

Simio API Note:

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Overview

This API Note describes how Simio can be configured to do the following:

1. Run a Schedule in a “headless” or unattended mode to create a Model Plan
2. Export the results from the schedule.

Although Simio is usually used with the desktop User Interface (UI) it can be configured to run unattended or “headless”.

This project will demonstrate a configuration where a model is set up to be run as a Windows service, and be triggered whenever a file is dropped into a give folder.

This Note describes some complex programming topics. It assumes that the reader is familiar with C# and .NET technologies such as locking and DLL dependencies.

Architecture

The diagram below illustrates the overall architecture of this API example:

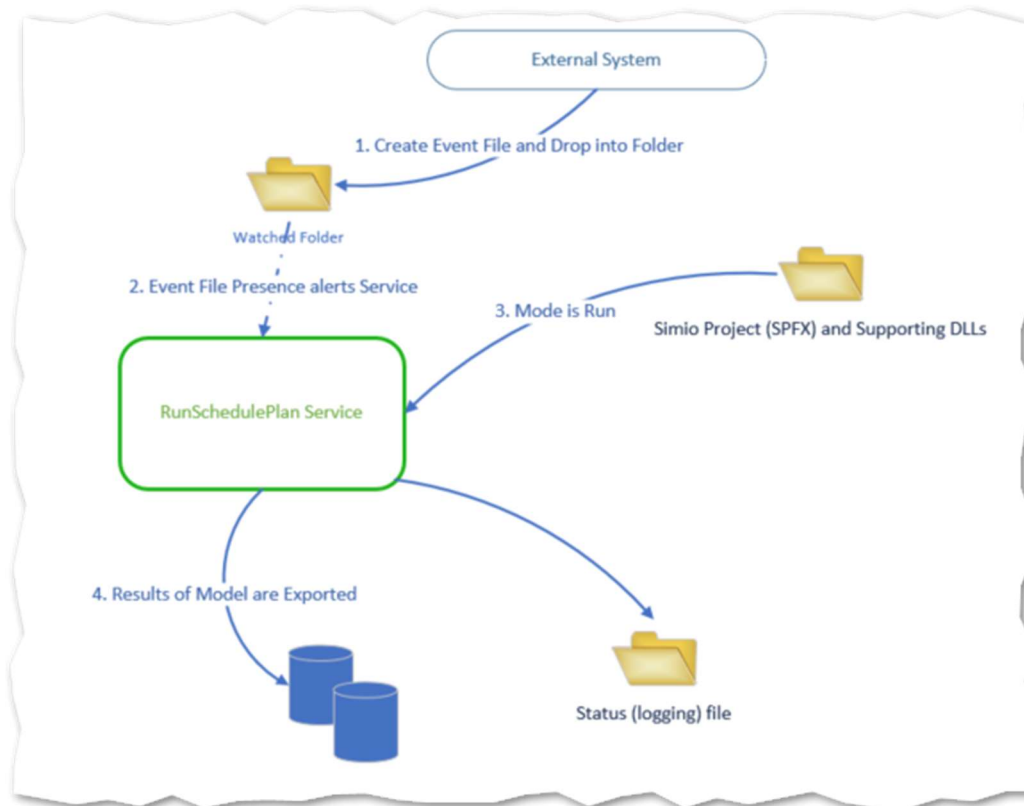


Figure 1- RunSimioSchedule Architecture

RunSimioSchedule is a windows process that runs as a service and waits for an event file to be dropped into a specified folder.

As the program begins the method Main is called which creates a RunContext which will exist throughout the life of the service. During the RunContext constructor, the following occurs:

- The API SimioProjectFactory.SetExtensionsPath is called to indicate to the model where all the support DLLs can be found.
- Some setup occurs, such as making sure of the existence of the Event file folder.
- The Simio project file (e.g. .SPFX) is located and loaded.
- Calls OnStart which creates a system FileWatcher which monitors the Events folder and has events for whenever an event file is created or changed within the folder. It also starts a timer that polls for the event file.

Then the program goes into an infinite loop, leaving the Event file event checking to do all the work.

Whenever an Event file is found, the method CheckAndRun is called, which subsequently calls RunScheduleExportResultsAndSaveProject, which is the central logic to this example.

RunScheduleExportResultsAndSaveProject does the following.

- Converts the Event File - which is a CSV (Comma Separated Value) file to a DataTable and then deletes the Event File.
- Gets the model from the already loaded Simio project.
- If the DataTable exists, then it is assumed to be downtime data and is Imported into the model's Resource Table the method ImportDowntime. If the model doesn't have a table called "Resources", then the data is simply ignored.
- If configured, the Model is saved prior to the run.
- If configured, the model's Plan is run.
- If configured, risk analysis is run on the model.
- If configured, the plan's schedule is exported.
- If configured, the model is saved

Some Background Information on the Simio Engine

The Simio engine (or simply as the Engine) is the logic that implements the simulation and planning logic of Simio. When used as a desktop application, it is paired with a UI, but in the “headless” mode it isn’t. Only the DLL containing the engine (SimioDLL.DLL) along with support files for API and some file operations will be used.

When running within the UI specific folders are searched by Simio when looking for DLLs, such as User Extensions and other add-ins.

When running headless this is not done, and instead all DLLs that are used must be in the location specified by the call `SetExtensionsPath` of `SimioProjectFactory`.

This can be a tricky problem, as often DLLs depend on other DLLs, which depend on even more and so on. There are a few free tools that might help you solve this puzzle:

One is DotPeek, which is made by JetBrains. With this tool you can inspect a DLL for its dependencies.

Another is Process Explorer, which part of Microsoft’s SysInternal toolset. When run in Administrator mode this tool permits you to examine a running process (such as Simio) and determine what DLLs are loaded.

In this document are included the instruction for loading your headless executable as a Windows Service..

Building A Headless Executable

The overall structure of the program is simple: a path to the extensions is set, and then a series of actions on the model, such as running the model plan or running risk analysis are issued.

The difficulty most users have – as was mentioned before – is determining the correct DLLs to include. This will be covered later in a separate section.

Separate but closely allied with the calling of the model is the need for a mechanism to initiate the model. This example employs a file-drop mechanism. When a file is dropped in a special folder, a method is triggered by the System FileWatcher. This method (called CheckAndRun) runs the method RunScheduleExportResultsAndSaveProject, which does most of the work.

Note: because of a well-known FileWatcher deficiency (under rare circumstances it won't detect a file event) there is also a timer that checks every so often for a file and runs the same model processing method.

There is also a file that logs information about the running of the model. This is specified in the configuration file.

The utility methods (such as those that are used to read and write information to the model are included in a utility class called HeadlessHelpers.

Configuration settings are included as Application Settings, which – during the build of this application are output into a configuration file (RunSimioSchedule.exe.config) that is placed in the same folder as the executable (RunSimioSchedule.exe).

Name	Type	Scope	Value
EventFile	string	User	C:\(test)\RunSimioScheduleTest\Event.csv
StatusFile	string	User	C:\(test)\RunSimioScheduleTest\RunStatus.txt
SaveProject	bool	User	True
ClearStatusBeforeEachRun	bool	User	False
DeleteStatusBeforeEachRun	bool	User	False
SimioProjectFile	string	User	C:\(test)\RunSimioScheduleTest\Model v92.0.spfx
ExportScheduleFile	string	User	C:\(test)\RunSimioScheduleTest\ExportSchedule.xml
ModelName	string	User	Model
RunPlan	bool	User	True
RunRiskAnalysis	bool	User	False
ExportSchedule	bool	User	False

When the program is built from Visual Studio the results are placed (as always) in a folder such as Source > RunSimioSchedule > bin > release, such as:

Name	Date modified	Type	Size
MathNet.Numerics.dll	5/22/2018 7:15 PM	DLL File	1,515 KB
QlmLicenseLib.dll	10/1/2019 8:43 AM	DLL File	988 KB
RunSimioSchedule.exe	11/28/2019 9:32 AM	Application	24 KB
RunSimioSchedule.exe.config	11/24/2019 5:05 PM	CONFIG File	3 KB
RunSimioSchedule.pdb	11/28/2019 9:32 AM	Program Debug Database	48 KB
ServiceModelEx.dll	7/16/2019 3:04 PM	DLL File	60 KB
SimioAPI.dll	10/14/2019 11:29 AM	DLL File	64 KB
SimioAPI.Extensions.dll	10/14/2019 11:29 AM	DLL File	21 KB
SimioAPI.Graphics.dll	10/14/2019 11:29 AM	DLL File	5 KB
SimioDLL.dll	10/14/2019 12:05 PM	DLL File	8,568 KB
SimioEnums.dll	10/14/2019 11:29 AM	DLL File	26 KB
SimioReplicationRunnerContracts.dll	10/14/2019 11:29 AM	DLL File	14 KB
SimioTypes.dll	10/14/2019 11:29 AM	DLL File	46 KB

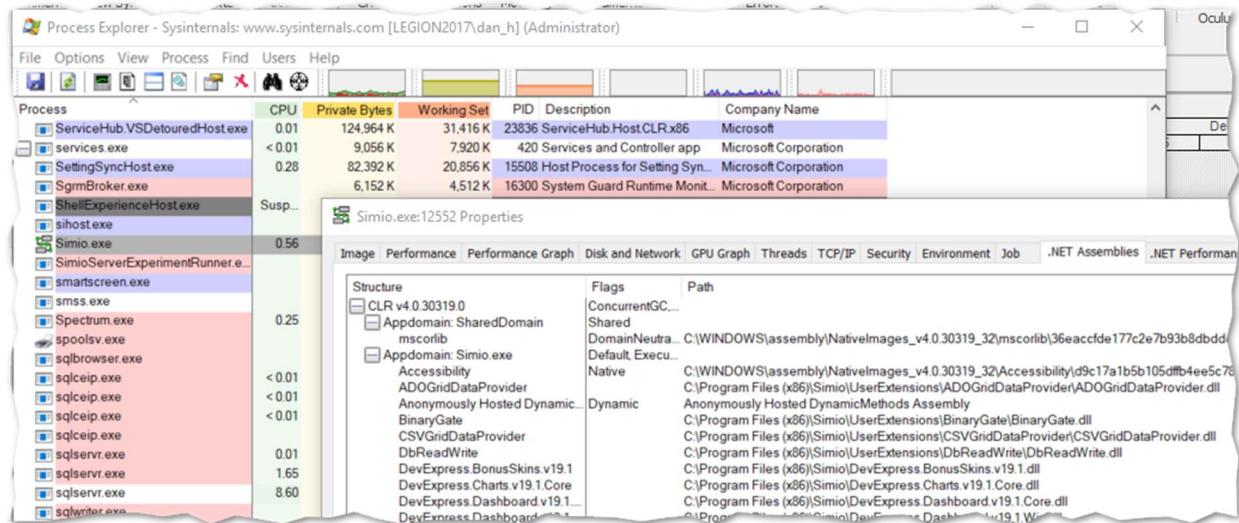
Figure 2 - Assemblies From Visual Studio - Very Likely Incomplete!

Now, you might think that all the DLLs you need would be found here. But this is likely wrong, since these are only the assemblies that Visual Studio could find through its process of compiling and linking and explicit references. The RunSchedulePlan program is going to – at run-time - launch a Simio Model, which may include many other DLLs (such as licensing files, user extensions, etc.)

So, what to?

A good starting point is to run Simio with our model and then run Microsoft's ProcessExplorer (as Administrator) to examine what DLL's are being used.

After starting Simio desktop and doing a RunPlan, Process Explorer is started. Look for Simio.exe and double-click to bring up its DLL view:



Looking through this we can see a lot of DevExpress DLLs, but many are DevExpress UI DLLs. There is a reference to DevExpress.Office.v19.1.Core, which is often included when Excel operations are employed.

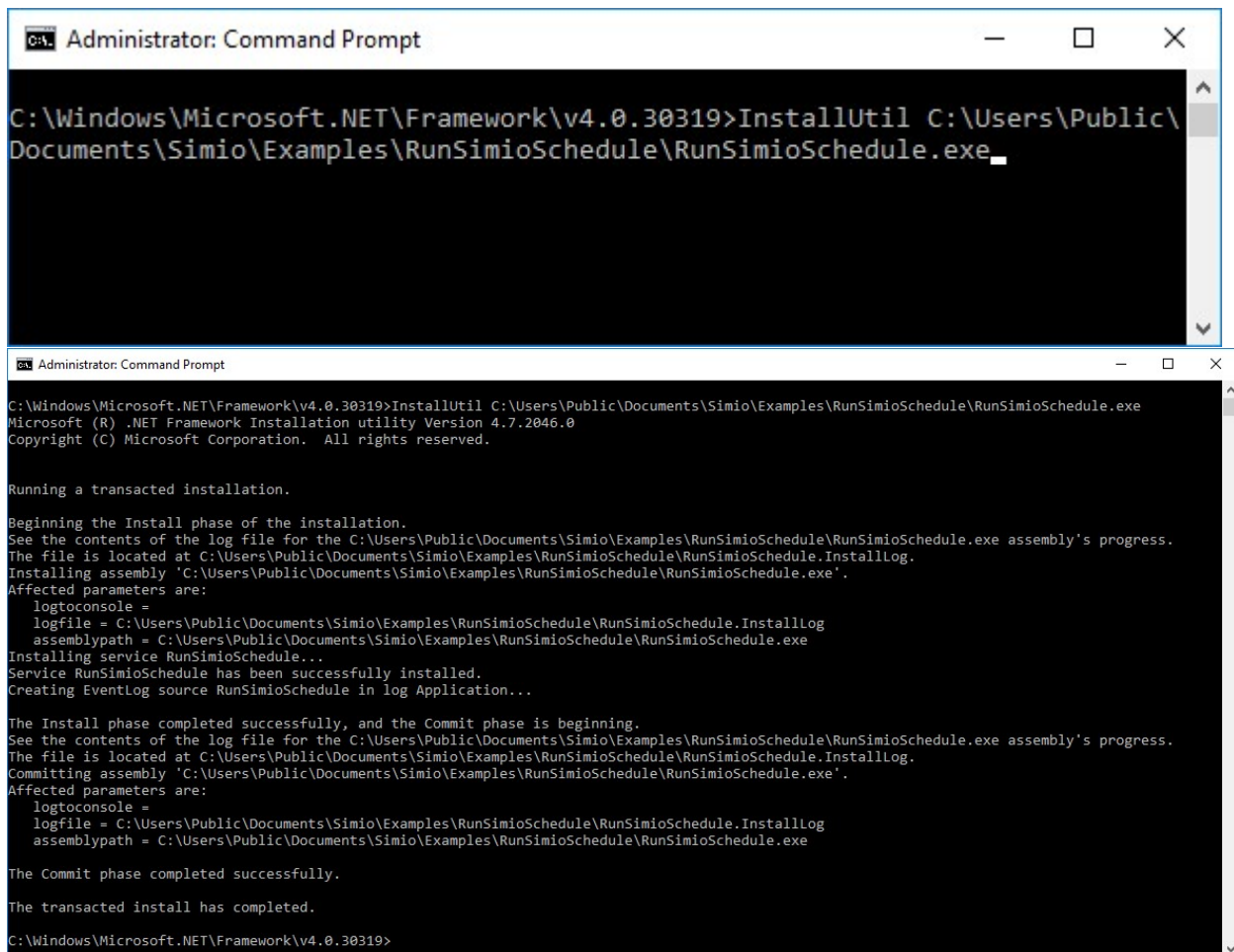
Of great interest to us are the ones within \SimioUserExtensions:

- ExcelGridDataProvider
- ExcelReadWrite
- GoodSelectionProcedure
- SimioRelocateObject
- SelectBestScenario
- SimioReplenishmentPolicies
- SimioSelectionRules
- SimioTravelSteeringBehaviors
- (no) SourceServerSink
- (no) WonderwareMES

- XMLGridDataProvider

Creating a Service From the Executable

- 1) Open a command prompt as Administrator
- 2) Navigate to your .NET installation folder. For example:
"C:\Windows\Microsoft.NET\Framework\v4.0.30319> "
- 3) Enter "InstallUtil followed by the path to your executable. For example:
C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\ RunSimioSchedule.exe". This will install the RunSimioSchedule as a windows service.



```
C:\Windows\Microsoft.NET\Framework\v4.0.30319>InstallUtil C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe

Microsoft (R) .NET Framework Installation utility Version 4.7.2046.0
Copyright (C) Microsoft Corporation. All rights reserved.

Running a transacted installation.

Beginning the Install phase of the installation.
See the contents of the log file for the C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe assembly's progress.
The file is located at C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.Installlog.
Installing assembly 'C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe'.
Affected parameters are:
  logtoconsole =
  logfile = C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.Installlog
  assemblypath = C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe
Installing service RunSimioSchedule...
Service RunSimioSchedule has been successfully installed.
Creating EventLog source RunSimioSchedule in log Application...

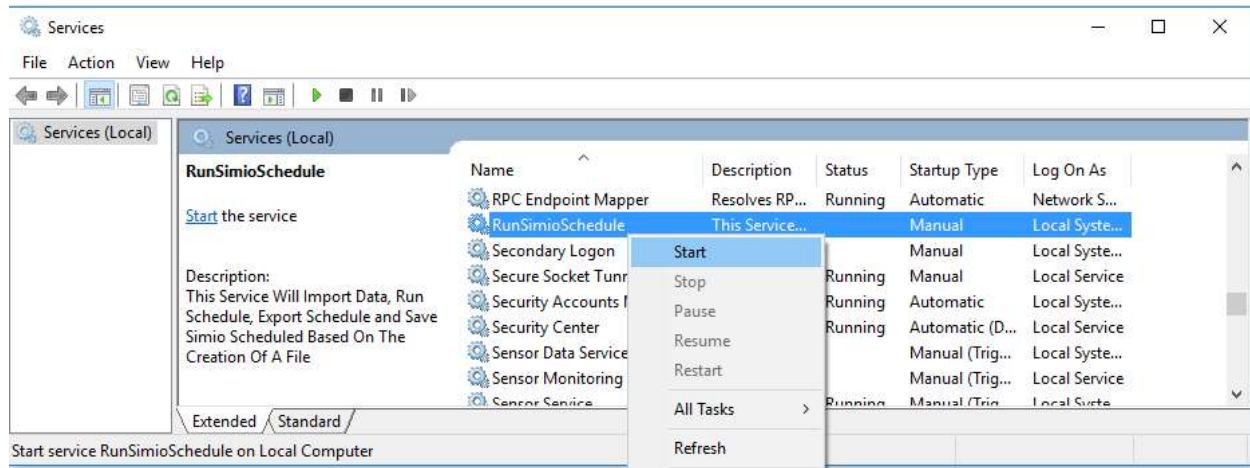
The Install phase completed successfully, and the Commit phase is beginning.
See the contents of the log file for the C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe assembly's progress.
The file is located at C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.Installlog.
Committing assembly 'C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe'.
Affected parameters are:
  logtoconsole =
  logfile = C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.Installlog
  assemblypath = C:\Users\Public\Documents\Simio\Examples\RunSimioSchedule\RunSimioSchedule.exe

The Commit phase completed successfully.

The transacted install has completed.

C:\Windows\Microsoft.NET\Framework\v4.0.30319>
```

- 4) Next, start the service from Services.



Process Explorer - Sysinternals: www.sysinternals.com [LEGION2017\dan_h] (Administrator)

File Options View Process Find Users Help

Process	CPU	Private Bytes	Working Set	PID	Description	Company Name
jucheck.exe		2,824 K	13,816 K	12992	Java Update Checker	Oracle Corporation
jusched.exe		2,176 K	12,608 K	26836	Java Update Scheduler	Oracle Corporation
LogiPresentation.exe		2,724 K	12,984 K	88	Logi Presentation.exe (UNIC...	Logitech, Inc.
LogiPresentationMgr.exe		3,656 K	15,900 K	12416	Logi Presentation Manager.e...	Logitech, Inc.
LogiPresentationUI.exe	< 0.01					
lsalso.exe	< 0.01					
lsass.exe	< 0.01					
lsmc.exe	< 0.01					
Memory Compression	< 0.01					
MSASCuiL.exe						
msoasb.exe						
notepad++.exe	0.02					
NVIDIA Web Helper.exe	0.01					
OneDrive.exe	0.27					
ONENOTEMEXE						
PerfWatson2.exe	0.01					
PerfWatson2.exe	0.01					
procexp.exe						
procexp64.exe	0.78					
RAVBg64.exe						
RAVCp64.exe						
Receiver.exe	0.07					
redirector.exe						
Registry						
schedhlp.exe						
Secure System	Susp...					
SelfService.exe						
SelfServicePlugin.exe						
services.exe	< 0.01					
Simio.exe	0.10					
SimioApiHelper.exe	< 0.01					
smss.exe						
System	0.28					
System Idle Process	76.32					

Simio.exe:23032 Properties

Image Performance Performance Graph Disk and Network GPU Graph Threads TCP/IP Security Environment Job .NET Assemblies .NET Performance Strings

Structure	Flags	Path
DevExpress.XtraGauges.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraGauges.v19.1.Win.dll
DevExpress.XtraGrid.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraGrid.v19.1.dll
DevExpress.XtraLayout.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraLayout.v19.1.dll
DevExpress.XtraMap.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraMap.v19.1.dll
DevExpress.XtraNavBar.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraNavBar.v19.1.dll
DevExpress.XtraPrinting.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraPrinting.v19.1.dll
DevExpress.XtraReports.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraReports.v19.1.dll
DevExpress.XtraRichEdit.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraRichEdit.v19.1.dll
DevExpress.XtraScheduler.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraScheduler.v19.1.dll
DevExpress.XtraTreeList.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraTreeList.v19.1.dll
DevExpress.XtraVerticalGrid.v19.1		C:\Program Files (x86)\Simio\DevExpress.XtraVerticalGrid.v19.1.dll
DirectConnect		C:\Users\dan_h\Documents\Simio\UserExtensions\DirectConnect.dll
EPPlus		C:\Users\dan_h\Documents\Simio\UserExtensions\EPPlus.dll
ExcelGridDataProvider		C:\Program Files (x86)\Simio\UserExtensions\ExcelGridDataProvider\ExcelGridDataProvider.dll
ExcelReadWrite		C:\Program Files (x86)\Simio\UserExtensions\ExcelReadWrite\ExcelReadWrite.dll
ExcelReadWriteEPPlus		C:\Users\dan_h\Documents\Simio\UserExtensions\ExcelReadWriteEPPlus.dll
ExportPlanData		C:\Users\dan_h\Documents\Simio\UserExtensions\ExportPlanData.dll
GoodSelectionProcedure		C:\Program Files (x86)\Simio\UserExtensions\GoodSelectionProcedure\GoodSelectionProcedure.dll
Microsoft.GeneratedCode	Dynamic	Microsoft.GeneratedCode
Microsoft.Win32.Primitives	Native	C:\WINDOWS\assembly\NativeImages_v4.0.30319_32\Microsoft.W3482a5f2#94ed2e82b44f14a947beac938
MigSharp		C:\Users\dan_h\Documents\Simio\UserExtensions\MigSharp.dll
NDepend.Path		C:\Program Files (x86)\Simio\NDepend.Path.dll
netstandard	Native	C:\WINDOWS\assembly\NativeImages_v4.0.30319_32\netstandard.78649c47844d891057c0bfa8951b44c\net
Newtonsoft.Json		C:\Program Files (x86)\Simio\Newtonsoft.Json.dll
OgreBindingCLI		C:\Program Files (x86)\Simio\OgreBindingCLI\OgreBindingCLI.dll
OgreBindingInterfaces		C:\Program Files (x86)\Simio\OgreBindingInterfaces.dll
PlexityHide.GTP		C:\Program Files (x86)\Simio\PlexityHide.GTP.dll
QlmLicenseLib		C:\Program Files (x86)\Simio\QlmLicenseLib.dll
RelocateObject		C:\Program Files (x86)\Simio\UserExtensions\RelocateObject\RelocateObject.dll
ResourceAssembly		ResourceAssembly