# File Maintenance Tool

A **safe, scheduled file maintenance utility** for Windows that:

- Scans configured paths
- Identifies files older than a given number of days
- Optionally backs them up to a local or network location (per-path setting)
- Deletes the original files
- Cleans up empty directories
- Manages log retention
- Runs with **bounded resource usage** (safe for busy PCs and SMB shares)

Designed for **unattended execution** (Windows Task Scheduler) and **network environments**.

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## 🛠 How It Works

The `file-maintenance` tool performs automated cleanup and optional backups of old files based on configurable rules.

The process follows a predictable and safe execution flow:

1. **Startup & Configuration**
    - CLI flags are parsed
    - Configuration files are loaded
    - Logging is initialized
    - Critical paths are validated
2. **Safety Checks**
    - Ensures target paths exist
    - Verifies backup destination is accessible (if any paths have backup enabled)
    - Displays popup notification if backup location is inaccessible
    - Terminates early on fatal misconfiguration
3. **Maintenance Worker**
    - Initializes execution context, queues, and counters
    - Captures a run-specific backup date (DDMmmYY)
    - Starts:
        - Bounded path walkers (discovery only)
        - A single processor goroutine (file operations)
4. **Backup & Cleanup**
    - Eligible files are enqueued for processing
    - Backup destination path is built as:

```
backupRoot/DDMmmYY/<folder-name>/relative-path
```

- Files are copied using streaming I/O with retry + backoff
- Original files are deleted only after successful backup (unless backup is disabled for that path)
- Empty directories are cleaned bottom-up

5. **Logging & Exit**

- All actions are logged (success, warning, error)
- Logs are flushed before clean exit

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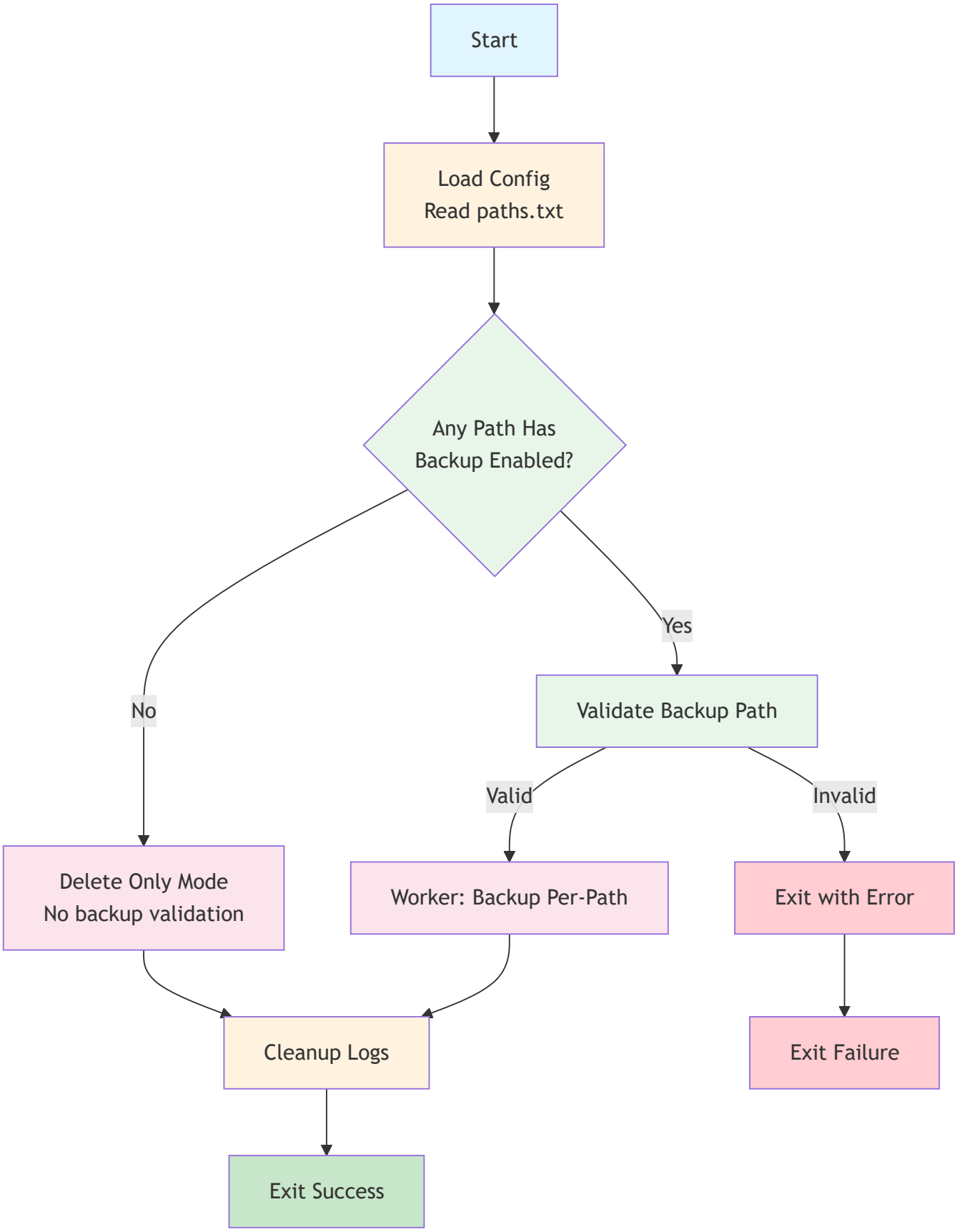


> The execution flow reflects a **single-processor design** for file operations: path scanning may be concurrent, but backup and deletion always occur one file at a time. Backups are grouped under a per-run date folder (`DDMmmYY`).

## Command-Line Flags

### Retention & Deletion

| Flag | Default | Description |
|---|---|---|
| `-days` | `7` | Only files older than this many days are eligible for deletion |
| `-log-retention` | `30` | Log retention in days |

### Paths & Configuration

| Flag | Default | Description |
|---|---|---|
| `-config-dir` | `<exe>/configs` | Config directory |
| `-log-dir` | `<exe>/logs` | Log directory |
| `-no-logs` | `false` | Console-only logging |

### Resource Controls

| Flag | Default | Description |
|---|---|---|
| `-walkers` | `1` | Concurrent path walkers |
| `-queue-size` | `300` | Job queue size |
| `-max-files` | `0` | Max files per run (0 = unlimited) |
| `-max-runtime` | `30m` | Max runtime |
| `-cooldown` | `0` | Cooldown between files |
| `-retries` | `2` | Copy retries |

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## ✨ Key Features

- ☑ **Backup before delete** (configurable per-path)
- 🗃 **Date-based backups**
  - One folder per run (`DDMmmYY`)
  - Preserves full relative directory structure
- 🧠 **Path-safe backups**
  - prevents directory traversal
  - Rejects paths escaping the source root
- 🧵 **Bounded concurrency**
  - Parallel path scanning (configurable)
  - Serialized file operations (copy/delete one file at a time)
- 🌐 **Network-friendly**
  - Streaming file copy (low RAM)
  - Retry + backoff for SMB hiccups
  - Optional cooldown between file operations
- 🧹 **Automatic cleanup**
  - Deletes empty directories (bottom-up, safe boundary)

    - Log retention management
- **Configurable logging**
    - File logging or console-only (`-no-logs`)
    - Per-level enable/disable via `logging.json`
- **Per-path backup control**
    - Each path can have backup enabled or disabled independently
    - Controlled via `config.ini` with simple `yes/no` syntax
- **User notifications**
    - Popup alerts when backup location is inaccessible
    - Critical errors shown even in unattended runs (Task Scheduler)
    - Error icon indicates issues requiring attention

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## Project Structure

```
.
├── cmd/
│   └── main/              # CLI entry point
├── internal/
│   ├── app/               # High-level application orchestration
│   ├── config/            # Reading config.ini and logging.json
│   ├── logging/           # Thread-safe logger
│   ├── maintenance/       # Core logic (scan, backup, delete, cleanup)
│   ├── types/             # AppConfig definition
│   └── utils/             # Helpers (exe path resolution, etc.)
├── configs/
│   ├── config.ini         # All configuration (backup path + paths list)
│   └── logging.json
└── build.ps1             # Helpers (Build, run, smoke, coverage helpers)
```

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## Configuration Files

These Files are required for the program to run

### `configs/config.ini`

Single configuration file containing both backup destination and paths list.

**Format**

```
[backup]
path=<backup-destination>

[paths]
path1, yes|no
path2, yes|no
```

### Sections

| Section | Key | Description |
|---|---|---|
| `[backup]` | `path` | Backup destination root path |
| `[paths]` | (standalone lines) | Paths to process with per-path backup control |

### Paths Format

```
path, yes|no
```

- `path`: the file or folder to process
- `yes`: enable backup before deletion
- `no`: delete without backup

### Path Types Supported

| Type | Description | Example |
|---|---|---|
| **Folder** | All files inside the folder (recursively) are evaluated | `C:\Temp\OldFiles, yes` |
| **File** | The specific file is evaluated directly | `C:\Data\Images\old-photo.jpg, no` |

### Examples

```
[backup]
path=D:\backups

[paths]
# Folders with backup enabled - delete all old files after backing up
C:\Temp\OldFiles, yes
\\server\share\incoming, yes

# Folders without backup - delete files directly (use with caution)
C:\Temp\ToDelete, no

# Specific files with backup
C:\Data\Images\old-photo.jpg, yes

# Specific files without backup
C:\Logs\debug.log, no
```

- Empty lines are ignored
- Lines starting with `;` or `#` are treated as comments
- Individual files must meet the age criteria (unless `-days 0` is used)
- Backup is enabled by default if not specified

`configs/logging.json`

Enable/disable log levels.

```
{
    "DEBUG": false,
    "COUNT": true,
    "INFO": true,
    "WARN": true,
    "ERROR": true,
    "SUCCESS": true,
    "FATAL": true
}
```

- `COUNT` is used for summary metrics (ex: deleted files per folder)
- Unknown levels default to enabled (fail-open policy)

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## Backup Layout (Important)

Backups are written using a date-based folder structure that preserves the original directory hierarchy.

Destination format:

```
<backupRoot>/<DDMmmYY>/<folder-name>/<relative folder structure>/<filename>
```

Example:

```
Source file:
C:\Data\Images\2024\Camera\IMG001.jpg

Backup destination:
\\server\share\backups\30Jan26\Camera\IMG001.jpg
```

Why this design: - Keeps backups grouped per run/day - Includes folder name for clear logging and easy restore - Preserves original folder structure for easy restore - Prevents filename collisions - Makes auditing and cleanup straightforward - The backup date folder is determined per run. All files processed in the same run share the same DDMmmYY folder.

## Usage

Basic run

```
fileMaintenance.exe -days 7
```

Deletes files older than 7 days (after backing them up).

### Per-path backup control

```
    fileMaintenance.exe -days 7
```

Configure backup behavior in `config.ini`:

```
[paths]
C:\Temp\OldFiles, yes    # Backup enabled
C:\Temp\ToDelete, no      # Backup disabled
```

### Resource-controlled run (recommended)

```
    fileMaintenance.exe -days 7 -walkers 1 -queue-size 300 -max-files 2500 -max-runtime 30m -cooldown 50ms -retries 2
```

Ideal for:

- busy workstations
- large image sets
- network (SMB) destinations

### Console-only logging

```
    fileMaintenance.exe -days 0 -no-logs
```

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## 🧠 Concurrency Model (Important)

- Path scanning Parallel, bounded by `-walkers` (default: 1)
- File operations (copy + delete) **always serialized** (one file at a time)

Why: - Prevents SMB saturation - Keeps CPU + disk usage predictable - Safer for large files (images, media)

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## 🧹 Empty Directory Cleanup

After a file is deleted:

- Parent directories are removed **only if empty**
- Cleanup proceeds bottom-up
- Deletion never crosses the configured path root

- Path comparisons are Windows-safe (case-insensitive)

This keeps folder trees tidy without risk

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## Logging

### File mode (default)

- logs/maintenance_YYYY-MM-DD.log - all levels
- logs/errors_YYYY-MM-DD.log - ERROR only
- logs/count_YYYY-MM-DD.log - COUNT only — (summary totals)

> [NOTE] Per-path delete counts are logged after the run finishes, so totals remain accurate.

### Console mode

- Enabled with `-no-logs`
- Useful for development and smoke tests

Log retention

```
log-retention 30
```

Deletes log files older than N days (best-effort, non-fatal).

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## Windows Task Scheduler (Recommended Setup)

### Suggested schedule

- Twice daily (e.g., 6:30 AM / 6:30 PM)

Example launch command:

```
powershell.exe -NoProfile -ExecutionPolicy Bypass -Command ^
Start-Process -FilePath "C:\path\fileMaintenance.exe" `
-ArgumentList "-days 7 -walkers 1 -max-runtime 30m -cooldown 50ms" `
-Priority BelowNormal -WindowStyle Hidden -Wait
```

Task options:

- ☑ Run whether user is logged on or not
- ☑ Run as soon as possible after a missed start
- ☑ Stop task if running longer than 1 hour

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## Safety Guarantees

This tool is designed to fail safe:

- ❌ No deletion if backup root is inaccessible (when backup is enabled)
- ❌ No deletion if backup copy fails
- ❌ No path traversal outside backup root
- ❌ No directory deletion above configured path root
- ❌ No unbounded goroutines or memory growth
- ☑ Network hiccups handled with retries + backoff
- ☑ Per-path backup control prevents accidental deletion without backup
- ☑ Popup notification alerts user when backup path is inaccessible

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## Development & Testing

### Smoke test

```
.\build.ps1 smoke
```

- Builds the binary
- Runs with `-no-logs`
- Verifies configs exist

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## License

Internal / private use.