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# **SCM Backup Documentation**

*Release 1.2.0*

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SCM Backup is a tool which makes offline backups of your cloud hosted source code repositories, by cloning them.

- Source code
- Website
- Download latest release

It's written in .NET Core, which means it's supposed to run on Windows, Linux and MacOS.



SCM Backup is a tool which makes offline backups of your cloud hosted source code repositories, by cloning them.

It's free and open source!

It supports backing up from multiple source code hosters and backing up multiple users/teams per source code hoster.

At the moment, the following hosters are supported:

- [GitHub](#)
- [Bitbucket](#)

## 1.1 How does it work?

SCM Backup uses the respective hoster's API to get a list of all your repositories hosted there.

Then, it uses the respective SCM (e.g. [Git](#) and/or [Mercurial](#), which need to be installed on your machine if you have at least one repository of the given type) to clone every repository into your local backup folder - or just pull the newest changes, if it already **is** in your local backup folder.

GitHub and Bitbucket repositories can have wikis, which are separate repositories and will be backed up as well.





## 2.1 System Requirements

### 2.1.1 .NET Core

SCM Backup is written in [.NET Core](#), the cross-platform version of .NET.

The available releases are [framework-dependent deployments](#), which means that the same download should work on any Windows, Linux and MacOS machine, as long as .NET Core is installed on it.

If it's not on your machine, you can get it from the [official download page](#). You need at least **version 2.1** of the .NET Core **runtime**.

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**Note:** So far, SCM Backup has been written and tested on Windows only. Technically, it should run on Linux and MacOS as well, but this has not been tested yet.

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### 2.1.2 Source control software

SCM Backup doesn't come with its own versions of [Git](#) and/or [Mercurial](#), so the respective SCM needs to be installed on your machine if you have at least one repository of the given type.

By default, SCM Backup expects all source control software to be in your path, so it just needs to execute `git`, `hg` etc. without a complete path, although it's possible to *specify the path to the executable in the config*.

Note that at runtime, SCM Backup checks the presence of all required SCMs on your system. It will stop if you have repositories needing a SCM which is not present on your system.

## 2.2 Download

At the moment, there are only `.zip` downloads.

Download the .zip file from [the latest release](#) and unzip it into a folder of your choice.

## 2.3 How to run

**Warning:** You should edit the configuration file before running SCM Backup for the first time!

*Read the guide* for more information.

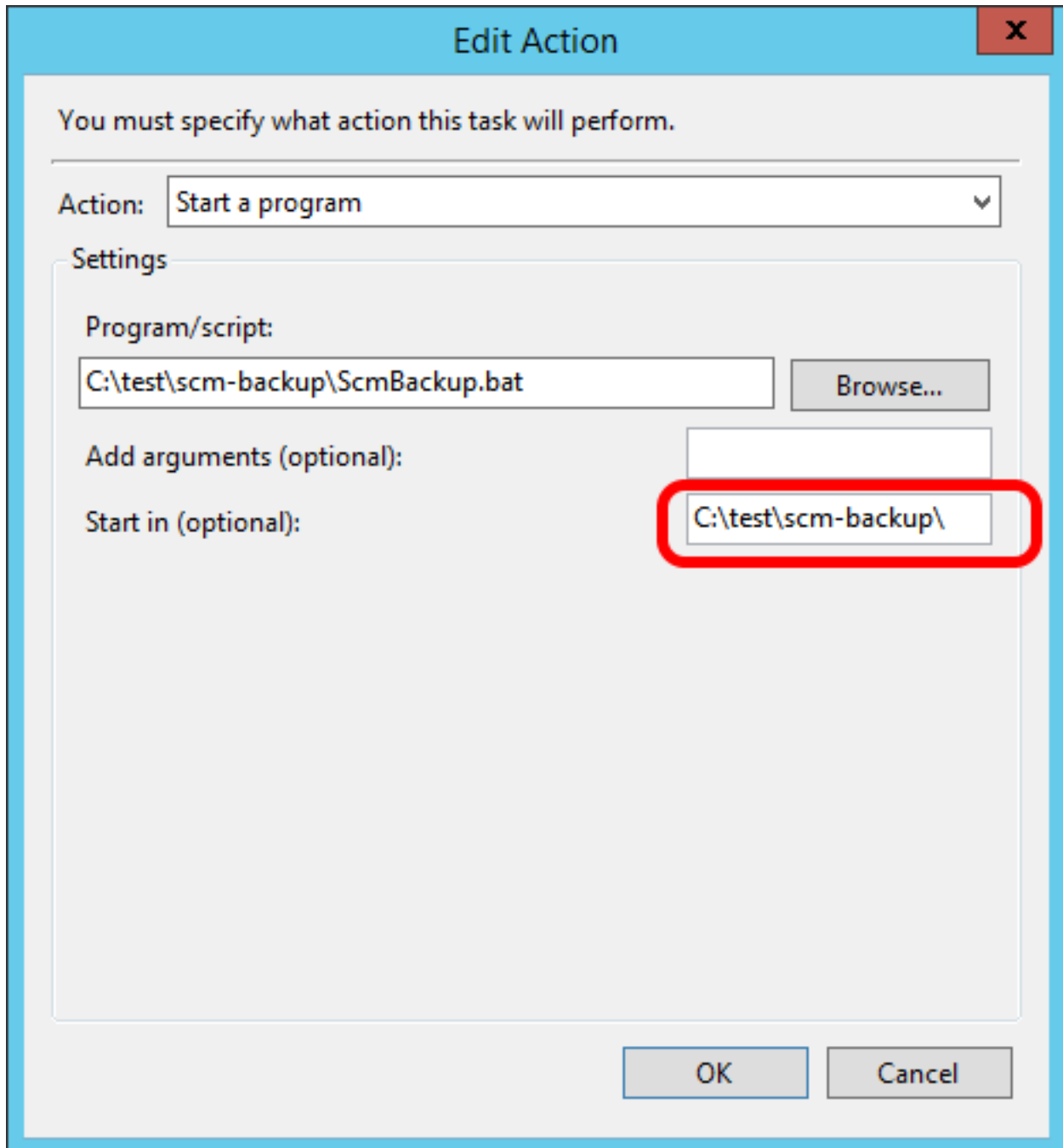
The actual application is in the `ScmBackup.dll` library. You can execute it with the `dotnet` command:

```
dotnet ScmBackup.dll
```

For Windows, there's a batch file named `ScmBackup.bat` which does exactly that.

### 2.3.1 Windows Task Scheduler

To run SCM Backup via Windows Task Scheduler, you need to specify the path to the batch file **and** the directory (in "Start in") in the "Edit Action" screen:



Omitting the directory can cause problems.



SCM Backup is configured in [YAML](#), by editing the config file `settings.yml`.

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**Note:** SCM Backup automatically makes a backup of its own configuration.

On each run, the following files are copied to the *backup folder*, into a subfolder named `_config`:

- `settings.yml`
  - The *logger's* config file
- 

## 3.1 General Options

### 3.1.1 localFolder

The folder (on the machine where SCM Backup runs) where all the backups will be stored.

The folder must already exist, SCM Backup won't create it.

Example:

```
localFolder: 'c:\scm-backup'
```

### 3.1.2 waitSecondsOnError

When an error occurs, SCM Backup will wait that many seconds before exiting the application.

Example:

```
waitSecondsOnError: 5
```

### 3.1.3 scms

SCM Backup uses the source control software already installed on your system. By default, it assumes that the required SCMs are installed in your path.

If this isn't the case, or if you have multiple versions of the same SCM on your system and want SCM Backup to use a specific one, you can specify the complete path to the executable in the config file.

Example:

```
scms:
- name: git
  path: 'c:\git\git.exe'
```

### 3.1.4 email

Settings for *sending log information via email*.

By default, the whole section is commented out via #. To enable it, remove the comments so it looks like this:

```
email:
  from: from@example.com
  to: to@example.com
  server: smtp.example.com
  port: 0
  useSsl: false
  userName: testuser
  password: not-the-real-password
```

Fill all settings with the proper values for your server.

SCM Backup will try sending emails when an un-commented `email` section exists in the configuration.

## 3.2 Sources

SCM Backup is able to backup from multiple source code hosters, and multiple accounts per hoster.

For example, your GitHub user may be a member of an [organization](#), and you may want to backup all repositories of your user, **and** all repositories of that organization.

In SCM Backup terms, these would be two different **sources**: your GitHub user would be one source, and the organization would be a second one.

You can define as many sources as you want in the config file, in this format:

```
sources:
- title: some_title
  hoster: github
  type: user
  name: your_user_name
- title: another_title
  hoster: github
  type: org
  name: your_org_name
```

Each source must have at least those four properties:

title

Must be unique in the whole config file.

For each source, SCM Backup will create a sub-folder named like the source's title in the *main backup folder*.

hoster

The source code hoster from which you want to backup. See the sub-pages for valid values for each hoster.

type

Either `user` or `org`, depending if you want to backup an user or a organization.

name

The name of the user/organization you want to backup.

There are more possible options (for authentication, for example), but these can vary depending on the source code hoster.

See the respective sub-page for detailed documentation per hoster:

### 3.2.1 GitHub

Configuration settings for backing up repositories from GitHub.

#### Warning: Known limitations:

- Issues are not backed up

### Sources

For the basics, please read the *Sources* section first.

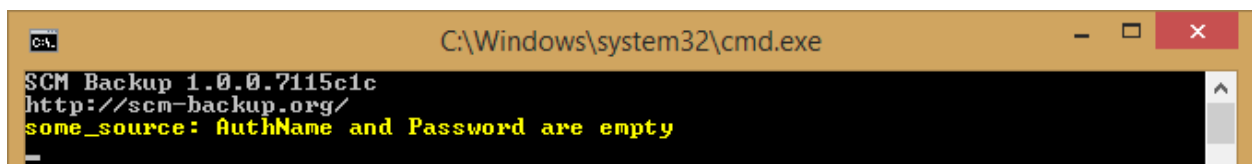
For GitHub, the `hoster` entry in the config file needs to look like this:

```
hoster: github
```

### Authentication

Without authentication, SCM Backup can only backup your public repositories.

In this case, it shows a warning:



```
C:\Windows\system32\cmd.exe
SCM Backup 1.0.0.7115c1c
http://scm-backup.org/
some_source: AuthName and Password are empty
```

To backup your private repositories as well, you need to authenticate:

- To backup a user's repositories, you need to authenticate with that user.

- To backup an organization's repositories, you need to authenticate with a user who has sufficient permissions to that organization's repositories.

Create a [personal access token](#) for SCM Backup for that user:

1. In the user's settings on GitHub, go to [Developer settings](#) [Personal access tokens](#) and create a new token. Give it at least the `repo` scope.

This scope allows SCM Backup to get a list of that user's repositories, including private ones, via the [GitHub API](#) ([read more about scopes](#)).

2. Put the username and the token into the `authName` and `password` properties of the source in the config file.

Example:

```
sources:
- title: some_title
  hoster: github
  type: org
  name: your_org_name
  authName: your_user_name
  password: your_token
```

This will backup the repositories of the organization `your_org_name`, but authenticate with the user `your_user_name`.

### 3.2.2 Bitbucket

Configuration settings for backing up repositories from Bitbucket.

#### **Warning: Known limitations:**

- Issues are not backed up

#### Sources

For the basics, please read the [Sources](#) section first.

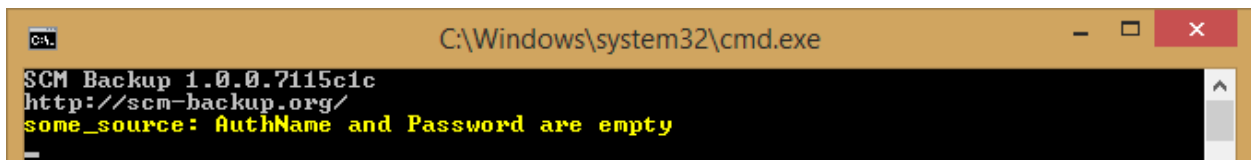
For Bitbucket, the `hoster` entry in the config file needs to look like this:

```
hoster: bitbucket
```

#### Authentication

Without authentication, SCM Backup can only backup your public repositories.

In this case, it shows a warning:



The screenshot shows a Windows command prompt window titled "C:\Windows\system32\cmd.exe". The prompt displays the following text: "SCM Backup 1.0.0.7115c1c", "http://scm-backup.org/", and "some\_source: AuthName and Password are empty". The error message is highlighted in yellow.

To backup your private repositories as well, you need to authenticate:



- To backup a user's repositories, you need to authenticate with that user.
- To backup a team's repositories, you need to authenticate with a user who has sufficient permissions to that team's repositories.

Create an **app password** for SCM Backup for that user:

1. In the user's settings on Bitbucket, go to the **App passwords** area (<https://bitbucket.org/account/user/YOUR-USERNAME/app-passwords>) and create a new app password. Give it at least the following permissions:

## Add app password

### Details

Label\*

### Permissions

<p><b>Account</b> <input checked="" type="checkbox"/> Email  <input checked="" type="checkbox"/> Read  <input type="checkbox"/> Write</p> <p><b>Team membership</b> <input type="checkbox"/> Read  <input type="checkbox"/> Write</p> <p><b>Projects</b> <input type="checkbox"/> Read  <input type="checkbox"/> Write</p> <p><b>Repositories</b> <input checked="" type="checkbox"/> Read  <input type="checkbox"/> Write  <input type="checkbox"/> Admin  <input type="checkbox"/> Delete</p>	<p><b>Pull requests</b> <input type="checkbox"/> Read  <input type="checkbox"/> Write</p> <p><b>Issues</b> <input checked="" type="checkbox"/> Read  <input type="checkbox"/> Write</p> <p><b>Wikis</b> <input checked="" type="checkbox"/> Read and write</p> <p><b>Snippets</b> <input type="checkbox"/> Read  <input type="checkbox"/> Write</p> <p><b>Webhooks</b> <input type="checkbox"/> Read and write</p> <p><b>Pipelines</b> <input type="checkbox"/> Read  <input type="checkbox"/> Write  <input type="checkbox"/> Edit variables</p>
---	---

- Account: Read
- Repositories: Read
- Issues: Read
- Wikis: Read and write (*SCM Backup only needs to read, but there's no separate "just read" permission*)

2. Put the username and the app password into the `authName` and `password` properties of the source in the config file.

Example:

```
sources:
- title: some_title
  hoster: bitbucket
  type: org
  name: your_team_name
```

(continues on next page)

(continued from previous page)

```
authName: your_user_name
password: your_app_password
```

This will backup the repositories of the team `your_team_name`, but authenticate with the user `your_user_name` and the app password.

### 3.2.3 ignoreRepos

Optional: For each source, you can specify a list of repositories you do **not** want to be backed up.

Example:

```
sources:
- title: some_title
  hoster: github
  type: user
  name: your_user_name
  ignoreRepos:
    - repol
    - Some-Other-Repo
```

---

#### Note:

- The repository names are case-sensitive!
  - For hosters where the repositories are “sub-items” of the users (like GitHub), you just need to specify the repository name, not the user name (i.e. `repo` instead of `user/repo`).
-

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## Getting SCM Backup's output

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For use cases where SCM Backup is running unattended, there are multiple options to get the output:

### 4.1 Logging

SCM Backup uses [NLog](#) for logging.

All console outputs are also generated via logging (with a [CompositeLogger](#) which logs to the console **and** to NLog).

So all console outputs are in the log files as well.

#### 4.1.1 Log levels

To keep it simple, SCM Backup only has [four log levels](#).

The [ConsoleLogger](#) outputs all levels except Debug.

The [NLogLogger](#) maps SCM Backup's log levels to a subset of NLog's log levels.

NLog is configured via NLog's regular [NLog.config](#) file, so all possible [NLog configuration settings](#) apply.

For example, you can change the minimal log level to Debug (default: `Info`), to log additional information.

#### 4.1.2 Log files

The log files are in a subfolder named `logs` in SCM Backup's application folder.

On each application start, a new log file (`scm-backup.log`) is generated.

Old files are available in the `archive` subfolder.

## 4.2 Emailing output

The same information which is logged to the console and to the log files, can be sent via email as well.

You need to provide the SMTP settings, as well as the `FROM` and `TO` email addresses, in the *email section in the config file*.

If this is set, SCM Backup will send a mail to the specified address after each finished backup.

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## Restoring your backups

---

Generally, SCM Backup creates local repositories and pulls from the remote repositories into the local ones.

Those local repositories are **bare repositories**, i.e. they don't contain a working directory.

When you look inside the repository directories, you'll see some directories and files, depending on whether it's a Git/Mercurial/etc. repository.

**Your complete history and your source code are in there - you just don't see the actual files!**

The repository is backed up without a working directory, because it's not necessary.

All the data already exists inside the repository, a second copy of everything in the working directory would just be a waste of space.

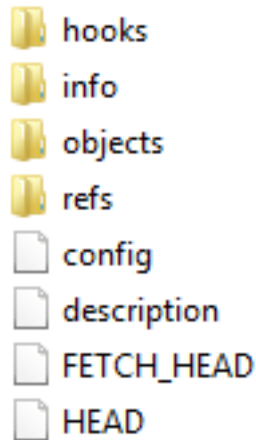
The easiest way to restore your working directory is to clone the bare repository that SCM Backup created (*called bare-repo in the examples*), which will create a clone **with** a working directory (*called working-repo in the examples*).

For more details, please see the sub-page for the respective SCM:

### 5.1 Restoring Git repositories

#### 5.1.1 How a bare repository looks like

It contains a few folders (`objects`, `refs...`) and some files:



### 5.1.2 How to restore

Clone the bare repository into a “regular” one:

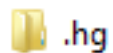
```
git clone bare-repo working-repo
```

working-repo will have a working directory.

## 5.2 Restoring Mercurial repositories

### 5.2.1 How a bare repository looks like

It contains a single folder named `.hg`:



### 5.2.2 How to restore

#### Clone

Clone the bare repository into a “regular” one:

```
hg clone bare-repo working-repo
```

working-repo will have a working directory.

#### Update

Updating a bare repo to any revision will create a working directory in that repository.

To do this, `hg update` to any revision. For the newest revision, update to `tip` (*a tag which points to the latest commit*):

```
cd bare-repo
hg update tip
```

In TortoiseHG, right-click on any revision **Update**.





## 6.1 Contribute to the application

### 6.1.1 How to run the integration tests

For each supported hoster, SCM Backup needs to:

- make API calls to get a list of repositories
- use Git/Mercurial etc. to clone repositories

So there are integration tests for each hoster which do these things as well, some of them with authentication.

We created test users especially for these tests (for example: `user` and `organization` used for GitHub integration tests ), but of course we can't publish their passwords.

So in order to run any of these integration tests, you need to setup your *own* test users and private test repositories.

SCM Backup's integration tests read the users, passwords etc. from a file named `environment-variables.ps1` in the main project directory, which is not in the repository.

You need to create your own by copying/renaming `environment-variables.ps1.sample`, and changing the values.

The public repositories are hardcoded in the tests, the tests just authenticate with the user/password from the environment variables.

#### xUnit.Net Cheat Sheet

##### Running a single test

Edit `run-all-tests.ps1`, look for the **INTEGRATION TESTS** section and add the `--filter` parameter to the `dotnet test` call, like this:

```
--filter "FullyQualifiedName=ScmBackup.Tests.Integration.Hosters.  
↳BitbucketBackupMercurialTests.MakesBackup"
```

### 6.1.2 Implementing a new hoster

Steps how to implement support for backing up a new source code hoster, using the implementation for Bitbucket as an example.

#### Basics

In the `ScmBackup` project, create a new subfolder in the “Hosters” folder and name it like the hoster you are implementing, e.g. `Bitbucket`.

Inside the folder, create the classes listed below.

---

**Note:** SCM Backup uses naming conventions to put everything together, so make sure that:

- all classes have exactly the same prefix
  - the part after the prefix is exactly like in the examples below
- 

**Note:** To see examples, take a look at:

- **the respective classes of the existing hosters**
    - Examples: `GitHub`, `Bitbucket`
  - **their tests:**
    - `...ConfigSourceValidatorTests` in the **unit tests**
    - `...ApiTests/...BackupTests` in the **integration tests**
- 

#### Hoster

- Example class name: `BitbucketHoster`
- Must implement `IHoster`

#### ConfigSourceValidator

Validates all config sources for that hoster.

- Example class name: `BitbucketConfigSourceValidator`
- Must inherit from `ConfigSourceValidatorBase`, which implements `IConfigSourceValidator` and contains “default” rules which apply to all hosters
- Tests: Create a new class in `ScmBackup.Tests.Hosters` which inherits from `IConfigSourceValidatorTests`

#### Api

- Example class name: `BitbucketApi`
- Must implement `IHosterApi`
- Should call the hoster’s API and return a list of repository metadata for the current user or organization

- Tests: Create a new class in `ScmBackup.Tests.Integration.Hosters` which inherits from `IHosterApiTests`

## Backup

- Example class name: `BitbucketBackup`
- Must inherit from `BackupBase`, which implements `IBackup` and creates the actual backups by cloning the repositories.
- Tests: Create a new class in `ScmBackup.Tests.Integration.Hosters` which inherits from `IBackupTests`

---

**Note:** When a hoster supports multiple SCMs, you want to test backups with all of them, so you should create a separate test class for each SCM.

An example for this is Bitbucket, which supports Git **and** Mercurial, so there are `BitbucketBackupGitTests` and `BitbucketBackupMercurialTests`.

---

## More about the tests

The base classes for the tests (`IConfigSourceValidatorTests`, `IHosterApiTests`, `IBackupTests`) contain all the tests and a few properties, some of them abstract or virtual.

The child classes just need to inherit from the respective base class and fill the properties (*for repo URLs, commit IDs etc.*).

So the same tests are executed for each `IConfigSourceValidator`, `IHosterApi` and `IBackup` implementation (please see also *How to run the integration tests*).

---

**Note:** For special cases, which only apply to a certain implementation, you can create additional tests directly in the child class instead of the base classes.

One example for this is the Github API. There's a [special quirk](#) which only occurs in the Github API.

Because of this, we have a special integration test for this, directly in the `GithubApiTests` class, so it's only executed there, and not for all `IHosterApi` implementations.

---

## Documentation

Add the hoster to the lists on [the website's front page](#), and on the [Introduction](#) page in this documentation.

### 6.1.3 Implementing a new SCM

---

**Note:** To see example code, take a look at the existing SCM implementations and their tests:

- [GitScm / GitScmTests](#)
  - [MercurialScm / MercurialScmTests](#)
-

### Add ScmType

Add the new SCM to the `ScmType` enum.

### IScm implementation

In the `ScmBackup` project, create a new class in the “`Scm`” folder. Name it like the SCM you are implementing, e.g. `GitScm`

The class must implement the interface `IScm`.

When the respective SCM has a command-line tool (*like most current SCMs do*), the easiest way to implement the class is by inheriting from the abstract `CommandLineScm` class.

(`CommandLineScm` handles the plumbing to actually execute the command line tool, including looking for the executable at *the path specified in the config*)

### ScmAttribute

All SCM implementations need to have an attribute, so SCM Backup is able to properly recognize them.

Apply the `ScmAttribute` to the class and set the `Type` parameter to the `ScmType` you added in the first step.

Example for Git:

```
namespace ScmBackup.Scm
{
    [Scm(Type = ScmType.Git)]
    internal class GitScm : CommandLineScm, IScm
    {
    }
}
```

### Integration tests

In the `ScmBackup.Tests.Integration` project, create a new test class in the `Scm` folder which inherits from `IScmTests`. Name it accordingly, e.g. `GitScmTests`.

`IScmTests` contains all the tests and a few abstract properties for repo URLs, commit IDs etc.

The child classes just need to set these, so the same tests are executed for all `IScm` implementations.

Please see also *How to run the integration tests*.

## 6.2 Contribute to the documentation

The documentation is built with Sphinx and hosted on Read the Docs.

The source code is here on GitHub.

## 6.2.1 Headlines

To make sure that the Read the docs Sphinx theme renders correctly, it's important that the headline styling is consistent across the whole documentation.

SCM Backup's documentation uses these stylings:

- ===== for level 1 (*the top headline of each page*)
- ----- for level 2
- ++++++ for level 3

## 6.3 Making a new release

To make a new release version, the following steps must be followed:

### 6.3.1 1. Determine the new version number

SCM Backup uses [Semantic Versioning](#).

The new version number **must** be in “three-digit” MAJOR.MINOR.PATCH format, for example 1.0.0 !!

### 6.3.2 2. Release the application

Each push to `master` creates a new CI build on [AppVeyor](#) anyway.

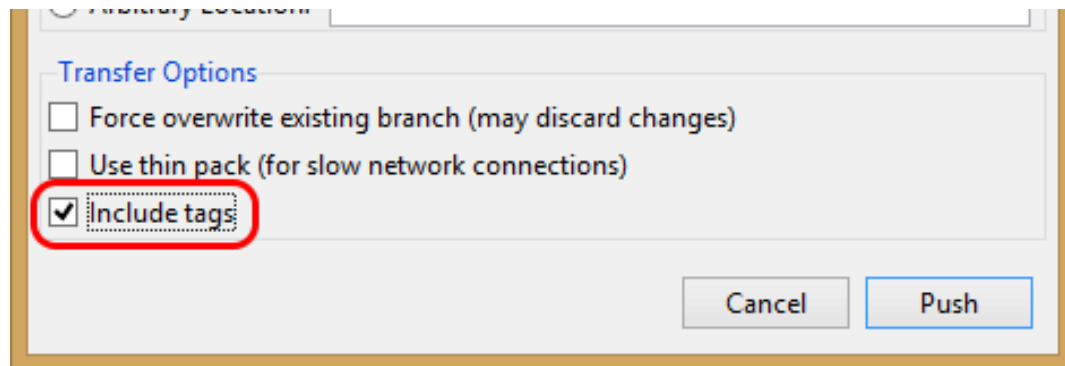
Create a new release by creating a Git tag in the [main repository](#) with the new version number.

The CI build will recognize this and automatically use this version number to create a new [GitHub release](#).

---

**Note:** Don't forget to actually push the tag! Git doesn't do this automatically.

- From the command line, it's `git push origin 1.0.0`.
- In Git GUI, you need to set this checkbox when pushing:



### 6.3.3 3. Release the docs

- Set the `version` and `release` numbers in the Sphinx configuration file `conf.py` to the new version number.

Set `version` to the short `X.Y` format, e.g. `1.0`.

Set `release` to the full three-digit format determined in step 1, e.g. `1.0.0`.

Apparently Read the Docs uses this number at least in the automatically created PDF.

- Create the same “version number” Git tag (*like in the main repository*) in the documentation repository as well.

This will create a version of the documentation for this release, making use of Read the Docs’ [versioning capabilities](#).

### 7.1 License

SCM Backup is licensed under the [GPL](#).

### 7.2 Acknowledgements

SCM Backup uses the following OSS projects:

- [Json.NET](#)
- [MailKit](#)
- [NLog](#)
- [Octokit](#)
- [RichardSzalay.MockHttp](#)
- [Simple Injector](#)
- [xUnit.net](#)
- [YamlDotNet](#)

Special thanks to [Steven](#) for invaluable advice.





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## Info for Bitbucket Backup users

---

**Bitbucket Backup** is a previous application written by the author of SCM Backup. It's similar to SCM Backup, but limited to Bitbucket and one user or team only.

**Here is some useful information for Bitbucket Backup users switching to SCM Backup:**

### 8.1 Setup

Bitbucket Backup is written in .NET 4, SCM Backup is written in .NET Core; see the different *System Requirements*. Plus, there's no MSI setup anymore, just a zip file with the binaries.

### 8.2 Configuration

When you run Bitbucket Backup for the first time, it asks for all configuration values and stores them in the user's settings.

SCM Backup is able to backup multiple accounts from multiple hosters, so asking for all the config values at runtime isn't practical anymore.

Instead, you save them all into a *configuration file*.

A minimal working configuration file to backup your Bitbucket user would look like this:

```
localFolder: 'c:\your-backup-folder' # your backups are stored here

sources:

  - title: some_title # must be unique in the whole config file, will be used as_
    ↪subfolder name
    hoster: bitbucket
    type: user
```

(continues on next page)

(continued from previous page)

```
name: your_user_name
authName: your_user_name
password: your_app_password
```

... or like this for a team:

```
localFolder: 'c:\your-backup-folder'

sources:
- title: some_other_title
  hoster: bitbucket
  type: org
  name: your_team_name
  authName: your_user_name
  password: your_app_password
```

... or like this to backup both the user **and** the team (*which Bitbucket Backup can't do*):

```
localFolder: 'c:\your-backup-folder'

sources:
- title: some_title
  hoster: bitbucket
  type: user
  name: your_user_name
  authName: your_user_name
  password: your_app_password

- title: some_other_title
  hoster: bitbucket
  type: org
  name: your_team_name
  authName: your_user_name
  password: your_app_password
```

Read more about possible settings for *sources* and *Bitbucket*.

### 8.3 Emailing output

Like Bitbucket Backup, SCM Backup is able to send an email with log information, but the configuration is different. See *how it's done in SCM Backup*.

Bitbucket Backup takes advantage of `SmtPClient`'s ability to [read configuration file settings](#) by itself.

So [all possible options](#) for `<mailSettings>` were available, and Bitbucket Backup didn't need to bother to support or even know about them all, because `SmtPClient` directly read them from the app's config file.

Apparently [this is not possible in .NET Core](#) and maybe `SmtPClient` is [kind of deprecated anyway](#), so SCM Backup is using `MailKit` instead, which [doesn't read values from the config and never will](#).

So SCM Backup has to know about every possible config value, and time will tell whether [those available now](#) will work for everyone.