

• GUI-Based Initial Configuration Tool (Optional): A very basic, optional GUI tool for tasks like network configuration and display setup could make the initial experience less daunting for newcomers. This shouldn't compromise the core principle of minimalism, but rather offer a helping hand.

• Curated Extension Repository: Maintain a curated repository of well-maintained and reliable extensions. This helps users quickly find high-quality software. Consider a rating system and clearer categorization.

• Focus on Security: Emphasize security best practices in the documentation and consider implementing security hardening measures by default.

• More Active Community Engagement: Actively solicit feedback from users and engage in discussions on the forums.

• Standardized Extension Packaging: Make the creation and distribution of extensions as easy and standardized as possible.

• Consider a "Core Enhanced" version: A version that ships with some drivers and common tools that could potentially appeal to more general users.

2. For TCL Users:

• Start with CorePlus: If you're new to Tiny Core or need broader hardware support, always begin with CorePlus. It provides a wider range of drivers and tools for initial setup.

• Embrace the Wiki and Forums: The Tiny Core Linux Wiki is your primary resource for information. The forums are where you'll find community support and solutions to common problems.

- Experiment in a Virtual Machine First: Before installing on bare metal, try Tiny Core in a virtual machine (VirtualBox, VMware, etc.) to get a feel for it and experiment with different configurations.
- Document Your Setup: Keep track of the extensions you install and any custom configurations you make. This will make it easier to recreate your setup if you need to reinstall or move to a new machine.
- Learn Basic Linux Commands: Familiarize yourself with essential Linux commands (e.g., ls, cd, mkdir, rm, nano, sudo, mount).
- Understand Persistence: Carefully choose and configure your persistence method to save your changes across reboots.
- Contribute Back: If you find solutions or create useful extensions, share them with the community.

3. For Developers Creating Extensions:

- Prioritize Stability and Security: Thoroughly test your extensions and ensure they don't introduce security vulnerabilities.
- Provide Clear Documentation: Include detailed instructions on how to install, configure, and use your extensions.
- Follow TCL Coding Conventions: Adhere to the coding conventions and standards used in Tiny Core to ensure your extensions integrate seamlessly.
- Keep Extensions Updated: Regularly update your extensions to fix bugs and add new features.
- Consider Packaging as .tcz Files: This is the standard format for TCL extensions.
- Make Your Code Open Source (If Possible): This allows others to contribute and improve your extensions.

In essence, my recommendations are about improving the overall user experience while maintaining the core principles of Tiny Core Linux. This includes making it more accessible to new users, enhancing the development process, and fostering a stronger sense of community.

Virtualization in Modern Operating Systems

✧ **What VIRTUALIZATION in Modern Operating Systems?**

Virtualization

What is virtualization ?

Virtualization in modern operating systems refers to the process of creating a virtual version of a computing resource, such as a hardware platform, operating system, storage device, or network. Instead of running directly on physical hardware, multiple virtual environments—called virtual machines (VMs)—can run simultaneously on a single physical system using a hypervisor or virtualization layer.

- Key Concepts:
  - ✓ Hypervisor: A software layer (like VirtualBox, VMware, or KVM) that manages and runs multiple virtual machines.
  - ✓ Guest OS: The operating system running inside the VM.
  - ✓ Host OS: The physical machine's main operating system.

- Benefits:
  - ✓ Resource Efficiency: Better use of hardware by running multiple systems on one machine.

- ✓ Isolation: Each VM operates independently, increasing security and stability.
- ✓ Testing and Development: Ideal for experimenting without affecting the host system.
- ✓ Portability: VMs can be moved across physical machines easily.

In short, virtualization allows one computer to act like many, increasing flexibility, scalability, and efficiency in modern computing environments.

■ How virtualization works ?

Virtualization in modern operating systems is the process of creating multiple simulated environments or virtual machines (VMs) on a single physical computer. This is done using a software layer called a hypervisor, which manages and allocates physical hardware resources (like CPU, memory, and storage) to each virtual machine.

Each VM runs its own operating system and applications, just like a real computer, but all are isolated from each other. This allows multiple OSes (like Linux, Windows, or Tinycore) to run simultaneously on one machine, making better use of hardware and enabling safe, flexible, and efficient testing, development, and deployment environments.

Virtualization is commonly used in cloud computing, server consolidation, software development, and network simulation.

■ How Virtualization Works in Modern Operating Systems

Virtualization is a technology that allows one physical computer to run multiple independent virtual machines (VMs), each with its own operating system and applications, as if they were separate physical systems. It is a key component of modern computing, cloud infrastructure, and software development workflows.

At its core, virtualization abstracts and divides the physical hardware of a system (CPU, memory, storage, network interface) into multiple logical instances, allowing each VM to behave like a standalone computer.

- **Components Involved in Virtualization**

  - ✓ Host Machine: The physical computer that provides the hardware resources.
  - ✓ Guest Machine: The virtual machine running inside the host.
  - ✓ Hypervisor: The software or firmware layer that manages the interaction between the host and guest systems.

- **Types of Hypervisors**

1. Type 1 (Bare-Metal Hypervisors)

Runs directly on the physical hardware without a host operating system.

- Examples: VMware ESXi, Microsoft Hyper-V, XenServer.
- Used in data centers and enterprise environments.

2. Type 2 (Hosted Hypervisors)

- Runs as an application on top of an existing host OS.
  - ✓ Examples: VirtualBox, VMware Workstation, Parallels Desktop.
  - ✓ Used on desktops/laptops for testing, development, and personal use.

- **How It Works: Step-by-Step Process**

1. Hardware Virtualization

The hypervisor emulates hardware components such as CPU, RAM, disk, and network interfaces. Each VM gets its own virtual version of these components.

2. Isolation

Each VM operates in its own sandboxed environment. One VM crashing or being compromised does not affect others or the host.Resource Allocation

3.The hypervisor manages the allocation of hardware resources. For example, a system with 16GB RAM might allocate 4GB to each of four VMs.

4. Execution

Each VM boots its own operating system, independently of the host OS. The guest OS and its applications think they are running on real hardware.

5. Managementand Monitoring

Administrators can control VM behavior—start, stop, pause, snapshot, or migrate VMs—

without affecting the host system.

Both VMs run side by side on your laptop, sharing CPU, RAM, and storage, but they are completely isolated from each other and from Windows.

Virtualization Features in Modern OSes

- ✓ hardware Pass-through: Allows VMs to access real hardware directly (like GPUs or USB devices).
- ✓ Snapshots: Save the state of a VM to restore later.
- ✓ Cloning: Duplicate VMs quickly for testing or deployment.
- ✓ Live Migration: Move running VMs from one host to another with minimal downtime.
- ✓ Dynamic Resource Management: Automatically adjust CPU/memory for VMs based on demand.

➢ Security and Isolation

Modern hypervisors are designed with strong isolation boundaries, meaning even if one VM is attacked or infected, the others remain safe. Additionally, many systems use Virtual Trusted Platform Modules (vTPM) and Secure Boot inside VMs to enhance virtual security.

➢ Alternatives and Related Technologies

- ✓ Containers (e.g., Docker, Tinycore): Lightweight virtualization at the OS level; faster but share the host kernel.
- ✓ Emulators (e.g., QEMU): Fully simulate hardware for running different architectures (e.g., ARM on x86).
- ✓ Hybrid Approaches: Some systems combine VMs with containers for maximum flexibility.

➢ why do we use virtualization

Virtualization is used in modern operating systems to improve efficiency, flexibility, and resource utilization. It allows multiple virtual machines (VMs) to run on a single physical computer, each with its own operating system and applications. This means better use of hardware, easier testing and development, and reduced costs since fewer physical machines are needed.Virtualization also provides isolation, so if one VM crashes or gets infected, others are not affected. It enables features like snapshots, easy backups, and fast system recovery, making it ideal for cloud computing, server management, and secure software development environments.

system call of Tinycore Linux

The `execve()` system call is part of the Linux kernel, and its implementation is consistent across Linux distributions, including TinyCore Linux. It is used to execute a program, replacing the current process image with a new one. Here's a brief explanation of its implementation:

1. **Kernel-Level Implementation**: The `execve()` system call is implemented in the Linux kernel source code. It involves functions like `do_execve()` and `sys_execve()` that handle the process of loading the new program into memory and setting up its execution environment.

2. **Functionality**: The `execve()` system call takes three arguments:

`pathname`: The path to the executable file.

`argv`: An array of arguments passed to the program.

`envp`: An array of environment variables.

- **Example Usage in C:**

```
#include <unistd.h>
#include <stdio.h>
#include <stdlib.h>
int main( int argc, char *argv[]) {
   if (argc < 2) {
       fprintf(stderr, "Usage: %s <command> [args...]\n", argv[0]);
       exit(EXIT_FAILURE);  }
    char *command = argv[1];
   char *args[argc];
   for (int i = 1; i < argc; i++) {
     args[i-1] = argv[i];    }
     args[argc-1] = NULL;
   if (execv(command, args) == -1) {
       perror("execv");
       exit(EXIT_FAILURE);}
    return 0;
   }
```

SUMMARY

Tiny Core Linux is a minimalist Linux distribution designed to provide a lightweight and efficient operating system environment. It is built around the Linux kernel and focuses on providing a small footprint, with the core system being only about 16 MB in size. This makes it ideal for use on older hardware or systems with limited resources. Tiny Core Linux operates entirely in RAM, allowing for rapid boot times and quick performance. Users can customize their installations by adding only the necessary applications and extensions, which can be easily managed through its package manager.

The distribution comes in three main versions: Core, which includes only the command-line interface; TinyCore, which adds a graphical user interface; and CorePlus, which offers additional drivers and tools for wireless networking and other functionalities. Tiny Core Linux emphasizes modularity, allowing users to choose exactly what they need for their specific use cases. This flexibility, combined with its low resource requirements, makes Tiny Core Linux a popular choice for embedded systems, educational purposes, and anyone looking to create a highly efficient computing environment.

References

http://www.tinycorelinux.net/

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"***Linux Pocket Guide***" – *Daniel J. Barrett*

"The Linux Command Line" – *William Shotts*

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