ThinkPad Libreboot Privacy Guide

Complete Hardware Hardening & Privacy Setup

⚠️ WARNING

These modifications will void your warranty. Incorrect flashing can brick your device. Hardware removal may affect functionality. Proceed at your own risk.

Introduction

This guide walks you through hardening a ThinkPad laptop for maximum privacy and security. You'll learn to:

- Flash Libreboot (a free BIOS replacement)
- Remove potential surveillance hardware
- Boot a non-persistent operating system from USB

Compatible ThinkPad Models

Libreboot-compatible models include:

- ThinkPad X60 / X60s / X60T
- ThinkPad T60 (specific models)
- ThinkPad X200 / X200s / X200T
- ThinkPad T400 / T500
- ThinkPad W500

Check libreboot.org for the most current compatibility list before proceeding.

Tools & Materials Required

For Flashing Libreboot:

- Raspberry Pi (or similar SPI programmer)
- SOIC8 test clip
- Jumper wires (female-to-female)
- microSD card (for Raspberry Pi)
- USB keyboard
- External monitor

For Hardware Removal:

- Small Phillips screwdriver set
- Plastic spudger/pry tool
- Anti-static wrist strap
- Small containers for screws
- Thermal paste (if reassembly needed)
- Electrical tape

PART 1: FLASHING LIBREBOOT

Step 1: Preparation

1. Download the appropriate Libreboot ROM for your ThinkPad model from libreboot.org
2. Set up Raspberry Pi with Raspbian OS and install flashrom:

```
sudo apt-get install flashrom
```

3. Backup your current BIOS if possible (optional but recommended)
4. Fully disassemble your ThinkPad to access the motherboard

Step 2: Locate BIOS Chip

1. Remove keyboard, palm rest, and any components blocking motherboard access
2. Locate the BIOS chip (usually labeled "BIOS" or has manufacturer markings like Winbond 25X64)
3. The chip is typically 8-pin SOIC format, rectangular with pins on two sides
4. Consult your specific ThinkPad service manual for exact location

Step 3: Wire Raspberry Pi to BIOS Chip

Pin connections (SOIC8 clip to Raspberry Pi GPIO):

```
Chip Pin 1 (CS)    → RPi Pin 24 (GPIO 8 / CE0)
Chip Pin 2 (MISO)  → RPi Pin 21 (GPIO 9 / MISO)
Chip Pin 3 (WP)    → 3.3V
Chip Pin 4 (GND)   → RPi Ground
Chip Pin 5 (MOSI)  → RPi Pin 19 (GPIO 10 / MOSI)
Chip Pin 6 (CLK)   → RPi Pin 23 (GPIO 11 / SCLK)
Chip Pin 7 (HOLD)  → 3.3V
Chip Pin 8 (VCC)   → RPi 3.3V
```

Connection Steps:

1. Attach SOIC8 clip to BIOS chip carefully (note pin 1 orientation - usually marked with a dot)
2. Connect jumper wires from clip to Raspberry Pi GPIO pins as shown above
3. Ensure solid connections - poor connections cause read/write errors

Step 4: Read and Verify Current BIOS

1. Power on Raspberry Pi (ThinkPad must be powered OFF and unplugged)
2. Detect chip:

```
sudo flashrom -p linux_spi:dev=/dev/spidev0.0,spispeed=512
```

3. Read BIOS:

```
sudo flashrom -p linux_spi:dev=/dev/spidev0.0 -r backup1.bin
```

4. Read again:

```
sudo flashrom -p linux_spi:dev=/dev/spidev0.0 -r backup2.bin
```

5. Compare files:

```
md5sum backup1.bin backup2.bin
```

6. If checksums match, your connection is good. Save backups!

Step 5: Flash Libreboot

1. Transfer Libreboot ROM file to Raspberry Pi
2. Write ROM:

```
sudo flashrom -p linux_spi:dev=/dev/spidev0.0 -w libreboot.rom
```

3. Wait for completion (5-10 minutes) - **DO NOT interrupt power**
4. Verify write:

```
sudo flashrom -p linux_spi:dev=/dev/spidev0.0 -v libreboot.rom
```

5. If verification succeeds, carefully remove SOIC8 clip

Step 6: Test Boot

1. Reassemble ThinkPad (just enough to power on - keyboard, screen, battery)
2. Power on and look for Libreboot payload screen
3. If successful, you'll see a text-based boot menu instead of Lenovo logo
4. If it doesn't boot, re-check connections and try flashing again

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PART 2: REMOVING HARDWARE COMPONENTS

⚠️ **Work in a static-free environment. Use anti-static wrist strap. Keep track of all screws.**

Removing the Camera

1. Open laptop screen to 90 degrees
2. Remove bezel screw covers (usually rubber pads in corners)
3. Unscrew all bezel screws and gently pry off the screen bezel with spudger
4. Locate camera module at top center of screen (small rectangular component)
5. Disconnect camera cable from small connector on module
6. Remove camera mounting screws and extract camera module
7. Cover the camera hole with black electrical tape or leave removed
8. Reattach bezel carefully

Removing the Microphone

1. The microphone is usually near the camera in the screen bezel, or near keyboard
2. For screen-mounted mics: follow camera removal steps above
3. For base-mounted mics: remove keyboard to access
4. Locate small cylindrical microphone component (3-5mm diameter)
5. Disconnect microphone wire connector from motherboard
6. Remove microphone from mounting bracket
7. Alternatively, you can cut the microphone wires close to the component
8. Tape over any microphone holes to prevent dust entry

Removing the WiFi Card

1. Power off completely and remove battery
2. Remove bottom panel screws and lift off bottom cover
3. Locate WiFi card (usually has two antenna cables connected - black and white)
4. Disconnect both antenna cables by pulling straight up on connectors
5. Remove retaining screw holding WiFi card
6. Pull WiFi card out at 30-degree angle from Mini PCIe or M.2 slot
7. Tape or secure antenna cables so they don't interfere with other components
8. **Note:** This disables all wireless connectivity (WiFi and Bluetooth)

Removing the Hard Drive

1. With bottom panel removed, locate HDD/SSD bay
2. For 2.5" SATA drives: remove screws securing drive caddy
3. Slide drive out from SATA connector
4. For M.2 SSDs: remove retaining screw and pull drive out at angle
5. Store removed drive securely
6. Clean drive bay of any dust
7. Leave bay empty for USB-only operation

Final Hardware Steps

1. Inspect all connections and ensure no loose cables
2. Reattach bottom panel and secure all screws
3. Reinstall battery
4. Test boot to ensure system powers on correctly

PART 3: BOOTING NON-PERSISTENT OS FROM USB

Step 1: Choose Your OS

Recommended non-persistent (live) operating systems:

- **Tails OS** - Designed for anonymity, routes through Tor, leaves no trace
- **Whonix** - Tor-focused, strong isolation between applications
- **Linux Mint Live** - User-friendly, general purpose
- **Ubuntu Live** - Popular, well-supported
- **Debian Live** - Stable, lightweight

For maximum privacy, use Tails or Whonix.

Step 2: Create Bootable USB

Using another computer:

1. Download your chosen OS ISO file from official website
2. Verify ISO checksum for authenticity
3. Download Rufus (Windows), balenaEtcher (all platforms), or use dd command (Linux/Mac)
4. Insert USB drive (8GB+ recommended, will be erased)
5. **Rufus:** Select ISO, choose GPT partition scheme, click Start
6. **Etcher:** Select ISO, select target USB, click Flash
7. **dd command:**

```
sudo dd if=distro.iso of=/dev/sdX bs=4M status=progress
```

   (replace sdX with your USB device)
8. Wait for write and verification to complete
9. Safely eject USB drive

Step 3: Configure Libreboot Boot Order

1. Insert bootable USB into ThinkPad
2. Power on the laptop
3. At Libreboot payload screen, press 'ESC' for boot menu
4. Use arrow keys to select your USB device
5. Press Enter to boot
6. To make USB first priority: in Libreboot, navigate to settings and adjust boot order

Step 4: Boot into Live OS

1. System will boot into your chosen live OS
2. Select "Try" or "Live" option (not Install)
3. For Tails: follow on-screen welcome configuration
4. All changes exist in RAM only and will be lost on shutdown
5. Use external encrypted USB for any data you need to persist

Step 5: Using Your Hardened System

- Every boot is a clean slate - no persistent storage
- Use ethernet cable for internet (WiFi card removed)

- All work disappears on shutdown unless saved to external encrypted media
- Camera and microphone physically removed - no software can access them
- Libreboot contains no proprietary firmware or backdoors
- Consider using Tor Browser for anonymous internet access

Security Considerations

What You've Achieved:

✓ No proprietary BIOS firmware
✓ No Intel Management Engine (pre-Core architecture)
✓ Physical removal of camera and microphone
✓ No persistent storage (RAM-only OS)
✓ No wireless hardware present
✓ Full control over boot process

Remaining Considerations:

Ethernet provides network access (use VPN/Tor)
Keyboard firmware could theoretically be compromised
Physical security remains critical
USB devices could contain malware
Supply chain attacks (use trusted hardware)
No system is 100% secure

Troubleshooting

Libreboot won't boot:

Check all hardware connections, ensure RAM is properly seated, verify correct ROM was flashed for your model.

Flashrom can't detect chip:

Verify wiring, ensure good SOIC8 clip contact, try slower SPI speed (256 instead of 512), check ThinkPad is fully powered off.

USB won't boot:

Recreate bootable USB, try different USB port, verify ISO download wasn't corrupted, check Libreboot boot order.

System won't power on after hardware removal:

Reseat all connectors, ensure keyboard cable properly connected, verify battery is charged and seated correctly.

Additional Resources

- **Libreboot Documentation:** libreboot.org/docs
- **ThinkPad Service Manuals:** thinkpads.com/support/hmm
- **Flashrom Documentation:** flashrom.org/Flashrom
- **Tails OS:** tails.boum.org
- **r/thinkpad Community:** reddit.com/r/thinkpad
- **r/libreboot Community:** reddit.com/r/libreboot

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