

ThinkPad T14 — Ubuntu 24.04 LTS (Btrfs Workstation Edition)

Purpose: Complete, production-ready guide for converting a Lenovo ThinkPad T14 (i5-10210U, 16 GB RAM, touchscreen, Synaptics fingerprint) into a highly optimized developer workstation using **Ubuntu Server 24.04 LTS** as the base, **Btrfs** as the root filesystem, **GDM** for fingerprint login, and **Hyprland** for the graphical compositor. This version includes full configuration, rationale, Timeshift setup, and post-install recovery instructions.

1. Executive Summary

You will install **Ubuntu Server 24.04.3 LTS** on the ThinkPad T14, replace the former D: partition with a Btrfs-based Ubuntu root, add a small swap partition for hibernation, and preserve Windows intact. After first boot, you will execute a one-shot automation script (`setup-t14-ubuntu-hyprland-btrfs.sh`) that:

- Installs firmware, drivers, audio, Bluetooth, fingerprint, GPU, and power-management utilities.
- Configures **GDM** + **fprintd** for fingerprint login.
- Installs **Hyprland**, **Waybar**, **Rofi**, **Kitty**, and all essential Wayland utilities.
- Applies performance tunings: `bfq`, `preload`, `zram`, 20 GB swap partition, `vm.swappiness=60`, and `tmpfs` caching.
- Enables Btrfs subvolumes for snapshots and Timeshift integration.
- Adds **TLP**, **Thermald**, and **powertop** optimization.
- Installs developer stack: Node.js LTS, npm, pnpm, Docker CE, Supabase CLI, VS Code or JetBrains Toolbox.
- Installs **bauh** GUI app store (Flatpak aware) and sets up Flathub.
- Configures CUPS and Avahi for on-demand printing.
- Adds a systemd timer for automatic bi-weekly updates.
- Configures **Timeshift** snapshot system and retention policy.

Rationale: This configuration balances raw performance with snapshot-based recoverability, providing near-instant boot/resume, strong protection from package regressions, and a modern lightweight Wayland desktop.

2. Hardware & Pre-Install Checks

| Component | Status |
|-----------|---------------------------------------|
| CPU | Intel i5-10210U (4 cores / 8 threads) |
| GPU | Intel UHD Graphics (Mesa) |
| RAM | 16 GB DDR4 |

| Component | Status |
|--------------|--|
| SSD | 256 GB NVMe |
| Input | Touchscreen, TrackPoint, Touchpad, Fingerprint (Synaptics) |
| Connectivity | Intel Wi-Fi 6, Bluetooth 5 |

Pre-installation steps: 1. Backup the old D: partition to external storage. 2. Disable **Windows Fast Startup** and suspend **BitLocker**. 3. Download `ubuntu-24.04.3-live-server-amd64.iso`. 4. Create bootable USB using Rufus or BalenaEtcher (GPT+UEFI mode). 5. Note UEFI key (F1=setup, F12=boot menu). Disable Secure Boot temporarily if necessary.

3. Disk Partitioning Scheme (Btrfs + Swap + Shared NTFS)

| Partition | Size | Type | Mountpoint | Purpose |
|--------------|---------|-------|--------------------------|--------------------------------------|
| EFI | 512 MB | FAT32 | <code>/boot/efi</code> | Shared bootloader (Windows + Ubuntu) |
| Windows C: | ~100 GB | NTFS | — | Keep intact |
| Ubuntu Root | 86 GB | Btrfs | <code>/</code> | Root filesystem (with subvolumes) |
| Swap | 20 GB | swap | — | Hibernation + swap overflow |
| Shared Data | ~50 GB | NTFS | <code>/mnt/shared</code> | Common file storage between OSes |
| Win Recovery | 1 GB | NTFS | — | Leave intact |

Btrfs subvolumes created by installer:

```
@
/home
/log
/cache
/snapshots
```

These are mounted as:

```
UUID=<btrfs-uuid> / btrfs defaults,ssd,noatime,compress=zstd:
3,space_cache=v2,subvol=@ 0 0
UUID=<btrfs-uuid> /home btrfs defaults,ssd,noatime,compress=zstd:3,subvol=@home
0 0
UUID=<btrfs-uuid> /var/log btrfs defaults,ssd,noatime,compress=zstd:
3,subvol=@log 0 0
UUID=<btrfs-uuid> /var/cache btrfs defaults,ssd,noatime,compress=zstd:
3,subvol=@cache 0 0
```

```
UUID=<btrfs-uuid> /.snapshots btrfs defaults,ssd,noatime,compress=zstd:
3,subvol=@snapshots 0 0
```

4. Installation Flow

1. Boot the USB installer → *Install Ubuntu Server*.
2. Choose keyboard, network, user, hostname normally.
3. In **Storage**, select *Custom Storage Layout* → delete D:, create new partitions as above.
4. Assign EFI = existing `/boot/efi` (do **not** format), root = Btrfs 86 GB, swap = 20 GB, shared = NTFS 50 GB.
5. Proceed with installation. Skip Snap packages.
6. Reboot into the new Ubuntu Server terminal.

5. Post-Install: One-Shot Script Overview

The `setup-t14-ubuntu-hyprland-btrfs.sh` performs:

1. **Base update** – `apt update && apt full-upgrade -y`
2. **Drivers** – `linux-firmware`, `intel-microcode`, `mesa-utils`, `iwlwifi`, `pipewire` stack.
3. **Display manager** – `apt install gdm3 fprintd libpam-fprintd`
4. **Hyprland install** – Clone JaKooLit (24.04 branch) → `kitty`, `waybar`, `rofi`, `dunst`, `wlogout`.
5. **Developer tools** – Node LTS, pnpm, Docker CE, Supabase CLI, VS Code deb, JetBrains Toolbox (optional).
6. **Performance tuning** – enable BFQ, preload, zram, swapfile 20 GB (already partitioned), `vm.swappiness=60`, tmpfs caching.
7. **Power** – install `tlp`, `thermald`, tune CPU governor switching.
8. **Timeshift** – install, auto-detect Btrfs, enable hourly snapshots (retain 6), daily (retain 7), weekly (retain 4).
9. **CUPS/Avahi** – install but disable; provide `toggle-printing` helper.
10. **Auto updates** – create systemd timer for `apt update && apt upgrade` every 14 days.
11. **uswsusp** – configure hibernate and `resume=UUID=<swap>` kernel parameter.

6. Timeshift Configuration (Btrfs Mode)

1. `sudo apt install timeshift -y`
2. Choose **Btrfs mode** during first run.
3. Select the root Btrfs volume (not a subvolume) as target.
4. Configure automatic snapshots:
5. Hourly: 6 retained
6. Daily: 7 retained
7. Weekly: 4 retained

8. Integrate with GRUB (`timeshift-autosnap-apt`) so every `apt upgrade` creates a snapshot.
 9. Restoring: Boot from live USB → `sudo timeshift --restore` → choose snapshot → restore.
-

7. Hibernation + Swap Partition Details

Your 20 GB swap partition serves dual roles: - **Runtime swapping:** kernel uses it when RAM fills (swappiness=60). - **Hibernation image:** when suspending, memory image is compressed and stored in this partition.

Verify setup:

```
sudo blkid | grep swap
sudo nano /etc/default/grub
```

Add `resume=UUID=<swap-uuid>` to `GRUB_CMDLINE_LINUX_DEFAULT`, then run `sudo update-grub`.

This ensures fast hibernation (<4 s resume) using `uswsusp`.

8. Power & Performance

- `bfq` scheduler for NVMe
- `preload` for frequent apps
- `zram-tools` + swap partition
- `tmpfs` mount for `~/.cache`
- `tlp` + `thermald` + `powertop --auto-tune`
- Optional: `auto-cpufreq` for battery optimization
- `wlsunset` for night color temperature

Typical idle memory footprint: ~600–700 MB, full dev session < 3 GB.

9. App Management & Printing

- **GUI app store:** `bauh` (Flatpak aware, lightweight)
- **Flatpak/Flathub:** add default repo via `flatpak remote-add --if-not-exists flathub https://flathub.org/repo/flathub.flatpakrepo`
- **CUPS toggle script:**

```
sudo systemctl start cups avahi-daemon
# after printing
sudo systemctl stop cups avahi-daemon
```

- Map to a Waybar button for one-click print enable/disable.

10. Developer Toolchain

- Node.js LTS (via NodeSource) + pnpm + yarn (optional)
- Docker CE + Docker Compose
- Supabase CLI
- VS Code (.deb) or JetBrains Toolbox
- GitHub CLI, curl, jq, zsh + oh-my-zsh

Use `tmux` for persistent sessions; Hyprland provides fast terminal control via `kitty`.

11. Recovery & Maintenance

GRUB repair:

```
sudo mount /dev/nvme0n1p3 /mnt
sudo mount /dev/nvme0n1p1 /mnt/boot/efi
sudo grub-install --boot-directory=/mnt/boot /dev/nvme0n1
sudo update-grub
```

Windows repair: use Windows Recovery → Command Prompt →

```
bootrec /fixmbr
bootrec /fixboot
bootrec /rebuildbcd
```

Timeshift restore: boot live USB → `timeshift --restore`.

12. Expected Advantages

- Snapshots with near-zero performance cost.
- Self-healing filesystem with checksums.
- Near-instant system restore after bad update.
- Excellent read/write performance on NVMe.
- Low idle memory usage and fast boot/resume.
- Touchscreen, fingerprint, Bluetooth fully functional.

Potential trade-offs: - Slight learning curve with Btrfs subvolumes. - Swap partition required for reliable hibernation. - Automatic updates limited to apt + Flatpak timer (no Snap).

13. First-Boot Checklist

1. `sudo apt update && sudo apt full-upgrade -y`
2. Verify mountpoints: `lsblk`, `mount | grep btrfs`
3. Run the one-shot setup script.
4. Reboot → select *Hyprland (Wayland)* in GDM.
5. Enroll fingerprint via `fprintd-enroll`.
6. Verify Timeshift automatic snapshot creation.
7. Test hibernate/resume.

Conclusion: The T14 Ubuntu24Btrfs workstation delivers enterprise-grade reliability, cloud-developer agility, and desktop-class speed. Timeshift provides instant rollback; Btrfs ensures modern snapshot and compression advantages. With Hyprland, Kitty, and tmux, you'll have a sleek, responsive, and future-proof Linux environment ready for intensive development and multitasking.