WINDOWS 11 · POWERSHELL · WINGET

Windows Handbook

For advanced users

Run the system from the inside. The PowerShell pipeline, bulk installs with winget, repairs with DISM and SFC, services, event logs, networking, Defender and BitLocker, the Registry, WSL and recovering a Windows that won't boot.

CONTENTS

Yellow italic text (like `<id>`) marks the parts you fill in. `PS>` means a normal Terminal, `Admin>` means Terminal (Admin). Read what a command does before running anything that changes the system.

PowerShell in depth

In PowerShell, objects flow through the pipeline, not text; so you select, filter and sort columns by name.

```
PS> winget install --id Microsoft.PowerShell -e
```

Installs PowerShell 7 (`pwsh`). It runs alongside Windows' 5.1 and can be made the default profile in Terminal.

```
PS> Get-Process | Get-Member
```

All properties and methods of an object.

```
PS> Get-Service | Where-Object Status -eq Running
```

Filtering.

```
PS> Get-ChildItem -Recurse | Sort-Object Length -Descending | Select-Object -First 10 FullName, Length
```

The 10 largest files.

```
PS> Get-Process | Export-Csv processes.csv -NoTypeInformation
```

Saves the result as CSV. `ConvertTo-Json` produces JSON.

```
PS> notepad $PROFILE
```

The profile file: aliases and functions that run at every start (create it first with `New-Item -Force $PROFILE` if missing).

```
function update { winget upgrade --all }
```

Defined in the profile, updates all apps with one word.

```
Set-Alias np notepad
```

Defines an alias.

```
PS> $env:PATH -split ';'
```

Lists PATH folders one per line.

```
PS> [Environment]::SetEnvironmentVariable("<NAME>", "<value>", "User")
```

Defines a permanent user environment variable.

```
PS> Install-Module <module> -Scope CurrentUser
```

Installs a module from the PowerShell Gallery.

`PS> Get-Help <command> -Online`	Opens the command's Microsoft Learn page in the browser.

winget in depth

`PS> winget export -o apps.json`	Exports the list of installed apps.
`PS> winget import -i apps.json`	Installs the same apps in bulk on a new computer.
`PS> winget pin add --id <id>`	Pins an app against updates. `winget pin list` / `remove`.
`PS> winget install --id <id> -e --version <version>`	Installs a specific version.
`PS> winget upgrade --all --include-unknown`	Also tries to update apps whose version can't be detected.
`PS> winget source list`	Package sources (winget, msstore).
`PS> winget settings`	Opens winget's settings file.

> TIP Alternative package managers: **Scoop** (no admin needed, good for developer tools) and **Chocolatey**.

System repair

When system files are corrupted, run DISM and then SFC. All of these need Terminal (Admin).

`Admin> DISM /Online /Cleanup-Image /RestoreHealth`	Repairs the Windows component store from Windows Update. Run this first.
`Admin> sfc /scannow`	Finds and repairs corrupted system files.

`Admin> chkdsk C: /scan`	Scans the disk online. For repairs, `chkdsk C: /f /r` is scheduled for the next boot.
`PS> rstrui`	The System Restore wizard.
`Admin> Checkpoint-Computer -Description "<description>"`	Creates a restore point manually (limited to one per day).
`Admin> net stop wuauserv; net stop bits; Rename-Item C:\Windows\SoftwareDistribution SoftwareDistribution.old; net start wuauserv; net start bits`	Resets a stuck Windows Update cache.
`PS> wsreset`	Clears the Microsoft Store cache.
`Admin> bcdedit /set "{current}" safeboot minimal`	Boots into Safe Mode next time. To undo: `bcdedit /deletevalue "{current}" safeboot`.
Settings › System › Recovery › Reset this PC	Reinstalls Windows; the “Keep my files” option keeps personal files.

Services, tasks, startup

`PS> Get-Service | Where-Object Status -eq Running`	Running services.
`Admin> Restart-Service <name>`	Restarts a service. `Start-Service` and `Stop-Service` also exist.
`Admin> Set-Service <name> -StartupType Disabled`	Stops it from starting at boot (Automatic / Manual / Disabled).
`PS> sc.exe query <name>`	Classic service query (in PowerShell `sc` is a different command; type `sc.exe`).

`PS> Get-ScheduledTask | Where-Object State -eq Ready | Select-Object TaskName, TaskPath`	Scheduled tasks.
`PS> taskschd.msc`	The Task Scheduler interface.
`PS> Get-CimInstance Win32_StartupCommand | Select-Object Name, Command, Location`	Programs that start at boot.
Task Manager › Startup apps	Turns startup programs on and off, with their impact.

Event logs and crash analysis

`PS> eventvwr.msc`	Event Viewer.
`PS> Get-WinEvent -FilterHashtable @{LogName='System'; Level=2; StartTime=(Get-Date).AddDays(-1)}`	System errors from the last 24 hours.
`PS> Get-WinEvent -LogName Application -MaxEvents 30`	The last 30 application events.
`PS> Get-WinEvent -FilterHashtable @{LogName='System'; Id=41} -MaxEvents 5`	Unexpected shutdowns (power loss, freezes).
`PS> perfmon /rel`	Reliability Monitor: crashes and updates by day. The most readable tool to start with.
`PS> Get-ChildItem C:\Windows\Minidump`	Blue screen dump files. To analyze them, WinDbg: `winget install --id Microsoft.WinDbg -e`.

Network commands

`PS> ipconfig /all`	All adapters, IP, DNS, MAC address.

`PS> ipconfig /flushdns`	Clears the DNS cache.
`PS> ipconfig /release; ipconfig /renew`	Gets a new IP address.
`PS> Get-NetIPAddress -AddressFamily IPv4`	IPv4 addresses.
`PS> Test-NetConnection <address> -Port 443`	Whether a specific port is reachable.
`PS> Resolve-DnsName <domain>`	DNS lookup.
`PS> Get-NetTCPConnection -State Listen | Sort-Object LocalPort`	Listening ports. The PID in the `OwningProcess` column tells you which program.
`PS> netsh wlan show profiles`	Saved Wi-Fi networks.
`PS> netsh wlan show profile name="<network-name>" key=clear`	Shows a saved Wi-Fi network's password (Key Content line).
`Admin> netsh winsock reset; netsh int ip reset`	Resets the network stack; restart afterwards.
`PS> tracert <address>`	The route packets take.
`PS> curl.exe -I https://<site>`	HTTP headers (in PowerShell the `curl` alias points to another command; type `curl.exe`).

Security: Defender, firewall, BitLocker

`PS> Get-MpComputerStatus | Select-Object AntivirusEnabled, RealTimeProtectionEnabled, AntivirusSignatureLastUpdated`	Defender status.
`Admin> Update-MpSignature`	Updates virus definitions.

`Admin> Start-MpScan -ScanType QuickScan`	Quick scan. For a full scan use `FullScan`.
`Admin> Start-MpWDOScan`	Offline scan: restarts and scans before Windows loads (for stubborn malware).
`PS> Get-NetFirewallProfile | Select-Object Name, Enabled`	Firewall profiles.
`Admin> New-NetFirewallRule -DisplayName "<name>" -Direction Inbound -Protocol TCP -LocalPort 8080 -Action Allow`	Opens a port for incoming connections.
`Admin> Remove-NetFirewallRule -DisplayName "<name>"`	Deletes the rule.
`PS> wf.msc`	Advanced firewall interface.
`Admin> manage-bde -status`	BitLocker status.
`Admin> (Get-BitLockerVolume -MountPoint C:).KeyProtector`	Shows the recovery key (RecoveryPassword).
`Admin> Suspend-BitLocker -MountPoint C: -RebootCount 1`	Suspends BitLocker for one boot before a BIOS/UEFI update.

Users and permissions

`PS> whoami /groups`	Your groups and privilege level.
`PS> Get-LocalUser`	Local users.
`Admin> New-LocalUser -Name <name>`	New local user (asks for a password).
`Admin> Add-LocalGroupMember -Group Administrators -Member <name>`	Makes a user an administrator. On non-English Windows the group name is localized; check with `Get-LocalGroup`.

```
PS> icacls <path>
```

Shows file/folder permissions. To grant: `icacls <path> /grant <user>:F`.

```
Admin> takeown /f <path> /r /d y
```

Takes ownership of a folder (for access denied errors).

```
PS> runas /user:<user> <program>
```

Runs a program as another user.

Disks and storage

```
PS> Get-Disk; Get-Partition; Get-Volume
```

Disks, partitions and volumes.

```
PS> Get-PhysicalDisk | Select-Object
FriendlyName, MediaType, HealthStatus
```

Disk type (SSD/HDD) and health.

```
Admin> Optimize-Volume -DriveLetter C -ReTrim
-Verbose
```

Runs TRIM on an SSD.

```
Admin> Dism /Online /Cleanup-Image
/StartComponentCleanup
```

Cleans up old update components (WinSxS).

```
PS> cleanmgr /sageset:1
```

Disk Cleanup settings; then `cleanmgr /sagerun:1`.

```
PS> winget install --id
AntibodySoftware.WizTree -e
```

Shows what's taking up disk space in seconds.

```
Admin> diskpart
```

Command-line disk tool: `list disk`, `select disk N`, `list partition`.

Registry and Group Policy

```
PS> regedit
```

Registry Editor.

`PS> reg export HKCU\Software\<key> backup.reg`	Backs up a key before changing it. Double-click the .reg file to restore.
`PS> Get-ItemProperty HKCU:\Software\Microsoft\Windows\CurrentVersion\Explorer\Advanced`	Reads a key's values with PowerShell.
`PS> Set-ItemProperty -Path HKCU:\<path> -Name <value> -Value <data>`	Writes a value.
`PS> gpedit.msc`	Local Group Policy Editor (Pro and above).
`PS> gpupdate /force`	Applies policies immediately.
`PS> gpresult /r`	Summary of applied policies.

> **WARNING** A wrong change in the Registry can keep Windows from booting. Back up first or create a restore point.

WSL: Linux inside Windows

WSL runs a distribution with a real Linux kernel inside Windows. This site has a handbook for the distribution you install.

`Admin> wsl --install`	Installs WSL and Ubuntu by default; restart afterwards.
`PS> wsl --list --online`	Distributions you can install.
`PS> wsl --install -d Debian`	Installs a specific distribution.
`PS> wsl -l -v`	Installed distributions and their WSL versions.
`PS> wsl --set-default <distribution>`	Changes the default distribution.

`PS> wsl --shutdown`	Shuts down all distributions (memory is released).
`PS> wsl --update`	Updates the WSL kernel.
`PS> wsl --export <distribution> backup.tar`	Backs up a distribution; restore with `wsl --import`.

> **TIP** Reach Linux files from File Explorer at `\\wsl$`. Memory and CPU limits are set in `%UserProfile%\.wslconfig`.

Drivers and hardware

`PS> Get-PnpDevice -Status Error`	Problem devices (yellow exclamation mark).
`PS> pnputil /enum-drivers`	Installed third-party drivers.
`Admin> pnputil /export-driver * D:\driver-backup`	Backs up all drivers (before a reinstall).
`PS> driverquery /v`	List of all drivers.

> **TIP** Get graphics drivers from the manufacturer's site or app: NVIDIA App, AMD Software: Adrenalin, Intel Driver & Support Assistant.

`PS> winget install --id Wagnardsoft.DisplayDriverUninstaller -e`	DDU: completely removes a broken graphics driver in Safe Mode.

Performance and power

`Admin> powercfg /batteryreport`	Generates a battery health report (design vs. current capacity) as HTML.
`Admin> powercfg /energy`	A 60-second energy efficiency analysis.

`Admin> powercfg /requests`	Programs keeping the computer from sleeping.
`PS> powercfg /list`	Power plans.
`PS> powercfg -duplicatescheme e9a42b02-d5df-448d-aa00-03f14749eb61`	Adds the hidden “Ultimate Performance” plan (for desktops).
`Admin> powercfg /h off`	Turns off hibernation and frees the space used by hiberfil.sys.
`PS> resmon`	Resource Monitor: disk, network and memory use per process.

Text, files and archives

`PS> Select-String -Path *.log -Pattern "<text>"`	Searches across several files.
`PS> (Get-Content <file>) -replace '<old>','<new>' | Set-Content <file>`	Find and replace in a file.
`PS> Get-Content <file> | Measure-Object -Line`	Line count.
`PS> Get-FileHash <file> -Algorithm SHA256`	Verifies the checksum of a downloaded file.
`PS> Invoke-RestMethod <URL>`	Calls a web API; turns JSON directly into objects.
`PS> Compress-Archive <folder> archive.zip`	Creates a zip. Extract with `Expand-Archive archive.zip`.
`PS> tar -czf archive.tar.gz <folder>`	Creates a .tar.gz with the tar built into Windows; `tar -xf` extracts.
`PS> robocopy <source> <target> /E /R:1 /W:1`	Copies a folder reliably; resumes if interrupted.

WARNING `robocopy /MIR` makes the target identical to the source: files not in the source are deleted from the target. Don't mix up source and target.

Recovering a Windows that won't boot

If Windows fails to start twice in a row, the Recovery Environment (WinRE) opens by itself. If it doesn't, boot a Windows install USB and choose “Repair your computer”.

WinRE › Troubleshoot › Advanced options › Startup Repair	Tries to repair boot problems automatically.
WinRE › Troubleshoot › Advanced options › Uninstall Updates	Removes the latest quality or feature update; the first thing to try when Windows won't boot after an update.
WinRE › Troubleshoot › Advanced options › System Restore	Returns a system that won't boot to an earlier restore point.
WinRE › Troubleshoot › Advanced options › Startup Settings	Safe Mode (4) or Safe Mode with Networking (5).
`Admin> bcdboot C:\Windows`	In the WinRE command prompt, rebuilds the boot files (confirm Windows' drive letter with `dir C:\`).
`Admin> sfc /scannow /offbootdir=C:\ /offwindir=C:\Windows`	Offline system file repair from WinRE.
WinRE › Troubleshoot › Reset this PC	Last resort: reinstalls Windows; with “Keep my files” personal files stay.

Commands are written for Windows 11 (Windows PowerShell 5.1 and PowerShell 7, winget); most also work on Windows 10. Menu names follow the English interface. Read what a command does before running anything that changes the system.