User Guide

Contents

Introduction 6

The User Interface 6

- The Ribbon 6
- The Quick Access Toolbar 7
- The Workflow Designer Panels 7
  - The Main Panel 8
  - The Activities Panel 8
  - The Library Panel 9
  - The Project Panel 9
  - The Properties Panel 10
  - The Outline Panel 10
  - The Output Panel 11

Connecting your Project to a Source Control 12

- Connecting to TFS 12
- Creating a New Team Project 14
- Connecting to SVN 15
- Context Menu Options 15
- Enabling Tracing 16
- Creating a Basic Workflow 18
- Introduction to Debugging a Workflow 22
  - Example of Debugging a Workflow 22
- Managing Packages 24
- Updating Packages 25
- Adding Your Own Packages 26
- Removing Your Packages 28
- Reusing automations - Library 28
  - How to add a folder to the show in Library pane: 29

Types of Workflow 32

- Sequences 32
  - Example of a Sequence 32
- Flowcharts 33
  - Example of a Flowchart 33
- State Machines 35

Example of How to Use a State Machine 37
Variables 39
Managing Variables 39
Creating Variables 39
Removing Variables 40
Browsing for .Net Variable Types 40
Types of Variables 41
Generic Value Variables 41
Text Variables 43
True or False Variables 44
Number Variables 46
Array Variables 47
Date and Time Variables 49
Data Table Variables 51
Arguments 54
Managing Arguments 54
Creating Arguments 54
Removing Arguments 54
Using Arguments 55
Example of Using an Argument 55
Imported Namespaces 57
About Imported Namespaces 57
Importing New Namespaces 57
Control Flow 59
About Control Flow 59
Control Flow Activities 60
The Assign Activity 60
The Delay Activity 60
The Do While Activity 61
The If Activity 63
The Switch Activity 64
The While Activity 66
The For Each Activity 67
The Break Activity 68

Recordings....70
About Recording....70
About Recording Types....71
Automatic Recording....73
Example of Automatic Recording with Basic and Desktop....74
Example of Automatic Recording with Web....78
Manual Recording....79
Types of Single Actions....80
UI Elements....85
About UI Elements....85
UI Activities Properties....85
Input Methods....86
Example of Using Input Methods....87
Output or Screen Scraping Methods....89
Google OCR....92
Microsoft OCR....93
Examples of Using Output or Screen Scraping Methods....94
The FullText method....95
The Native method....96
The Microsoft OCR method....97
The Google OCR method....97
Data Scraping....101
About Data Scraping....101
Example of Using Data Scraping....104
Selectors....109
About Selectors....109
UiPath Explorer....110
Field Descriptions for the UiPath Explorer Window....111
SAP Automation & Mainframe....114
How to Automate SAP Applications - The Quick Guide....114
How does UiPath work with SAP?....114
The Basic Workflow....114
The Process....115
Automating SAP via Click on Text and Screen Scraping....118

Radio Buttons 119
Automating Terminals and Mainframes 120
1. Introduction 120
2. Terminal wizard 120
3. Terminal activities 123
4. Supported providers 132

Introduction

UiPath is a complete solution for application integration, and automating third-party applications, administrative IT tasks and business IT processes. One of the most important notions in UiPath is the workflow.

A workflow is a graphical representation of a business process. It enables you to automate rule-based processes, by giving you full control of the execution order and the relationship between a custom set of steps, also known as activities in UiPath Studio. Each activity consists of a small action, such as clicking a button, reading a file or writing to a log panel.

The main types of workflows supported are:

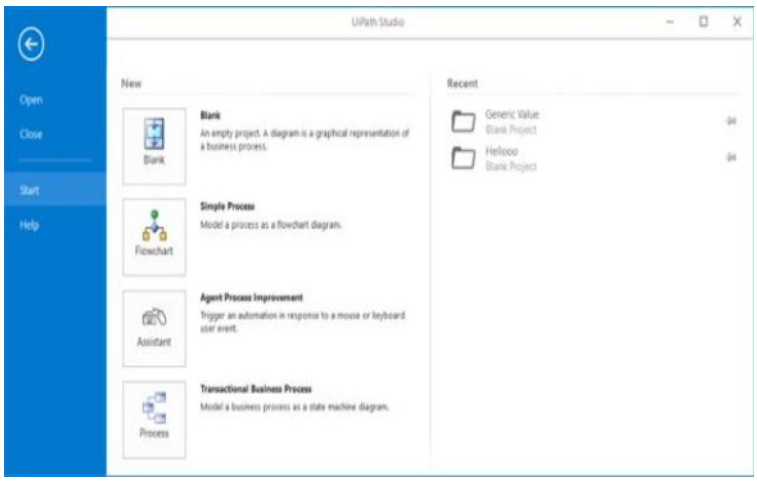
- Sequences - suitable to linear processes, enabling you to smoothly go from one activity to another, without cluttering your workflow.
- Flowcharts - suitable to a more complex business logic, enabling you to integrate decisions and connect activities in a more diverse manner, through multiple branching logic operators.
- State Machines – suitable for very large workflows; they use a finite number of states in their execution which are triggered by a condition (transition) or activity.

The User Interface

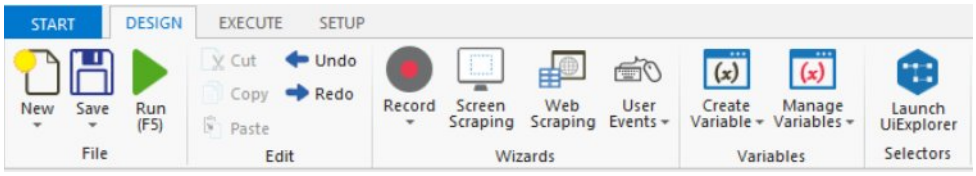
The Ribbon

The ribbon is straightforward and can be minimized or expanded by clicking the **Minimize / Expand** button . It consists of the following four tabs:

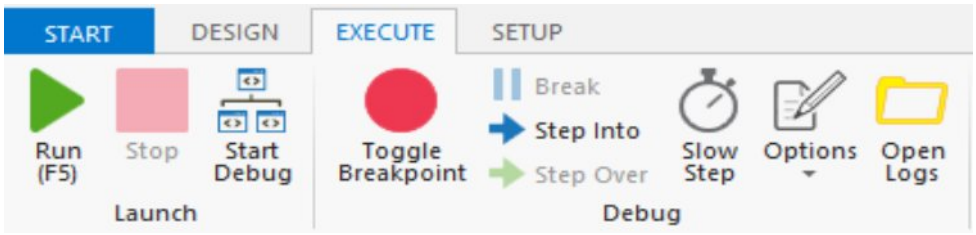
1. **Start** - create a project or open a previously created one, switch to a Beta or Stable version, Update Studio, go to the online documentation or submit a request. By default, projects are created in `C:\Users\Username\Documents\UiPath`.



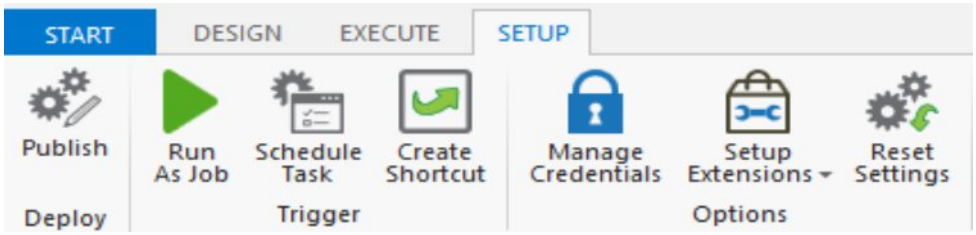
2. **Design** - create or launch sequences, flowcharts or state machine diagrams, access wizards, manage variables, and inspect user interface elements from third-party apps.



3. **Execute** - run or stop projects, start the debug process, slow down steps and open logs.



4. **Setup** - publish a project or create a shortcut for it, schedule tasks, and install extensions with just one click.



The Quick Access Toolbar

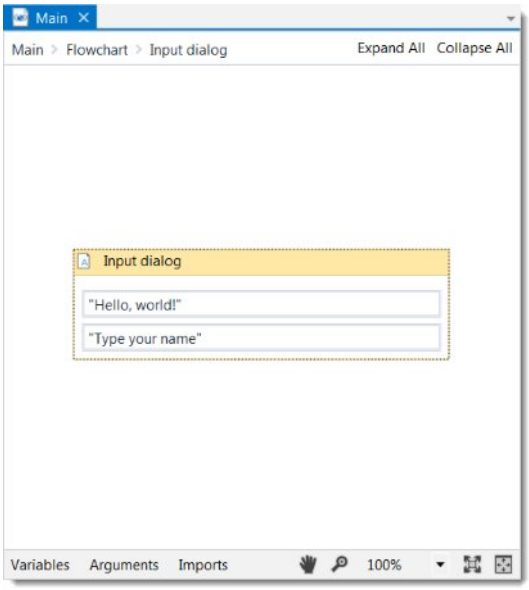
The **Quick Access Toolbar** is located by default on the title bar, above the ribbon, yet you can easily move it bellow.

It provides shortcuts for the most used commands, and you can add new ones to it by right-clicking a desired button and selecting the **Add to Quick Access Toolbar** option.

The Workflow Designer Panels

UiPath contains multiple panels for an easier access to specific functionalities. They can be docked, act as floating windows, or the Auto-hide option can be enabled.

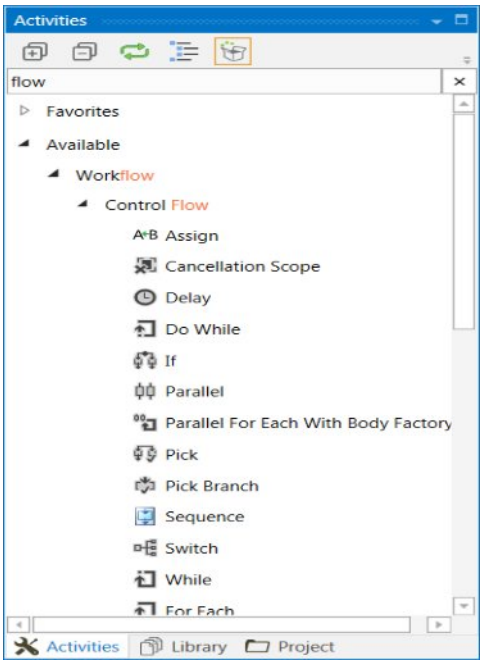
The Main Panel



The **Main** panel displays your current workflow or workflows, enables you to make changes to them, and provides quick access to variables, arguments and imports.

It is possible to navigate within a workflow, by double-clicking the activity you want to view. The path is displayed as breadcrumbs in the header of the **Main** panel.

The Activities Panel

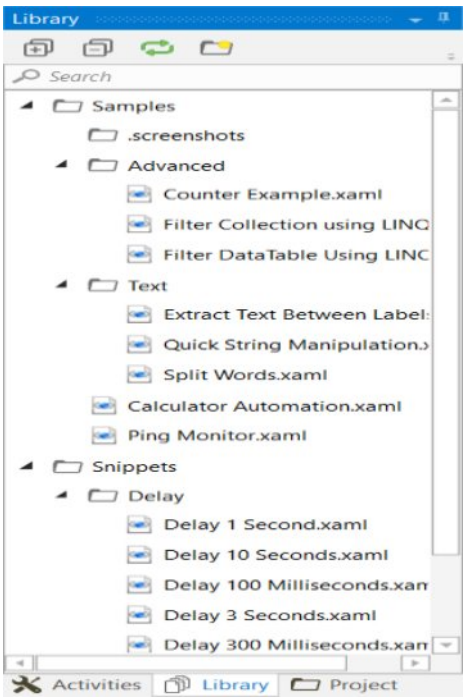


The **Activities** panel provides quick access to all available activities that can be dragged to the current workflow.

It features a search box, and the **Show Activities** list enables you to hide or show the **Favorites**, **Recent** and **Available** folders of activities.

The **Manage Packages** functionality enables you to install additional activity packages.

The Library Panel



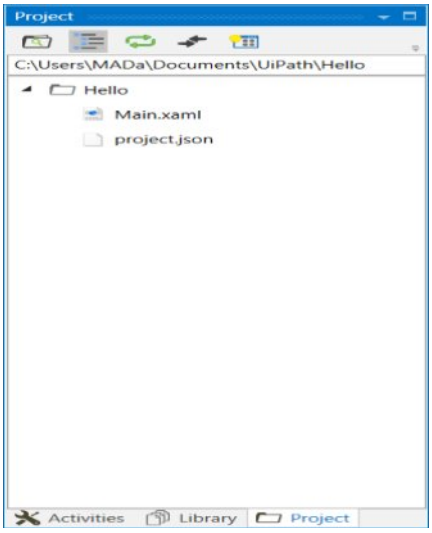
The **Library** panel enables you to easily reuse workflows. A search box is included to facilitate finding items faster.

It includes, by default, multiple samples and snippets, and you can add your own by clicking the **Add Folder** button and selecting a directory from your hard drive.

To remove a folder, right-click it and select **Remove**.

Note: If you add empty folders they are not going to be displayed.

The Project Panel

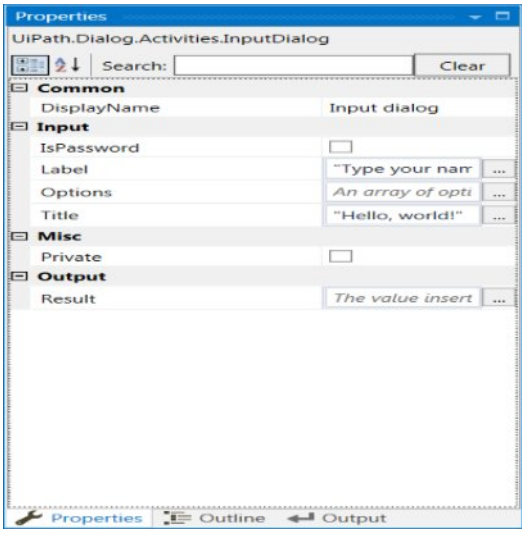


The **Project** panel enables you to view the contents of the current project and open the file location in a **Windows Explorer** window.

You can connect to a team project from the Team Foundation Server (TFS) and create a new project directly from this panel.

Version control is available through the context menu, and it is also possible to view the history of a selected file.

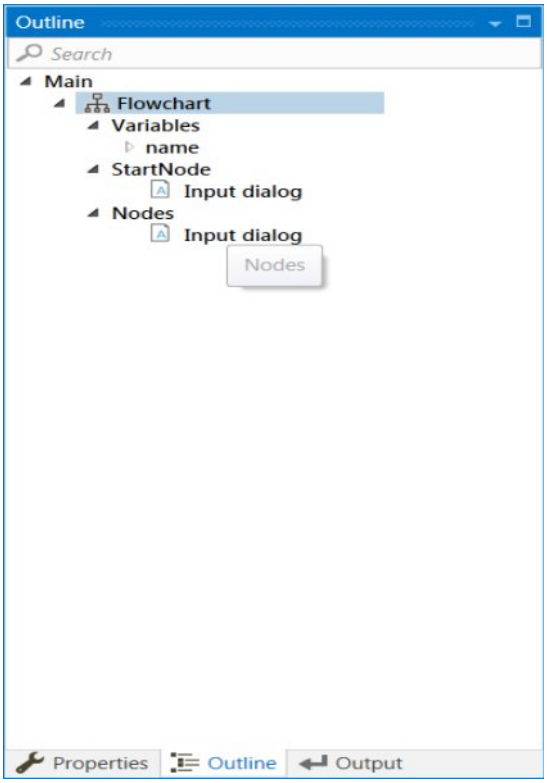
The Properties Panel



The **Properties** panel is contextual and enables you to view and change the properties of a selected activity.

The properties can be sorted alphabetically, while the search box enables you to look for a specific one.

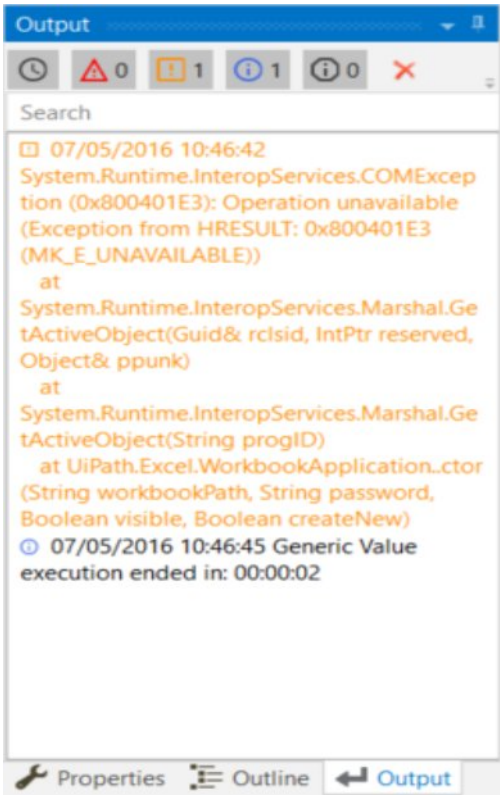
The Outline Panel



The **Outline** panel displays the workflow hierarchy, all available variables and nodes, and includes a search box. This enables you to easily navigate large workflow.

You can highlight activities in this panel by selecting them in the **Main** panel, or you can go to a specific activity by selecting it in the **Outline** panel.

The Output Panel



The **Output** panel enables you to display the output of the **Log Message** or **Write Line**activities, as well as the logs when the debug mode is activated.

The logs are more or less detailed, depending on the option you selected in the **Execute**tab, under **Options > Logging Level.**

You can hide or show timestamps, errors, warnings, information or trace data, by clicking the buttons in the panel's header. Additionally, the **Clear All** button erases all info displayed in the **Output** panel.

Double-clicking a message displays further details about it.

Connecting your Project to a Source Control

The **Project** panel enables you to, among others, connect to a type of Source Control, such as **TFS** or **SVN**. When you are connected to one of them, the **Connect Project to a Source Control** button changes to **TFS** or **SVN** .

Additionally, hovering over the **TFS** and/or **SVN** button displays the URL of the repository.

Note: You cannot connect to both TFS and SVN, in the same time.

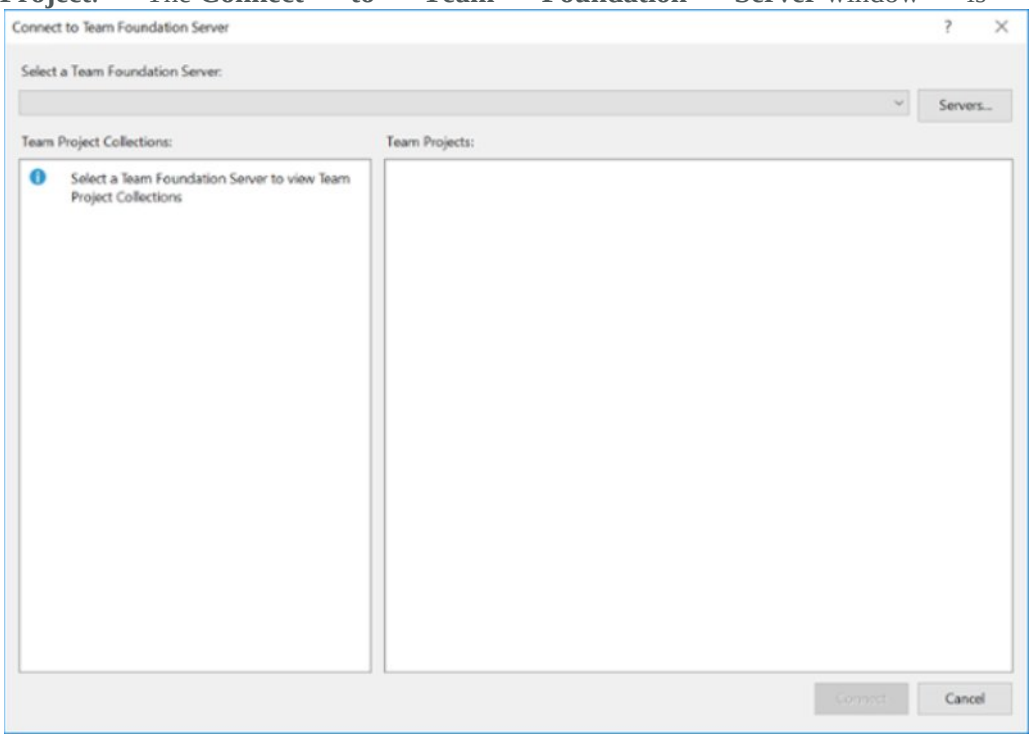
The supported versions of Team Foundation Server are:

- 2012
- 2013
- 2015
- Express 2012
- Express 2013
- Express 2015

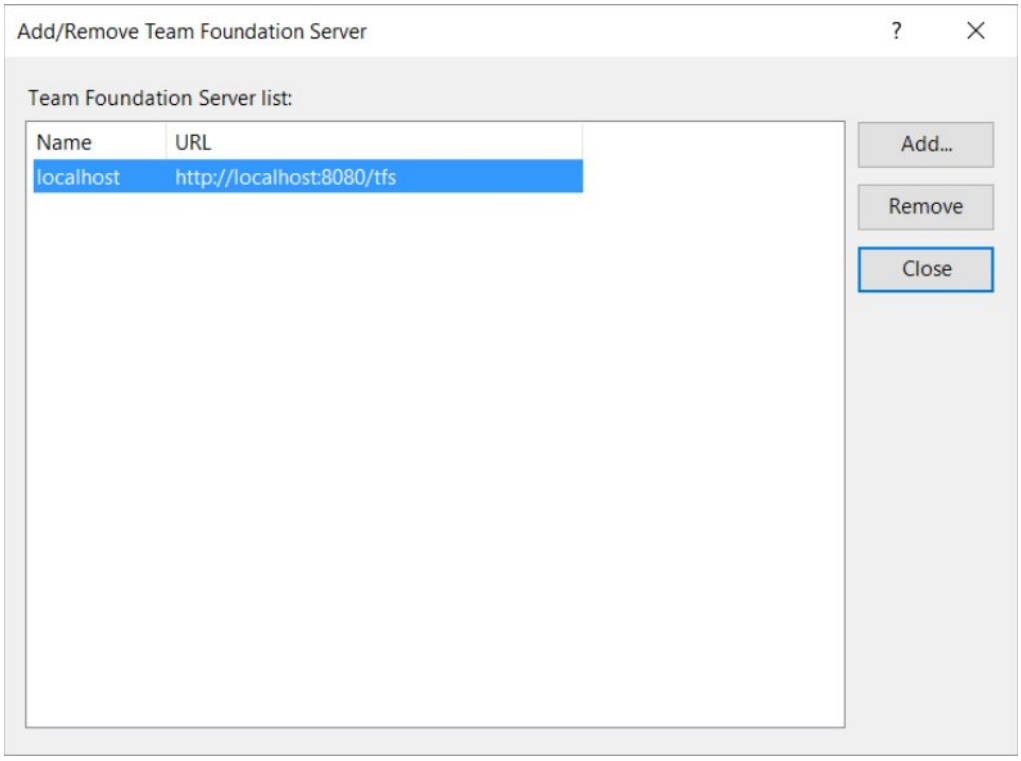
Note: Due to Microsoft limitations, the 2015 and none of the Express TFS versions do not permit you to create new projects.

Connecting to TFS

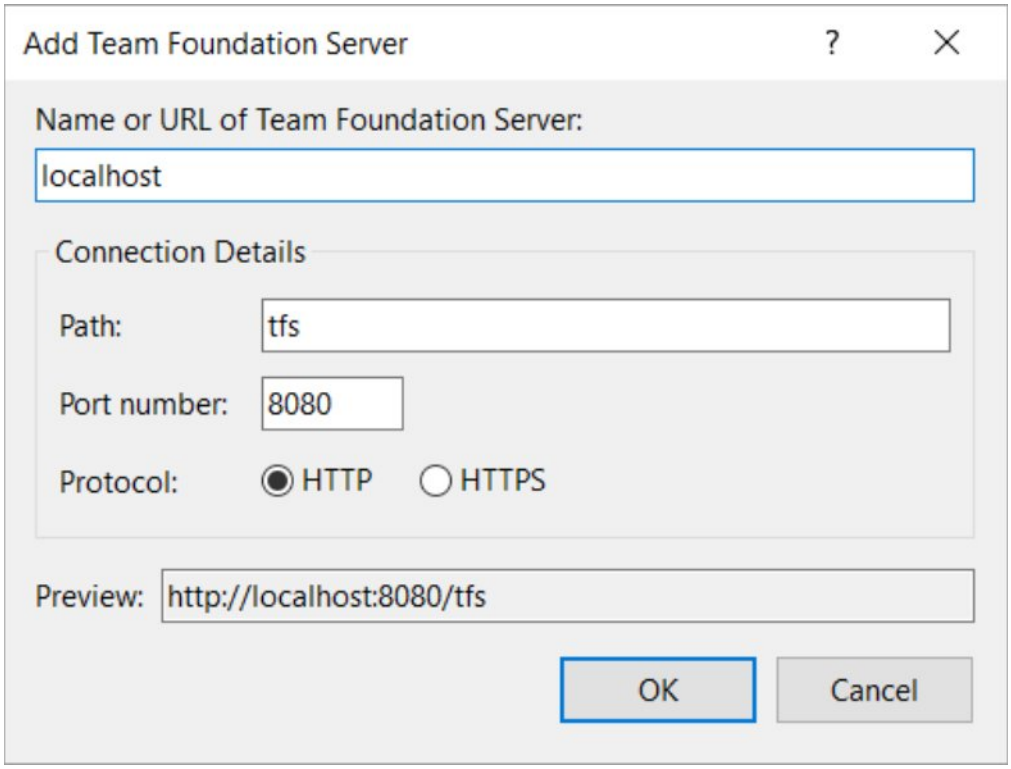
1. On the **Project** panel, click **Connect Project to a Source Control** > **TFS** > **Connect to Team Project**. The **Connect to Team Foundation Server** window is displayed.



2. Click **Servers**. The **Add/Remove Team Foundation Server** window is displayed.



3. Click the **Add** The **Add Team Foundation Server** window is displayed.

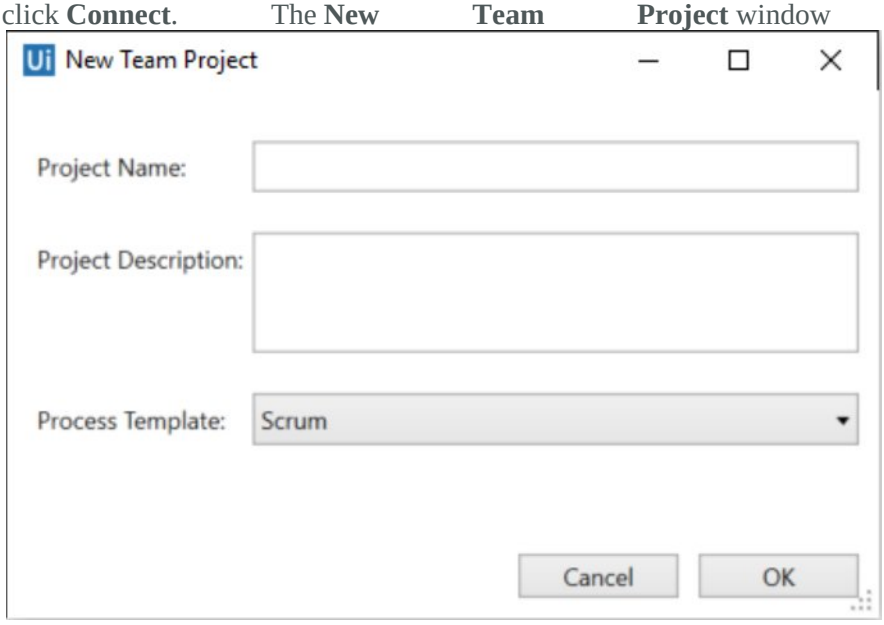


4. Fill in the details of your TFS and click **OK**. In the **Connect to Team Foundation Server**window, your team's collections and projects are available and the **Connect Project to a Source Control** button is now changed to **TFS** TFS.

Creating a New Team Project

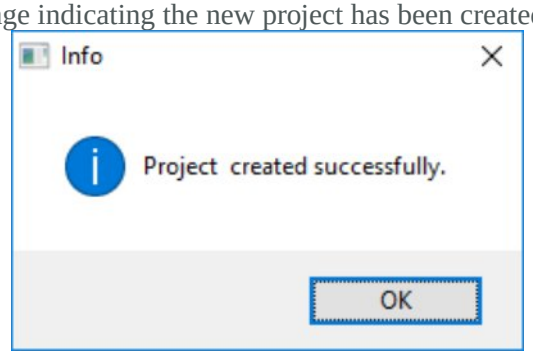
1. On the **Project** panel, click **Connect Project to a Source Control**

> **TFS** > **New Team Project** . The **Select a Team Project Collection** window is displayed.
2. In the **Select a Team Project Collection** window, select your server, one of your collections and click **Connect**. The **New Team Project** window is displayed.



Note: Due to Microsoft limitations, the 2015 and none of the Express TFS versions do not permit you to create new projects.

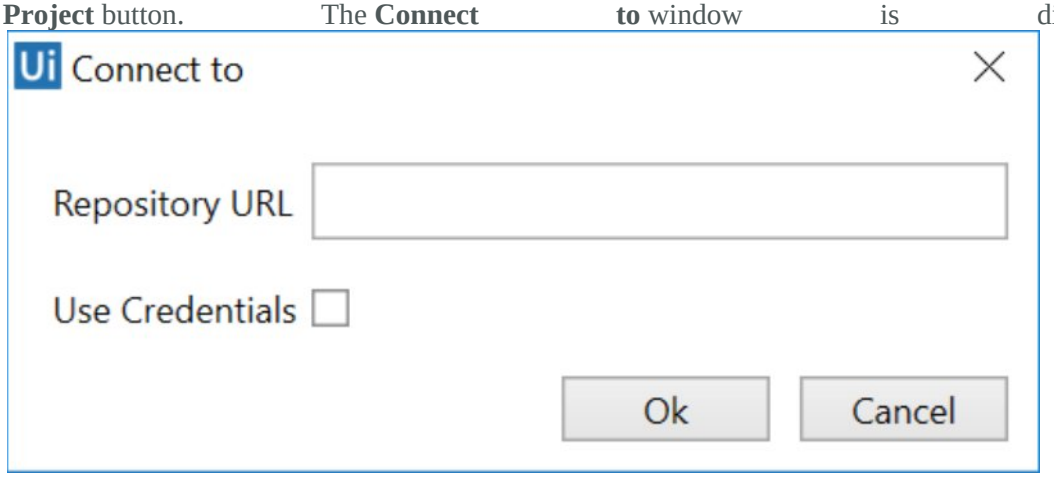
3. Fill in the **Project Name** and **Project Description** fields, select a **Process Template** and click **OK.** A confirmation message indicating the new project has been created is displayed.



4. Click **OK**. The new project that has been created is displayed in the **Projects** panel, and you are automatically connected to the project.

Connecting to SVN

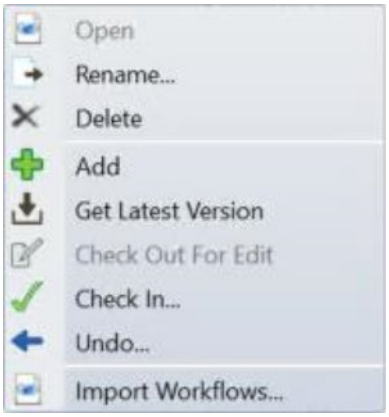
1. On the **Project** panel, select **Connect Project to a Source Control** > **SVN** > **Connect to Project** button. The **Connect to** window is displayed.



2. Insert the **Repository URL** of your SVN server into the text field. Selecting the **Use Credentials** box will enable you to insert your account User and Password. Click Your project is now connected to SVN.
3. Enter the **Repository URL** of your SVN server and select the **Use Credentials** check box. The **User** and **Password** fields are displayed.

Fill in the user and password information, and click **OK**. You are now connected to SVN and the **Connect Project to a Source Control** button is now changed to **SVN.**

Context Menu Options



Once your project is connected to either TFS or SVN, right-clicking any file or folder in the **Project** panel opens a context menu that contains the following options:

Option	Description
Open	Opens the selected .xaml file in the **Main** panel.
Rename	Enables you to rename the selected file or folder, and opens the **Rename Item** window.
Delete	Deletes the selected item.

Add	Uploads the selected item to the TFS/SVN server. This option is not available, if the item was previously uploaded to the server.
Get Latest Version	Downloads the latest version of the selected item from the TFS/SVN server.
Check Out for Edit	Marks the selected file or folder as locked for editing.
Check In	Displays the **Check In Changes** window and enables you to upload the selected item to the server as the newest version.
Undo	Displays the **Undo Pending Changes** window and enables you to Revert the changes done to the project.
Import Workflows	Imports .xaml files to the project. This option is only available when selecting a directory.

Enabling Tracing

By default, UiPath generates log files that track the activity of Studio and the Robots. These logs can be accessed from the **Execute** ribbon tab, by clicking the **Open Logs**button.

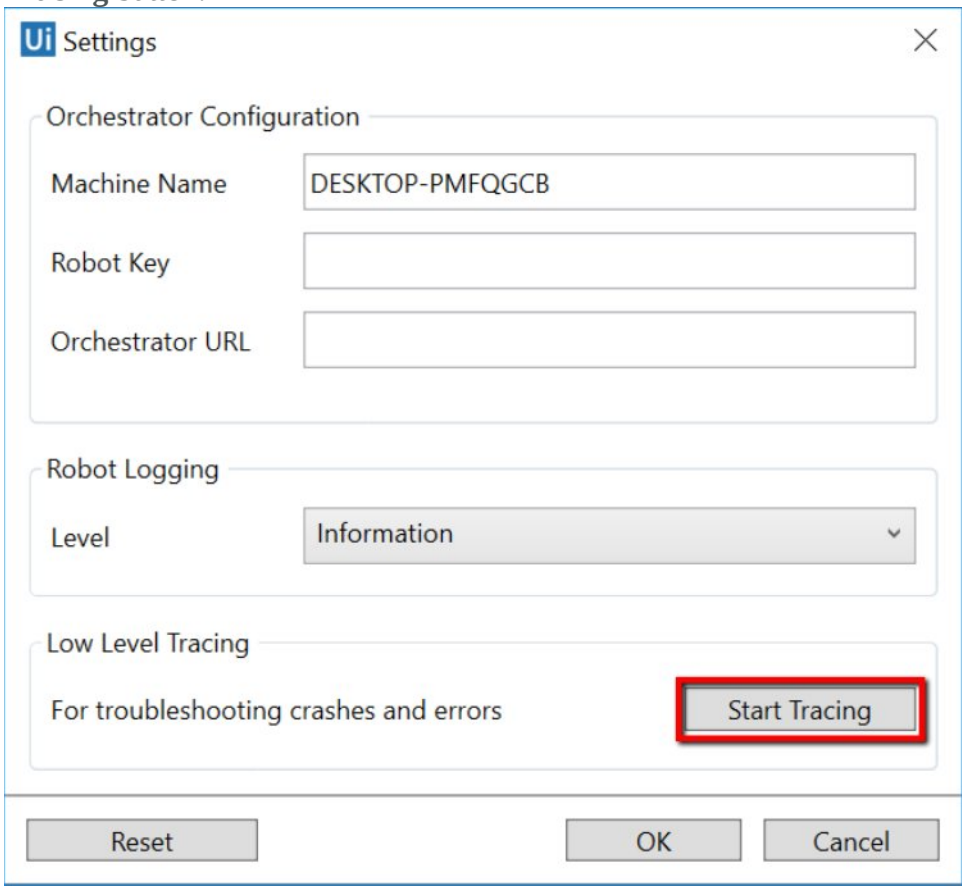
For complex issues, more details about your automation are needed. To gather them, tracing must be enabled.

In UiPath Studio, tracing generates an .etl file. It contains binary log data at the trace level, such as disk accesses or page faults, and is used to log high-frequency events while tracking the performance of an operating system. To enable tracing, do the following:

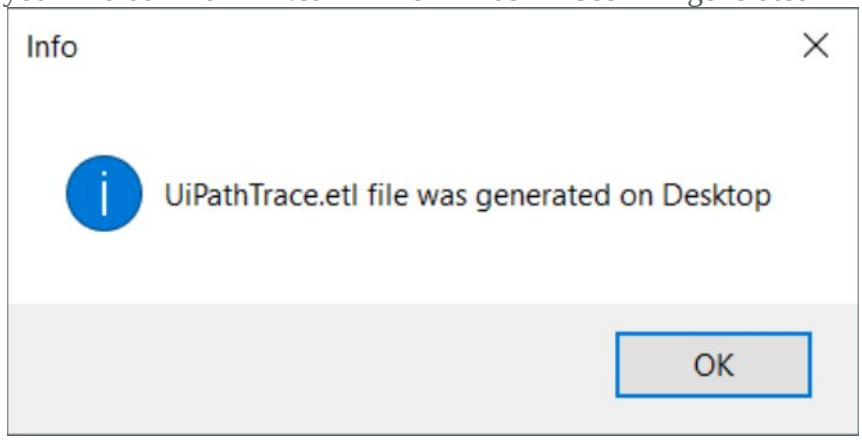
1. In the system tray, click the **UiPath Robot** button. The **UiPath Robot** window is opened.

2. Click **Advanced** > **Settings**. The **Settings** window is displayed.

3. Click the **Start Tracing** button.



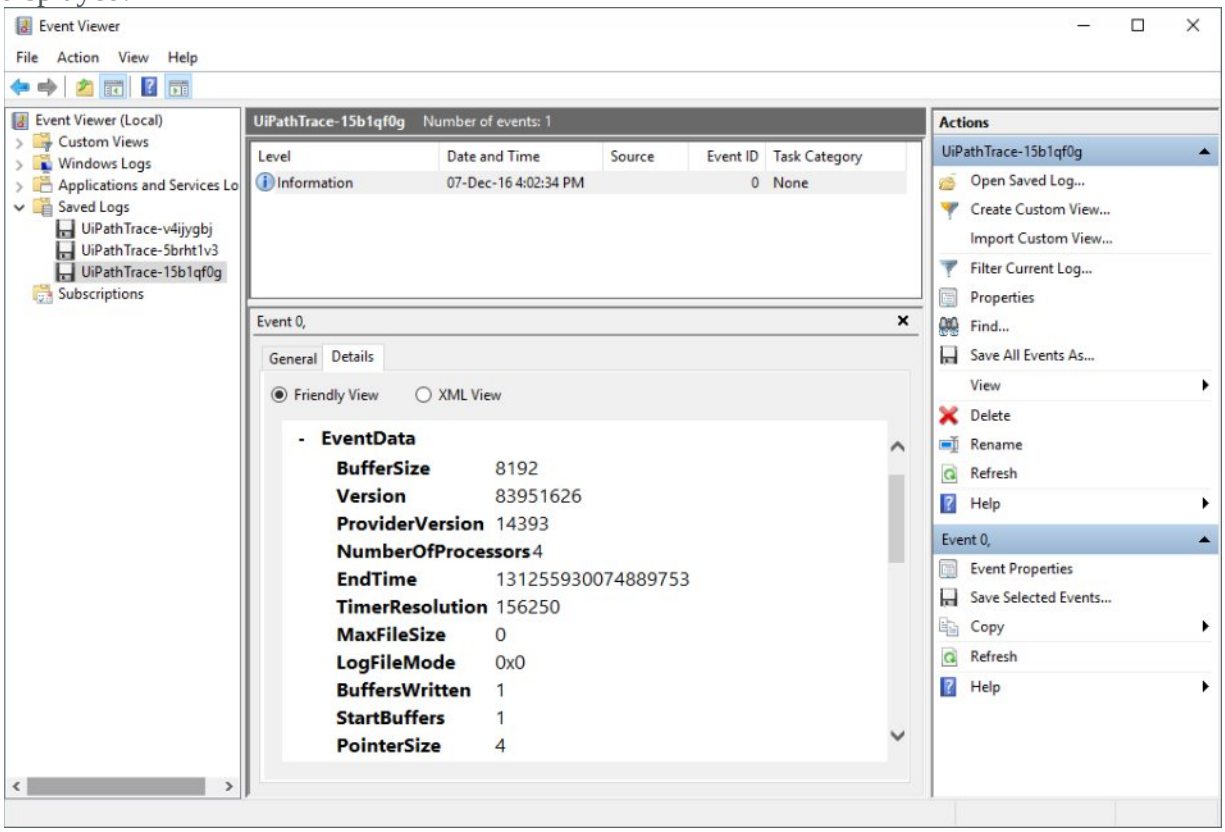
4. Run the workflow that you want to trace.
5. In the **Settings** page, click the **Stop Tracing** button. A dialog box is displayed, informing you that an .etl file has been generated on the Desktop.



This type of file can be opened from the Event Viewer:

1. In Event Viewer, in the **Actions** panel, click **Open Saved Log**. The **Open Saved Log**window is displayed.
2. Browse for the trace log file generated and click Open. The file is displayed in the left panel, under **Saved Logs**.

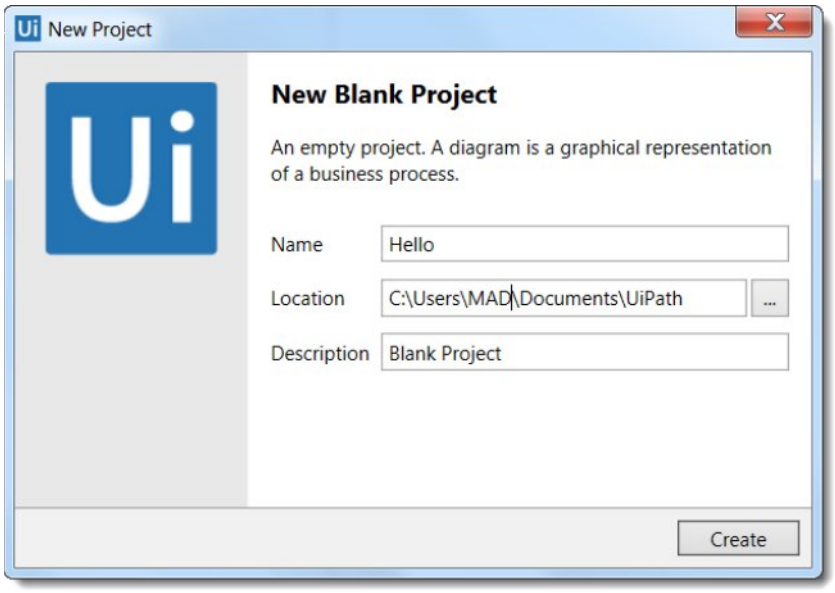
3. Select the file. Note that the contents of the logs are displayed.



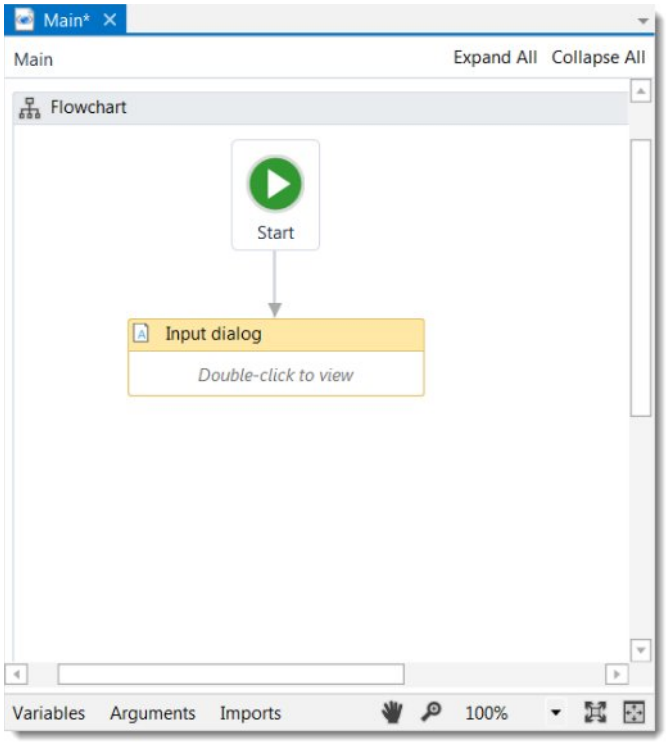
Creating a Basic Workflow

To create a basic workflow that asks for a user's name and then displays it on the screen, do the following:

1. On the **Start** tab, under the **New section**, click **Blank**. The **New Project** window is displayed.



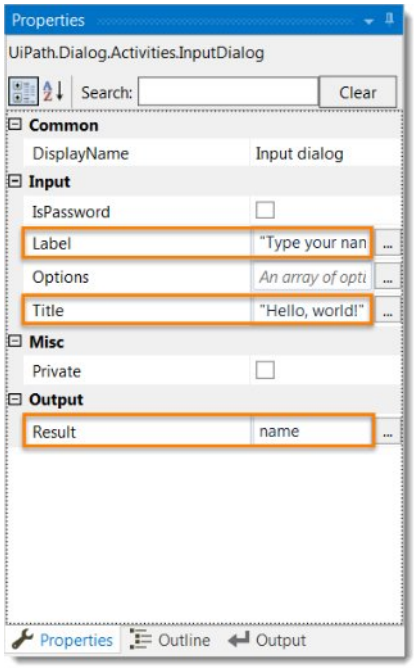
2. In the **Name** field, type the name of your project, such as Hello, and click **Create**. A new project is saved with the chosen name on the hard drive.
3. From the **Activities** panel, drag a **Flowchart** activity to the **Main** panel
4. Add an **Input Dialog** activity.
5. Right-click the activity and click **Set as Start Node**. The activity is connected to the **Start** node.



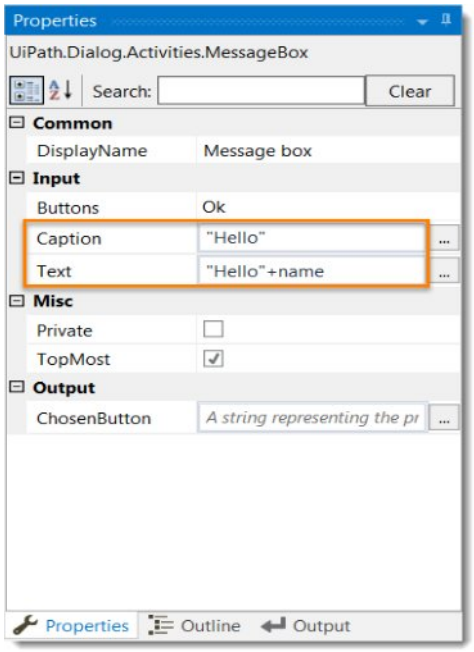
6. On the **Design** tab, select **Create Variable** > **Text** to create a string variable in which to store the user's name, called `name`, for example.
7. On the **Properties** panel, under the **Input** section, add a **Label** for the activity, such as "Type your name," and a **Title**, such as "Hello, world!.".

   Note: In UiPath, all strings have to be placed between quotation marks.

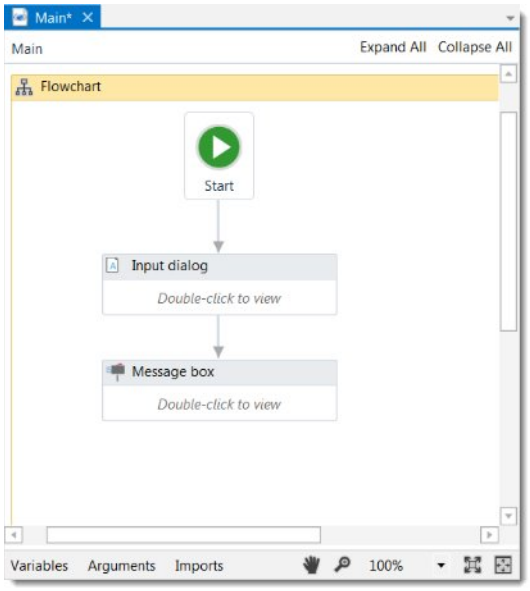
8. Under the **Output** section, in the **Result** field, add the variable created at step 5.



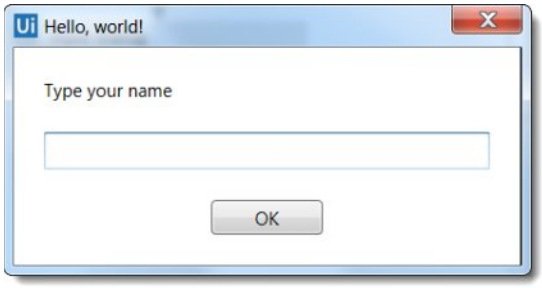
9. Add a **Message Box** activity to the **Main** panel and connect it to the existing **Input Dialog** activity.
10. Make sure that the **Message Box** activity is selected. The **Properties** panel is updated accordingly.
11. Under the **Input** section, add a **Caption** such as "Hello," and in the **Text** field add a string and the previously created variable, such as `"Hello"+name`.



12. The workflow should look as in the screenshot below.



13. Click **Run** on the **Design** tab or press F5. The workflow is executed. The **Hello World**window is displayed, prompting you to input your name.



14. Type your name in the field and press **OK**. The **Hello** window with the name previously added is displayed.

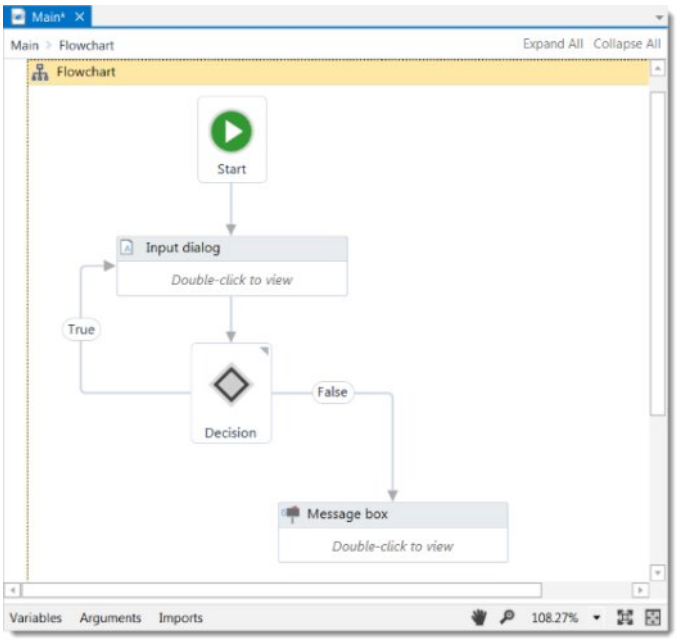
However, this workflow has a small flaw because, when prompted to add your name, you can leave the field blank. This also causes the **Hello** window to be empty.

To fix this problem and other similar ones, it is good practice to validate fields. You can do this with the **Flow Decision** or **If** activities that enable you to verify if a certain condition was met.

To solve the issue in the example workflow above, do the following:

1. Select the arrow between the **Input Dialog** and the **Message Box** activities and press Delete. The arrow is deleted.
2. Add a **Flow Decision** activity between the **Input Dialog** and the **Message Box**activities.
3. Select the **Flow Decision** activity and, in the **Properties** panel, add a **Condition** to check if the variable name is empty, such as `name = ""`.
4. Connect the **Input Dialog** activity to the **Flow Decision**. This means that after the user is prompted to add his or her name, the condition added at step 3 is going to be checked.
5. Connect the **True** branch of the **Flow Decision** activity to the **Input Dialog**. This means that if the name field is empty, the user is going to be prompted to type his name in the **Hello World** window until the field is filled in. You just created your first loop.
6. Connect the **Message Box** activity to the **False** branch of the **Flow Decision**. This means that if the name field is not empty, the **Hello window** can be displayed with the string added by the user.

The final workflow should look as in the following screenshot.



Introduction to Debugging a Workflow

Debugging is the process of identifying and removing errors from a given workflow. Coupled with logging and breakpoints, it becomes a powerful functionality that offers you information about your project and step-by-step highlighting, so that you can be sure it is error-free.

Logging enables you to display details about what is happening in your workflow in the **Output** panel. This in turn makes it easier for you to debug a workflow.

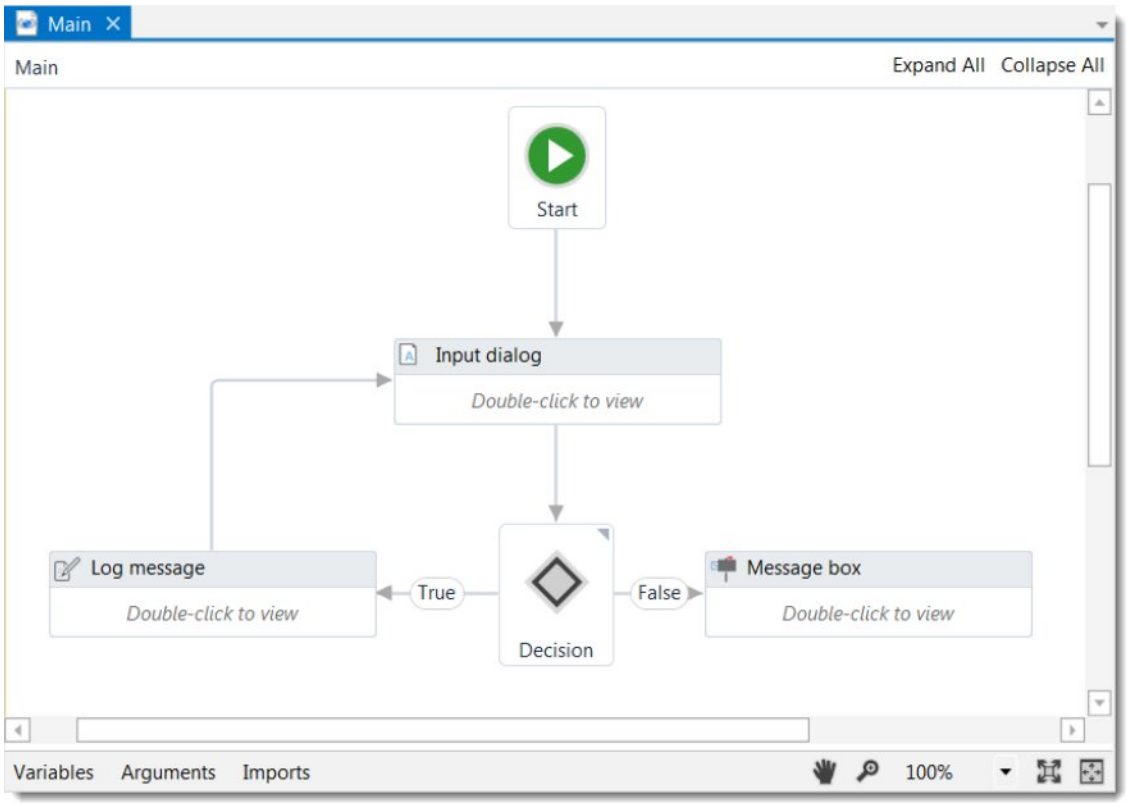
Breakpoints enable you to pause the execution of a workflow so that you can check its state at a given point.

Example of Debugging a Workflow

To debug the workflow designed in Creating a Basic Workflow, do the following:

1. Select the **True** branch between the **Input Dialog** and **Flow Decision** activities, and press Delete. The **True** branch has been deleted.

2. Add a **Log Message** activity next to the **Flow Decision**.
3. Connect the **Log Message** activity to the **True** branch of the **Flow Decision** and to the **Input Dialog** activity. The workflow should look as in the following screenshot.

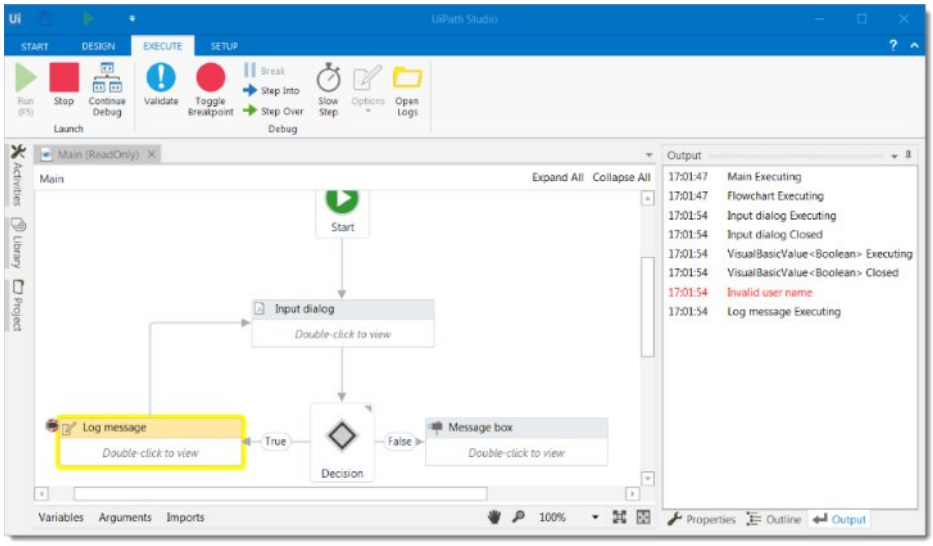


4. Select the **Log Message**. The **Properties** panel is updated accordingly.
5. From the **Level** list, select **Error**, and in the **Message** field type what error message to be returned, such as "Invalid user name." When you execute the workflow, the error message is displayed in the **Output** panel every time the user does not fill in the **Hello World window.**
6. Press F5 to execute the workflow and do not fill in the **Hello World** window the first time when you are prompted. The **Output** panel has logged the error message you added at step 5.

7. On the **Execute** tab, in the **Debug** group, from the **Options** menu, select **Logging Level** > **Verbose**. This means that the logs that are going to be displayed in the **Output** panel are going to be explicit.

8. Select the **Log Message** activity and, on the **Execute** tab, in the **Debug** group, click **Toggle Breakpoint**. Note that a small that a red dot with white stripes is displayed next to it. This signals that this activity has a breakpoint applied.

9. On the **Execute** tab, in the **Launch** group, click **Start Debug**. The debugging process starts and the **Hello World** window is displayed.
10. Do not fill in the field and click **OK**. The breakpoint has been triggered and, as a result, the workflow stopped. Note that, in the **Output** panel, the error and all steps covered until now have been logged, and the **Log Message** activity is highlighted.



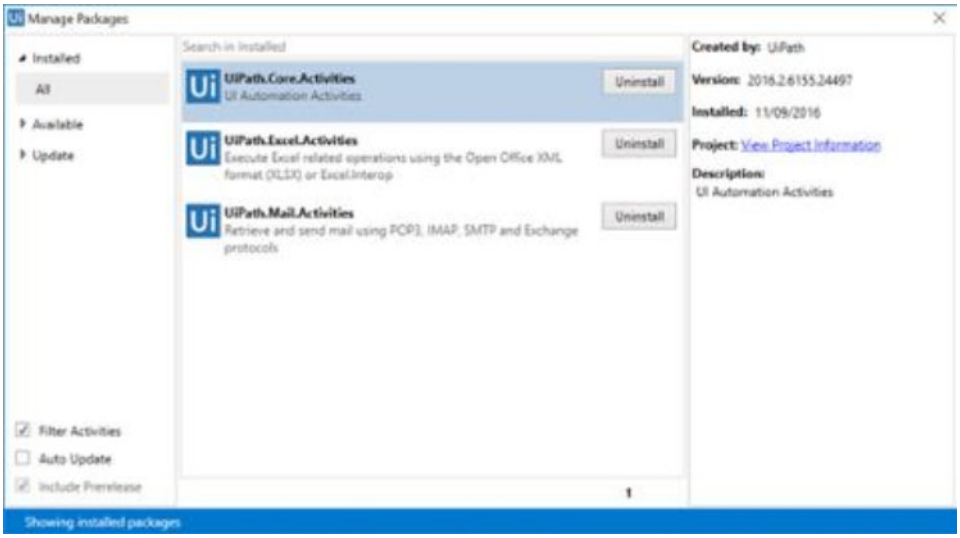
11. On the **Execute** tab, in the **Launch** group, click **Stop**. An information dialog box is displayed, letting you know that the debugging process has been canceled.

Note: After a breakpoint has been triggered you can stop, go to the next step of the workflow or continue the debugging process by clicking **Stop**, **Step Over**, **Step Into** or **Continue Debug** on the **Execute** tab.

Managing Packages

The package manager functionality enables you to download activity packages, libraries, frameworks, wrappers and others, view the ones already installed on your computer and update them, as well as add and remove your own.

These features are available through the **Manage Packages** window that you can open by clicking the **Manage Packages** button on the **Activities** panel.



An activity package is a bundle of activities that can help you automate a certain application (`UiPath.Excel.Activities`, `UiPath.Word.Activities`) or a category of apps (`UiPath.Mail.Activities`, `UiPath.Terminal.Activities`), or use certain technologies in your workflows (`UiPath.OCR.Activities`, `UiPath.FTP.Activities`). Details about packages and libraries are displayed in the right panel of the **Manage Packages** window, as you can see in the screenshot above.

The **Filter Activities** check box enables you to view only activity packages.

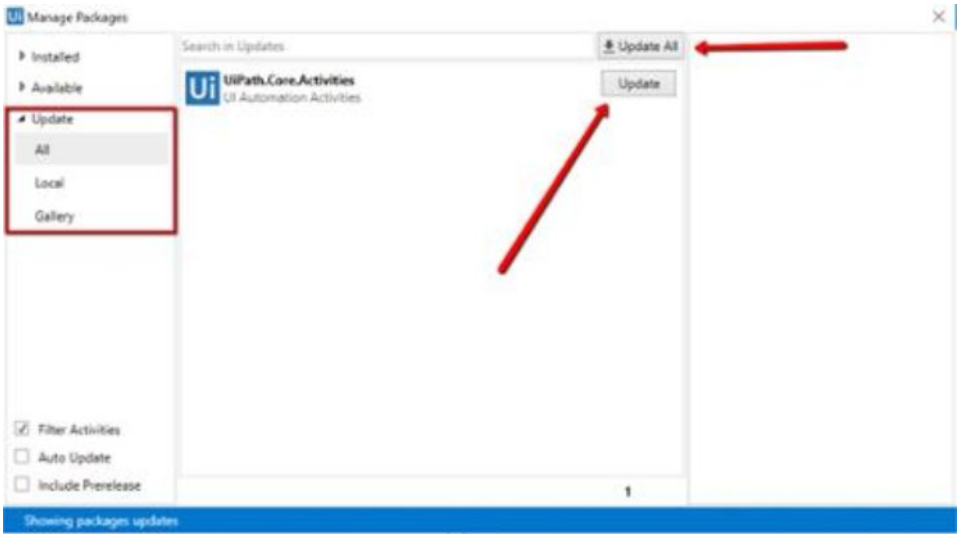
Updating Packages

The **Manage Packages** button on the **Activities** panel displays an orange border when there are packages that need to be updated, as in the following screenshot.

All your activities can be automatically updated when a new version is available, by selecting the **Auto Update** check box, in the **Manage Packages** window.

If you want to manually update activities packages:

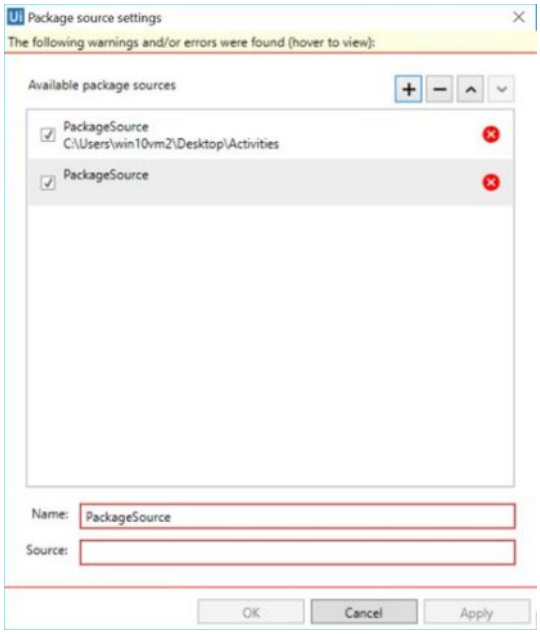
1. On the left side of the **Manage Packages** window, click the **Updates** category. The **Manage Packages** window displays all activities packages to be updated.
2. Click the **Update** button next to the package that interests you. The updated package is no longer displayed in this view.
3. Optionally, update all the packages at once by clicking the Update All button.



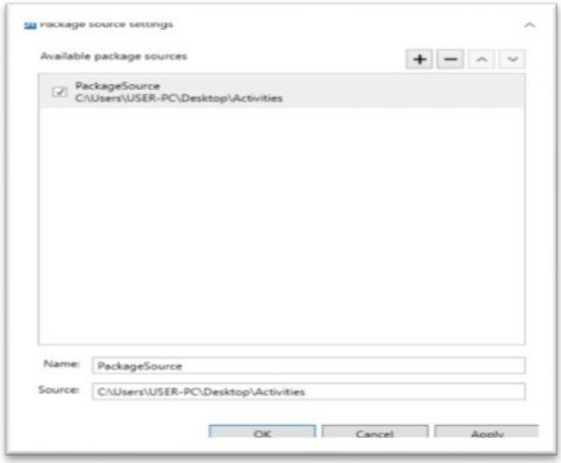
Adding Your Own Packages

1. In the **Manage Packages** window, in the left panel, right-click any category.

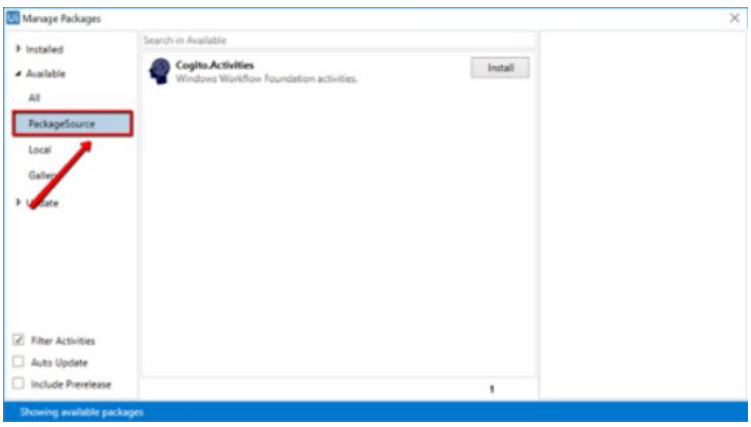
2. Select **Configure Sources** from the context menu. The **Package Source Settings**window is displayed.
3. Click the **Add** + button. A new blank package is added and an error message is displayed because the **Name** and **Source** fields are not filled in correctly.



4. In the **Name** field, type the name of the package.

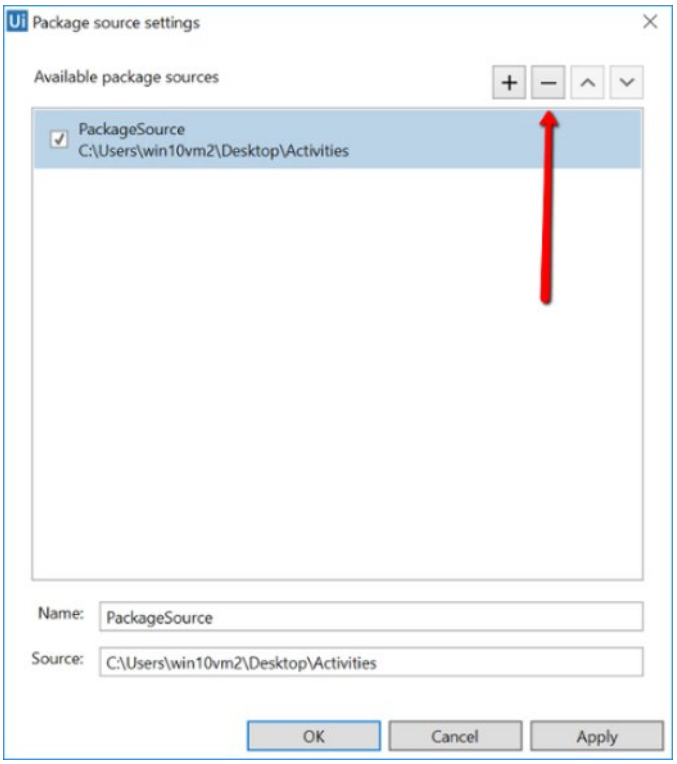


5. In the **Source** field, type the local drive folder pathway, the shared network folder pathway or the NuGet feed URL of the package.
6. Click **Apply**. Your configuration is saved.
7. Click **OK**. The **Package Source Settings** window closes. Note that the **Name** is displayed in the **Manage Packages** window, as a new category.



Removing Your Packages

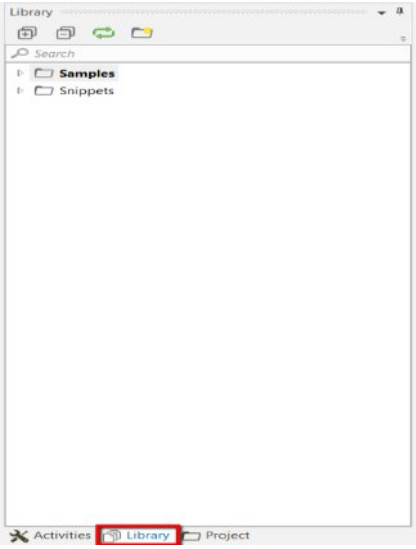
1. In the **Manage Packages** window, in the left panel, right-click any category.
2. Select **Configure Sources** from the context menu. The **Package Source Settings** window is displayed.
3. In the **Package Source Settings** window, select the package you wish to remove by clicking on it and press the **Remove** − button.



4. Click **Apply**. Your configuration is saved.
5. Click **OK**. The **Package Source Settings** window closes. The package is removed from the **Manage Packages** window.

Reusing automations - Library

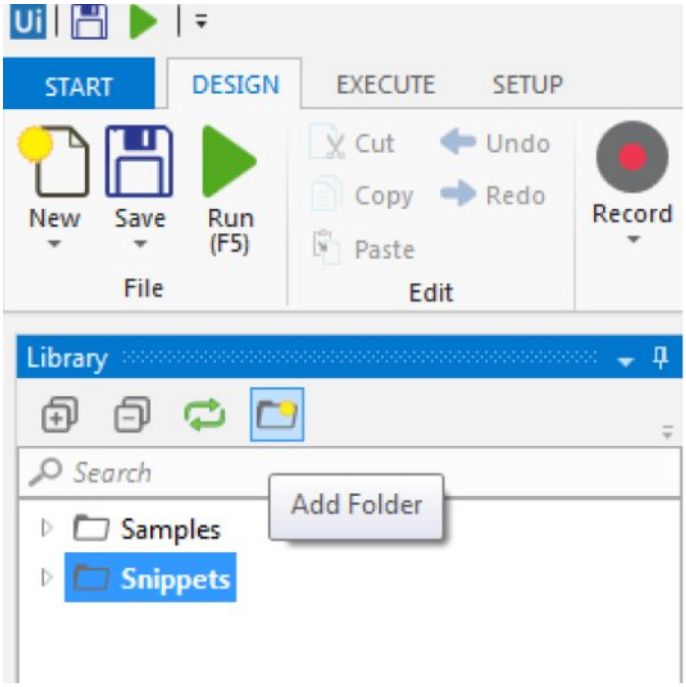
When creating workflows we often need to automate the same processes. In these situations it is easier to create workflows that contain small pieces of common automation that are reusable and applicable in multiple workflows, and add them to Library.



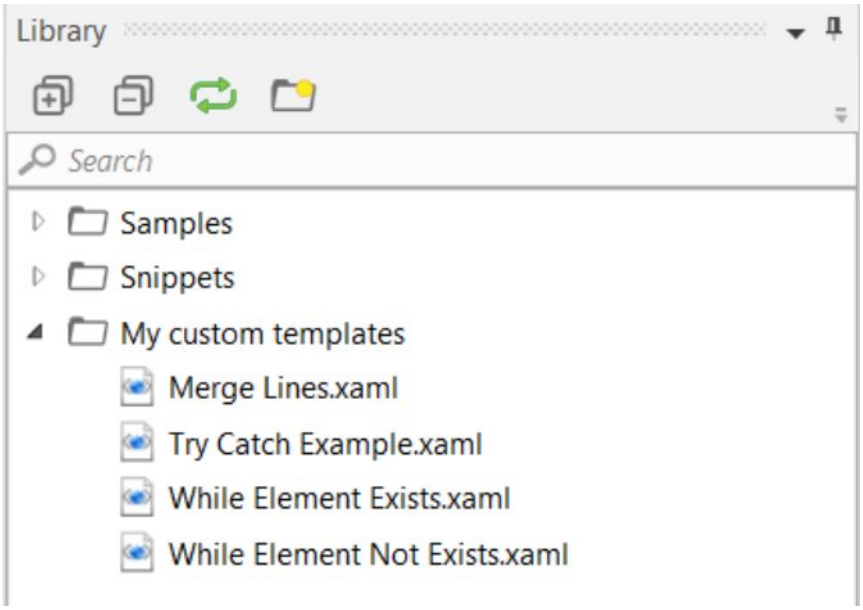
Library pane shows a list of folders containing workflows. Any workflow from Library can be added to a workflow by dragging and dropping it into the designer workspace, just like any activity.
In Samples and Snippets some of our templates from UiPath Studio 7 can be found.

How to add a folder to the show in Library pane:

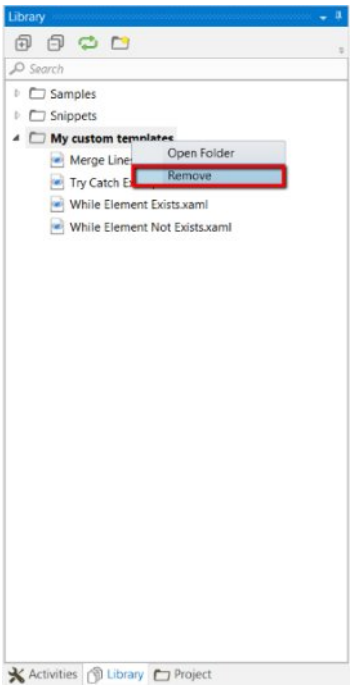
- In Library Pane click on the Add Folder button



- In the folder dialog browser that appears, select the folder that contains the workflows to be added to Library and click on Select Folder button.
- The added folder and all the workflows it contains should appear now in the Library pane

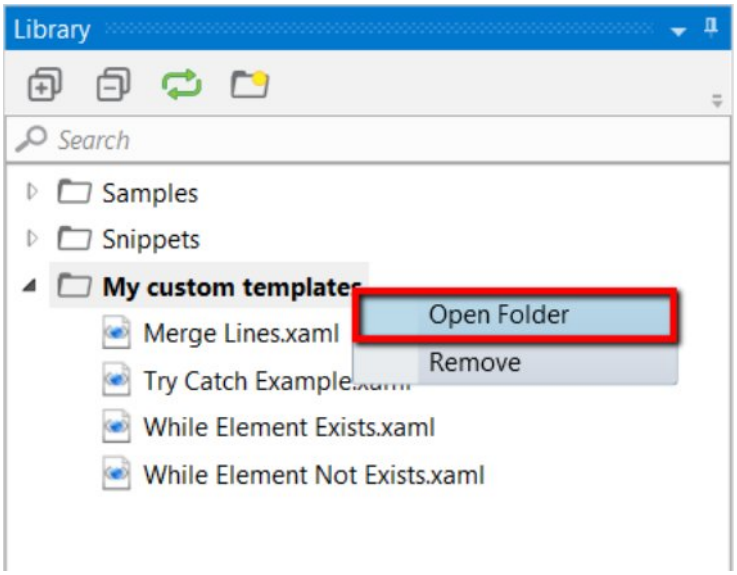


If a folder is empty or it doesn't have any workflows, it will not appear in Library pane. To remove a folder from Library, simply right click the folder and select Remove from the menu.

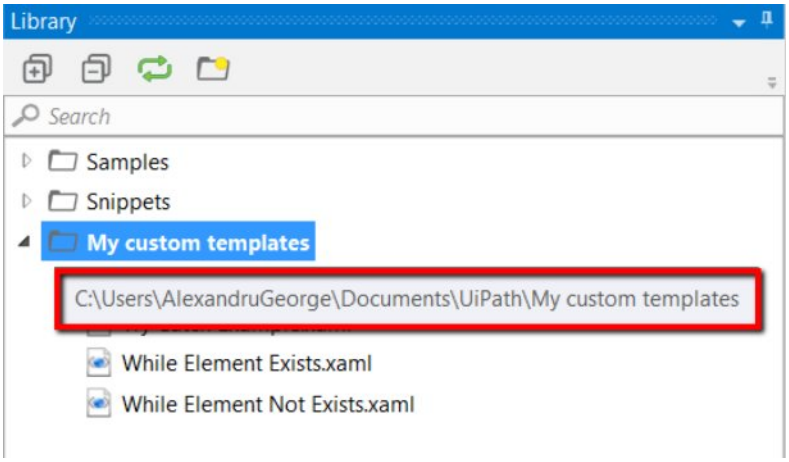


To add a new workflow to Library you can either add the folder that it is in to Library using the steps presented above, or copy it in a folder that is already added to Library. Once you`ve done that, you need to press the Refresh button and you`re workflow will appear there.

To open a specific folder to view it`s content, right click and and select Open Folder.



Also, if you hover the mouse pointer over the folder, you can see it`s full path.



Types of Workflow

Sequences

Sequences are the smallest type of workflow. They are suitable to linear processes as they enable you to go from one activity to another seamlessly, and act as a single block activity.

One of the key features of sequences is that they can be reused time and again, as a standalone workflow or as part of a state machine or flowchart.

For example, you can create a sequence to take information from a .pdf file and add it to a spreadsheet, and reuse it in a different setting, while changing just a few properties.

Note: Sequences do not use connectors.

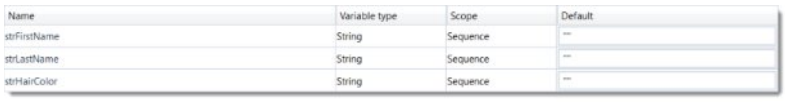
Example of a Sequence

To create a sequence that asks the user for his first and last name, and his hair color, and then displays his answers, do the following:

1. Create a blank workflow and, on the **Design** tab, in the **File** group, select **New** > **Sequence**. The **New Diagram** window is displayed.

   Note: You can also add a **Sequence** activity to the **Main** panel to create a new sequence.

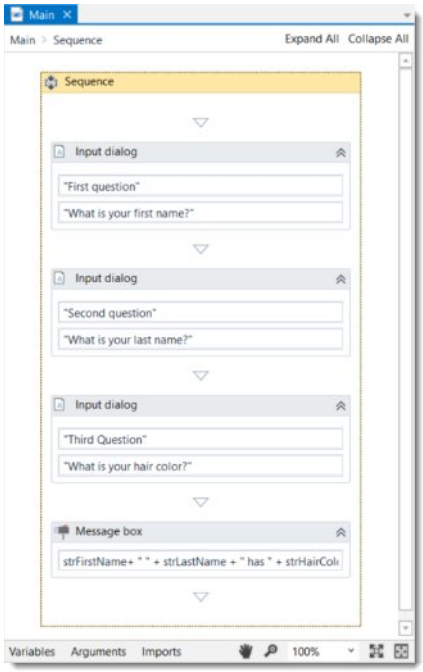
2. In the **Name** field type a name for the workflow, such as "First Sequence," and click **Create**. The **Main** panel is updated accordingly.
3. Create three **String** variables such as `strFirstName`, `strLastName`, and `strHairColor`, so that you can store data from the user in them. Leave the **Default**field empty, to indicate that there is no default value.



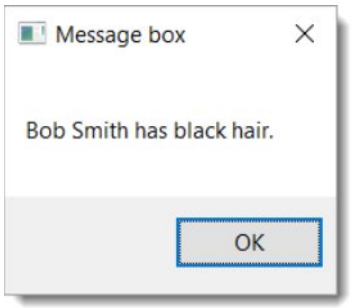
4. Drag three **Input Dialog** activities to the **Main** panel, one under the other.
5. Select the first **Input Dialog** and, in the **Properties** panel, add a **Label** asking for the first name of the user, and a custom **Title**.
6. In the **Result** field, add the `strFirstName` variable. This indicates that this variable is going to be updated with the value added by the user at this point.
7. Repeat steps 6 - 7 for the second and third **Input Dialog** activities to ask the user for his last name and hair color, and store them in the `strLastName` and `strHairColor` variables.
8. Add a **Message Box** activity under the third **Input Dialog** window.
9. Select the **Message Box** and, in the **Properties** panel, in the **Text** field, add the variables and a string to enable you to display all information gathered from the user, such as: `strFirstName + " " + strLastName + " has " + strHairColor + " hair."`.

   Note: Remember to add spaces between variables and within strings for an optimal output.

The final workflow should look as in the following screenshot.



10. On the **Design** tab, in the **File** group, click **Run**. The workflow is executed. The final output message should look as in the following screenshot.



Flowcharts

Flowcharts can be used in a variety of settings, from large jobs to small projects that you can reuse in other workflows.

The most important aspect of flowcharts is that, unlike sequences, they present multiple branching logical operators, that enable you to create complex business processes and connect activities in multiple ways.

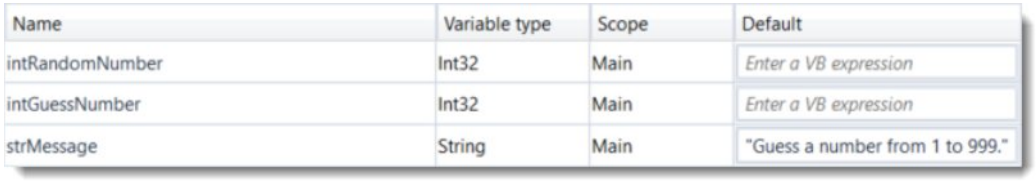
Example of a Flowchart

To exemplify the properties of a flowchart, we are going to build a guessing game that generates a random number from 1 to 999 that the user must guess. To create such a workflow, do the following:

1. Create a blank workflow and from the **Design** tab, in the **File** group, select **New** > **Flowchart**. The **New Diagram** window is displayed.

Note: You can also add a **Flowchart** activity to the **Main** panel to create a new flowchart workflow.

2. In the **Name** field type a name for the workflow, such as "First Flowchart," and click **Create**. The **Main** panel is updated accordingly.
3. Create two **Int32** variables (`intRandomNumber`, `intGuessNumber`) and a **String** one (`strMessage`).
4. Set the default value of the `strMessage` variable to "Guess a number from 1 to 999.0". The `intRandomNumber` stores a random number between 1 and 999, `intGuessNumber` stores the user's guess, and `strMessage` stores the message that is going to be displayed to prompt the user.



Name	Variable type	Scope	Default
intRandomNumber	Int32	Main	*Enter a VB expression*
intGuessNumber	Int32	Main	*Enter a VB expression*
strMessage	String	Main	"Guess a number from 1 to 999."

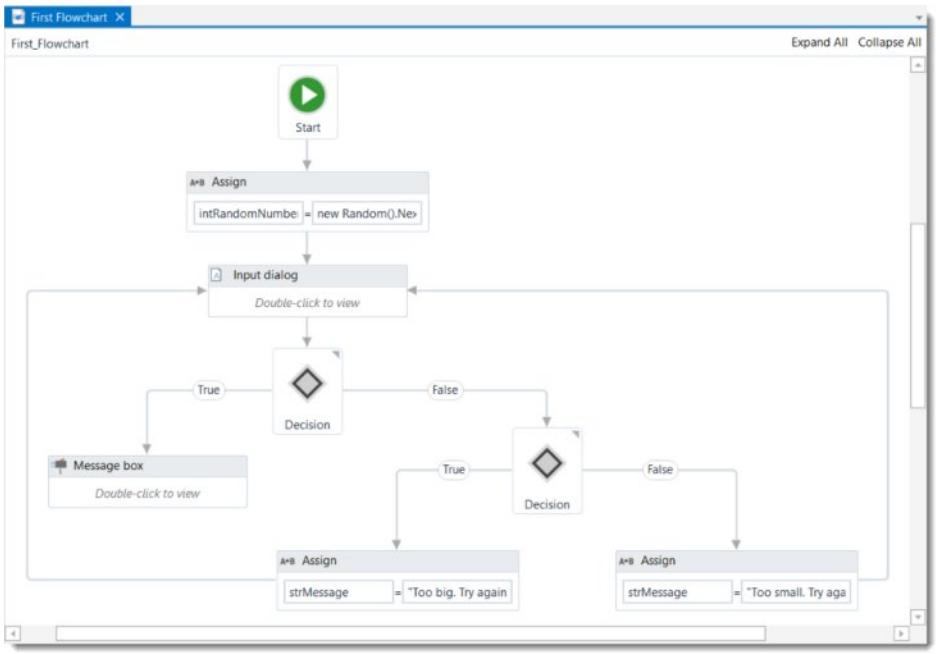
5. Add an **Assign** activity to the **Main** panel, and connect it to the **Start** node.
6. In the **Properties** panel, in the **To** field add the intRandomNumber variable.
7. In the **Value** field, type new `Random().Next(1,999)`.

Note: This field uses the `Random()` function to generate a random number between 1 and 999.

8. Add an **Input Dialog** activity to the **Main** panel and connect it to the **Assign** one.
9. In the **Properties** panel, in the **Label** field, add the `strMessage` variable.
10. In the **Result** field, add the `intGuessNumber` variable. This activity asks and stores the user's guesses in the `intGuessNumber` variable.
11. Add a **Flow Decision** activity and connect it to the **Input Dialog**. This activity enables you to tell the user if he correctly guessed the number or not.
12. In the **Properties** panel, in the **Condition** field, type `intGuessNumber = intRandomNumber`. This enables you to verify if the number added by the user is the same as the randomly-generated one.
13. Add a **Message Box** activity and connect it to the **True** branch of the **Flow Decision**.
14. In the **Properties** panel, in the **Text** field, type `"Congratulation! You guessed correctly! The number was " + intRandomNumber.ToString + "."`. This is the message that is going to be displayed if the user correctly guessed the number.
15. Add a new **Flow Decision** activity and connect it to the **False** branch of the previously added **Flow Decision**.
16. In the **Properties** panel, in the **Condition** field, type `intGuessNumber > intRandomNumber`. This activity enables you to check if the number the user added is bigger than the randomly-generated one.
17. In the **DisplayName** field, type **Comparison**. This enables you to easily to tell the difference between the two **Flow Decisions** used.
18. Add an **Assign** activity and connect it to the **True** branch of the **Comparison** activity.
19. In the **To** field, type the `strMessage` variable, and in the **Value** field, type a message indicating that the guess was too high, such as "Too big. Try again.".
20. Select the **Assign** activity and press Ctrl+C. The entire activity and its properties are copied to the Clipboard.
21. Press Ctr+V. A duplicate of the previous **Assign** activity is displayed.

22. Connect it to the **False** branch of the **Comparison** activity and, in the **Properties** panel, in the **Value** field, type “Too small. Try again.”.
23. Connect the **Assign** activities created at steps 18-22 to the **Input Dialog**. A loop is created, asking the user to type a smaller or bigger number, until he guesses correctly.

The final workflow should look as in the screenshot below.



State Machines

A state machine is a type of workflow that uses a finite number of states in its execution. It can go into a state when it is triggered by an activity, and it exits that state when another activity is triggered.

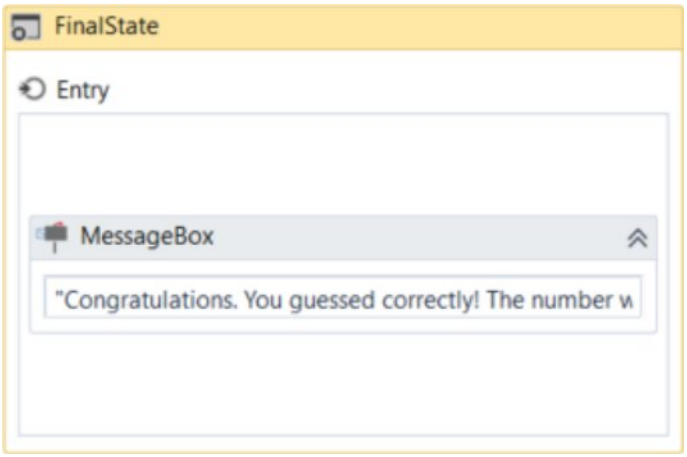
Another important aspect of state machines are transitions, as they also enable you to add conditions based on which to jump from one state to another. These are represented by arrows or branches between states.

There are two activities that are specific to state machines, namely **State** and **Final State**, and they are found under **Workflow > State Machine**.

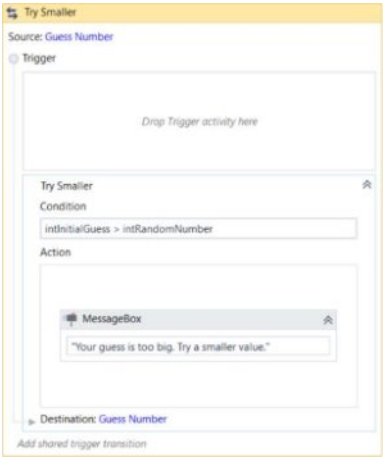
Note: You can only create one initial state, yet it is possible to have more than one **Final State**.

The **State** activity contains three sections, **Entry**, **Exit** and **Transition(s)**, while the **Final State** only contains one section, **Entry**. Both of these activities can be expanded by double-clicking them, to view more information and edit them.

The **Entry** and **Exit** sections enable you to add entry and exit triggers for the selected state, while the **Transition(s)** section displays all the transitions linked to the selected state.



Transitions are expanded when you double-click them, just like the **State** activity. They contain three sections, **Trigger**, **Condition** and **Action**, that enable you to add a trigger for the next state, or add a condition under which an activity or sequence is to be executed.



Example of How to Use a State Machine

To exemplify how to use a state machine, we are going to build the guessing game we did in the previous chapter, only we will try to guess a number between 1 and 100.

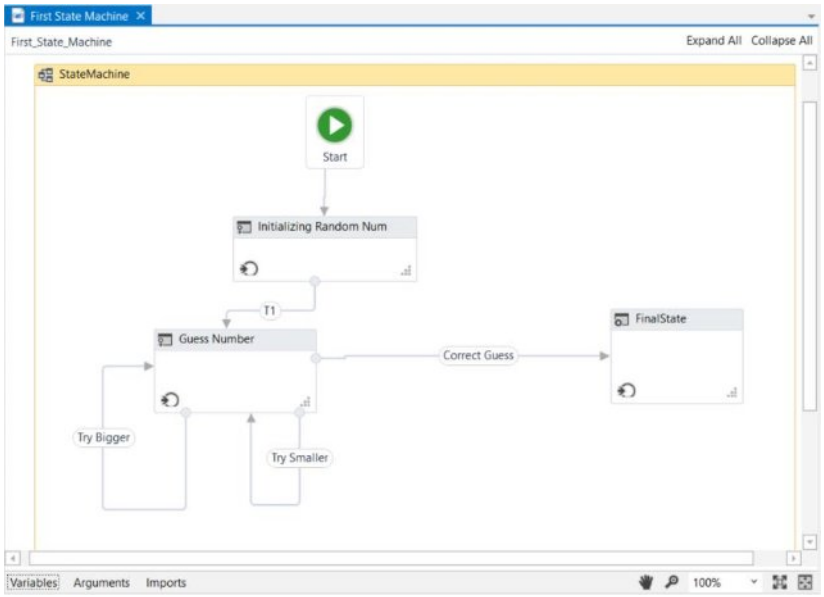
1. Create a blank workflow and, on the **Design** tab, in the **File** group, select **New** > **State Machine**. The **New Diagram** window is displayed.

   Note: You can also add a **State Machine** activity to the **Main** panel to create a new state machine workflow.

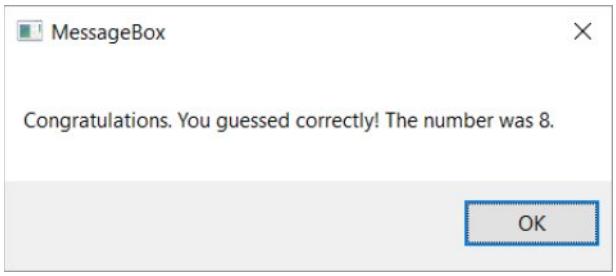
2. Create two integer variables, `intGuess` and `intRandomNumber`. The first variables stores your guess, while the second stores the random number.
3. Add a **State** activity to the **Main** panel and connect it to the **Start** node. This is the intial state, and it is used to generate the random number.
4. Double-click the activity. This **State** activity is displayed explanded in the **Main** panel.
5. In the **Properties** panel, in the **DisplayName** field, type Initializing Random Number. This enables you to easily tell states apart.
6. In the **Entry** section, add an **Assign** activity.
7. In the **To** field, add the `intRandomNumber` variable.
8. In the **Value** field, type `new Random().Next(1.100)`. This expression generates a random number.
9. Return to the main workflow view and add a new **State** activity.
10. Connect it to the previously added activity.
11. Double-click the last added **State** activity. This activity is displayed expanded in the **Main** panel.
12. In the **Properties** panel, in the **DisplayName** field, type Guess Number. This state is used to prompt the user to guess a number.
13. In the **Entry** section, add an **Input Dialog** activity.
14. Select the **Input Dialog**, and in the **Properties** panel, add an appropriate **Label** and **Title** to prompt the user to guess a number between 1 and 100.
15. In the **Result** field, add the `intGuess` variable. This variable stores the user's guess.
16. Return to the main workflow view and create a transition that points from the **Guess Number** state to itself.
17. Double-click the transition. The transition is displayed expanded in the **Main** panel.
18. In the **Properties** panel, in the **DisplayName** field, type Try Smaller. This message is displayed on the arrow, enabling you to run through your workflow easier.
19. In the **Condition** section, type `intGuess > intRandomNumber`. This verifies if the user's guess is bigger than the random number.
20. In the **Action** section, add a **Message Box** activity.
21. In the **Text** field, type something similar to "Your guess is too big. Try a smaller number." This message is displayed when the user's guess is bigger than the random number.
22. Return to the main workflow view and create a new transition that points from the **Guess Number** state to itself.
23. Double-click the transition. The transition is displayed expanded in the **Main** panel.
24. In the **Properties** panel, in the **DisplayName** field, type "Try Bigger.". This message is displayed on the arrow, enabling you to run through your workflow easier.
25. In the **Condition** section, type `intGuess < intRandomNumber`. This verifies if the guess is smaller than the random number.
26. In the **Action** section, add a **Message Box** activity.
27. In the **Text** field, type something similar to "Your guess is too small. Try a bigger number.". This message is displayed when the users guess is smaller than the random number.
28. Return to main workflow view and add a **Final State** activity to the **Main** panel.
29. Connect a transition from the **Guess Number** activity to the **Final State**.
30. In the **Properties** panel, in the **DisplayName** field, type Correct Guess.

31. In the **Condition** field, type intGuess = intRandomNumber. This is the condition on which this workflow steps to the final state and end.
32. Double-click the **Final State** activity. It is displayed expanded in the **Main** panel.
33. In the **Entry** section, add a **Message Box** activity.
34. In the **Text** field, type something similar to `"Congratulations. You guessed correctly! The number was " + intRandomNumber.ToString + "."`. This is the final message that is to be displayed, when the user correctly guesses the number.

    The final workflow should look as in the following screenshot.



35. Press F5. The workflow is executed correctly.



Variables

Managing Variables

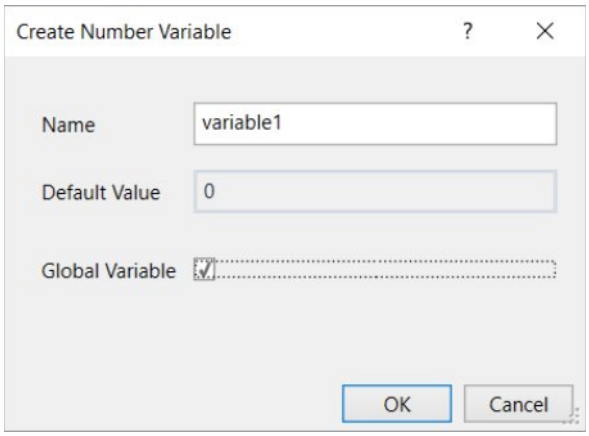
In UiPath Studio, variables are used to store multiples type of data. Another key aspect of variables is that their value can change so that you can, for example, control how many times the body of a loop is executed.

The data stored within a variable is called a value, and it can be of multiple types. In UiPath, we support a large amount of types, ranging from generic value, text, number, data table, time and date, to UiElements.

Creating Variables

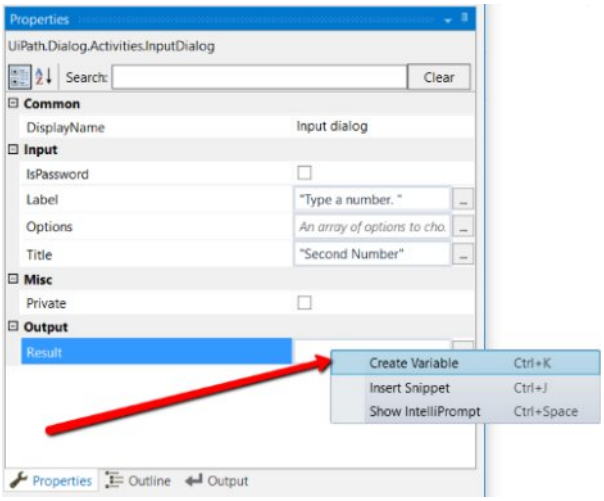
From the Design ribbon:

1. On the **Design** ribbon tab, in the **Variables** group, select **Create Variable** > **[Type of variable]**. The **Create Variable** window is displayed.



2. Fill in the required fields and click **OK**. The variable is created and you can view and edit it in the **Variables** panel.

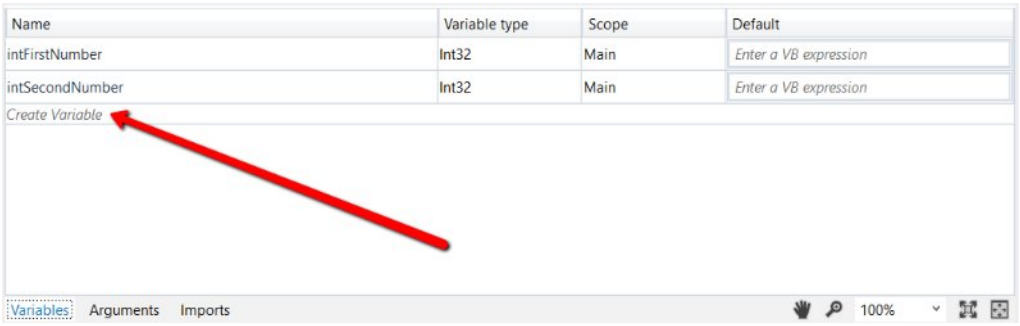
From the context menu or with a keyboard shortcut:



1. In the **Properties** panel of any activity, right-click a field that can be edited, and select **Create Variable** from the context menu, or press Ctrl+K. A **Set Name** field is displayed.
2. Fill in the name and press Enter. The variable is created and you can view and edit it in the **Variables** panel.

Note: When creating variables like this, the type is automatically generated, depending on the selected property.

From the Variables panel:



1. In the **Main** panel, click **Variables**. The **Variables** panel is displayed.
2. Click the **Create Variable** line. A new variable with the default values in displayed.

Note: By default, all new variables are of String type if you create them from the **Variables**panel.

Removing Variables

- In the **Variable** panel, right-click a variable and select the **Delete** option.
- In the **Variable** panel, select a variable and press the Delete key.

Note: If you want to undo this action, press Ctrl+Z.

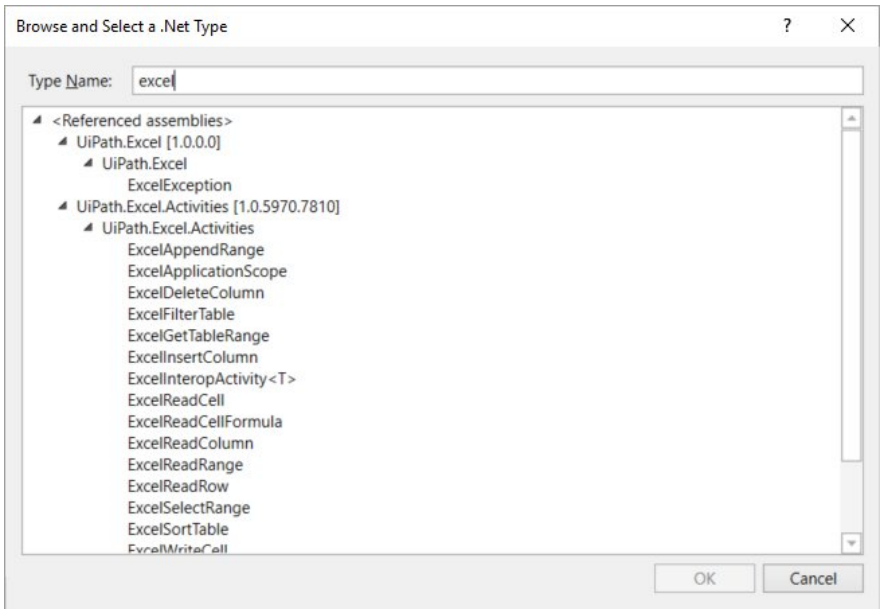
You can also remove all the variables that are not used in your currently opened workflow:

1. On the **Design** ribbon tab, in the **Variables** group, select **Manage Variables** > **Remove Unreferenced**. Note that the **Variables** panel only contains the variables used in your workflow.

Browsing for .Net Variable Types

To search for types of variables that are not displayed by default in the **Variable Type** list, do the following:

1. In the **Variable** panel, from the **Variable Type** drop-down list, select **Browse for Types**. The **Browse and Select a .Net Type** window is displayed.



2. In the **Type Name** field, type a keyword for the variable you are looking for, such as excel. Note that the result section is updated, displaying all the .Net variable types that contain your keyword.
3. Select one and click **OK**. A new variable is created with the selected type and is displayed in the **Variables** panel.

Note: After using a type of variable from the **Browse and Select a .Net Type** window, it is displayed in the **Variable Type** drop-down list, in the **Variables** panel.

Types of Variables

Generic Value Variables

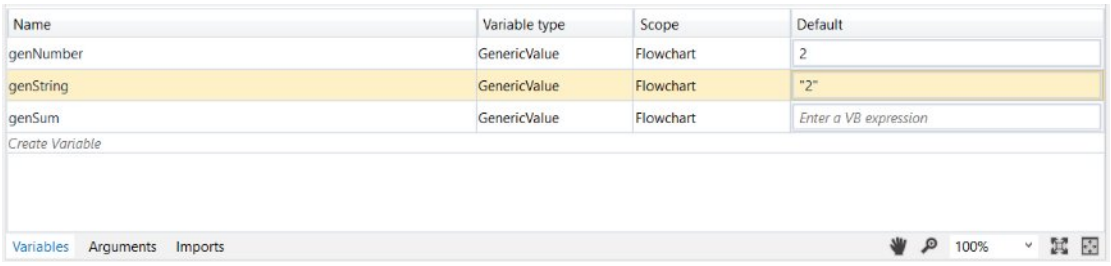
The generic value variable is a type of variable with a wide range that can store any kind of data, including text, numbers, dates and arrays, and is particular to UiPath Studio.

Generic value variables are automatically converted to other types, in order to perform certain actions. However, it is important to use these types of variables carefully, as their conversion may not always be the correct one for your workflow.

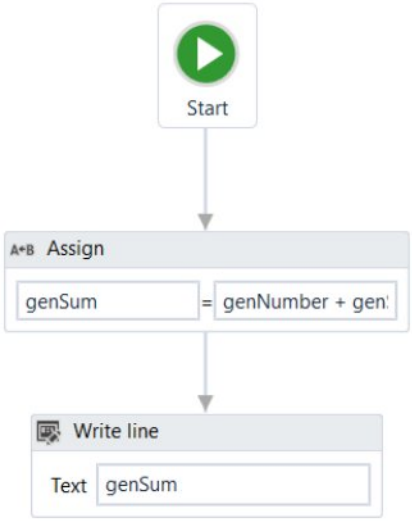
Example of Using a Generic Value Variable

To demonstrate how a generic value variable can be converted and used, let's create a workflow that displays in the **Output** panel the sum of two numbers, using generic value variables with different types of values.

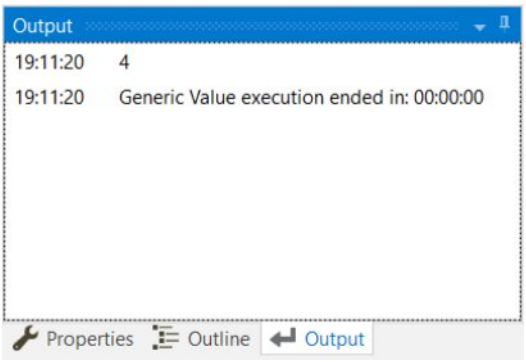
1. Create a flowchart.
2. Create three generic value variables, `genNumber`, `genString` and `genSum`.
3. In the **Default** column for the `genNumber` variable, type 2, and for the `genString`variable, type"2." The first value is interpreted as as integer, and the second one as a string.



4. Add an **Assign** activity to the **Main** panel and connect it to the **Start** node.
5. In the **Properties** panel, in the **To** field, enter the `genSum` variable.
6. In the **Value** field, type `genNumber+genString`.
7. Add a **Write Line** activity and connect it to the **Assign** one.
8. In the **Properties** panel, in the **Text** field, enter the `genSum` variable.



9. Press F5 to execute your workflow. Note that, in the **Output** panel, the sum of the two numbers is displayed.



This means that UiPath Studio knows that the `genNumber` is an integer and knows how to transform the generic value `genString` variable to an integer, so that it can add it to the first one.

However, keep in mind that this was our goal from the beginning. If we wanted to display the two variables in the **Output** panel as strings using this exact method, it would not have worked.

Text Variables

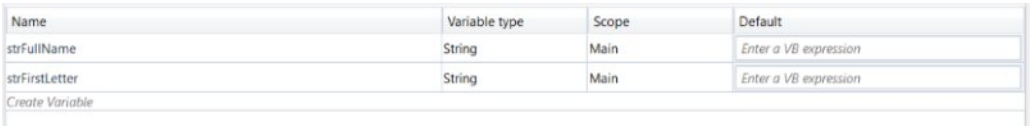
A text or string variable is a type of variable that can store only strings. These types of variables can be used, for example, to store names, passwords or information extracted from a table.

Note: All strings in UiPath Studio have to placed in between quotes.

Example of Using a Text Variable

To exemplify how you can work with text variables, we are going to create a workflow that asks for the user's name, stores it and displays only the first letter of his name in the **Output** panel.

1. Create a sequence.
2. Create two simple string variables, `strFullName` and `strFirstLetter`.



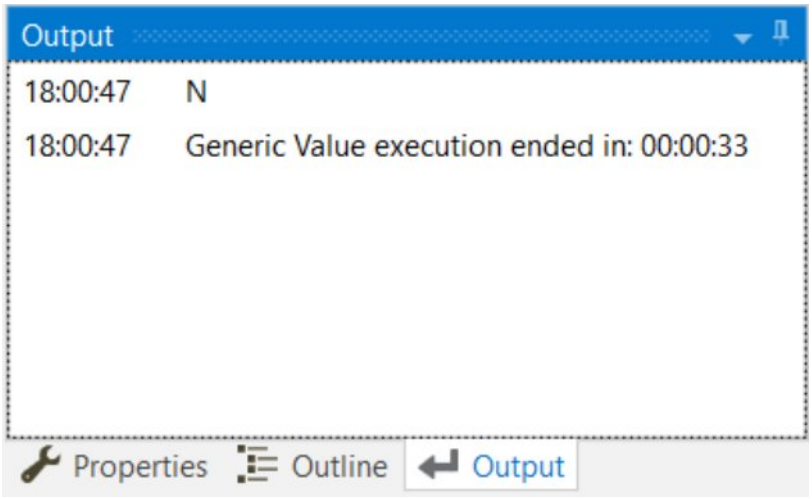
3. Add an **Input Dialog** activity to the **Main** panel.
4. In the **Properties** panel, in the **Label** field, type "Type your full name please.".
5. In the **Title**field, type "What is your name?".
6. In the **Result** field, add the `StrFullName` variable. This variable stores whatever the user writes when prompted with the **Input Dialog** activity.
7. Add an **Assign** activity under the **Input Dialog** one.
8. In the **Properties** panel, in the **To** field, add the `strFirstLetter` variable.
9. In the **Value** field, type `strFullName.Substring(0,1)`. The `strFirstLetter`variable is assigned the new value created by the `strFullName.Substring(0,1)`expression.

   Note: This field uses the `Substring()` function to find the first character from the string added by the user in the **Input Dialog**.

10. Add a **Write Line** activity under the **Assign** one.
11. In the **Properties** panel, in the **Text** field, enter the `strFirstLetter` variable. The **Output** panel is going to display the first letter of what the user wrote in the **Input Dialog**.

    The workflow should look as in the following screenshot.

12. Press F5. The **What is your name** window is displayed.
13. Type your name in the text field and click **OK**. In Uipath Studio, in the **Output** panel, note that the first letter of your name is displayed.



True or False Variables

The true or false variable, also known as boolean, is a type of variable that only has two possible values, true or false. These variables enable you to make decisions, and thus have a better control over your flow.

Example of Using a True or False Variable

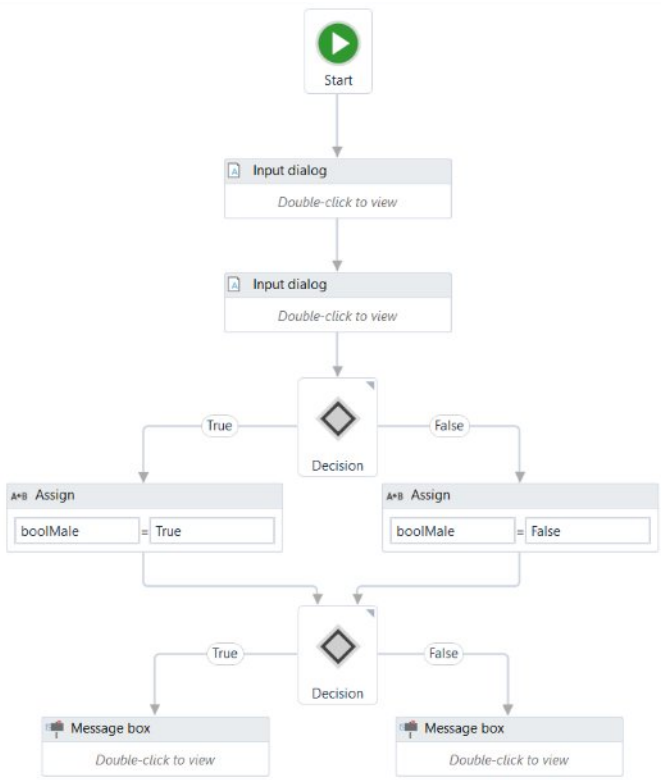
To exemplify how you can work with true or false variables, we are going to create a workflow that asks the user for his name and gender, and displays the results in another window.

1. Create a new workflow.
2. Create two string variables, `strName` and `strGender`. The first is going to be used to store the name of the user, and the second to store the user's gender.
3. Create a boolean variable, `boolMale`. This variable is used to verify if the user is a male.

Name	Variable type	Scope	Default
strName	String	Main	*Enter a VB expression*
strGender	String	Main	*Enter a VB expression*
boolMale	Boolean	Main	*Enter a VB expression*

4. Add an **Input Dialog** activity to the **Main** panel and connect it to the **Start** node.
5. In the **Properties** panel, in the **Label** field type "What is your name?".
6. Add a title and, in the **Result** field, add the `strName` variable.
7. Add another **Input Dialog** activity and connect it to the previous one.
8. In the **Properties** panel, in the **Label** field type "What is your gender?".
9. Add a title and, in the **Result** field, add the `strGender` variable.
10. Add a **Flow Decision** activity to the **Main** panel, and connect it to the second **Input Dialog**.
11. In the **Properties** panel, in the **Condition** field, type `strGender = "Male" or strGender = "male"`. This activity checks if the user is a male or female.
12. Add two **Assign** activities.
13. Connect one to the **True** branch of the **Flow Decision** activity.
14. In the **Properties** panel, in the **To** field enter the boolMale variable.
15. In the **Value** field, type **True**. This assigns the **True** value to the `boolMale` variable when the `strGender = "Male" or strGender = "male"` condition is met.
16. Connect the second **Assign** activity to the **False** branch of the **Flow Decision**.
17. In the **Properties** panel, in the **To** field, enter the `boolMale` variable.
18. In the **Value** field, type **False**. This assigns the **False** value to the `boolMale` variable when the `strGender = "Male" or strGender = "male"` condition is not met.
19. Add a new **Flow Decision** and connect the previously added **Assign** activities to it.
20. In the **Properties** panel, in the **Condition** field, type `boolMale = True`.
21. Add a **Message Box** activity and connect it to the **True** branch of the **Flow Decision**.
22. In the **Properties** panel, in the **Text** field, type `strName + " is a " + strGender + "."`. This message displays the name of the user and its gender, if `boolMale` is true.
23. Add another **Message Box** activity and connect it to the **False** branch of the **Flow Decision**.
24. In the **Properties** panel, in the **Text** field, type `strName + " is a " + strGender + "."`. This message displays the name of the user and its gender, if `boolMale` is false.

The final workflow should look like in the following screenshot.



25. Press F5. The workflow is executed. Note that the final **Message Box** displays the message as expected.

Number Variables

Number variables are also known as integer or Int32, and are used to store numeric information. They can be used to perform equations or comparisons, pass important data and many others.

Example of Using a Number Variable

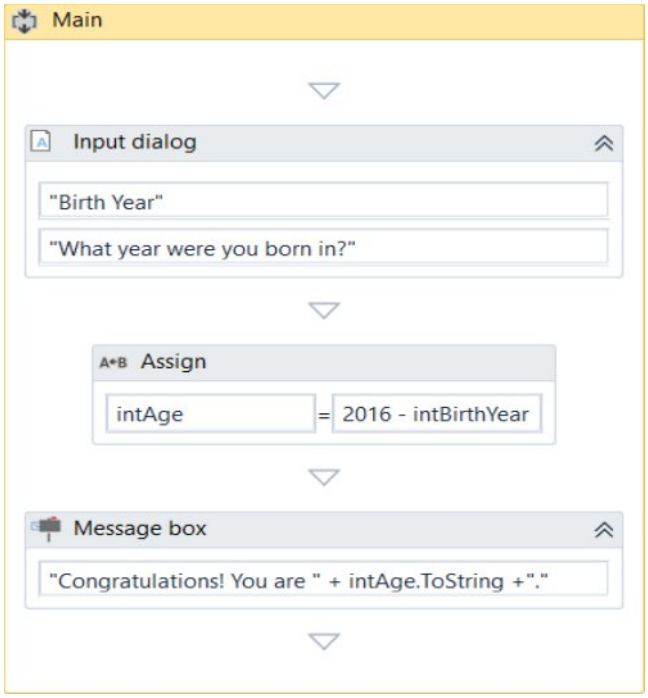
To exemplify how you can work with number variables, we are going to create a workflow that asks the user for the year in which he or she is born and displays the age in a window.

1. Create a new sequence.
2. Create two Int32 variables, `intBirthYear` and `intAge`. The first stores the user's birth year and the second, the user's age.
3. Add an **Input Dialog** activity to the sequence.
4. In the **Properties** window, type an appropriate title and label.
5. In the **Result** field, add the `intBirthYear` variable.

6. Add an **Assign** activity under the **Input Dialog**.
7. In the **Properties** panel, in the **To** field, add the `intAge` variable.
8. In the **Value** field, type `2016 – intBirthYear`. This assigns the value of the subtraction (2016 – user's birth year) to the `intAge` variable.
9. Add a **Message Box** activity under the **Assign** one.
10. In the **Properties** panel, in the **Text** field, type `"Congratulations! You are " + intAge.ToString +"."`.

Note: The `.ToString` method converts the integer stored in `the intAge` variable to a string and display it as such.

The final workflow should look as in the following screenshot.



11. Press F5. The workflow is executed. Note that the **Message Box** displays your age, as expected.

Array Variables

The array variable is a type of variable which enables you to store multiple values of the same type.

UiPath Studio supports as many types of arrays as it does types of variables. This means that you can create an array of numbers, one of strings, one of boolean values and so on.

Example of Using an Array Variable

To exemplify how you can work with array variables, we are going to create a workflow that asks the user for his first and last name and age, stores the information in an array and then writes it in a .txt file.

1. Create a new sequence.
2. Create three string variables, `strFirstName`, `strLastName` and `strAge`, in which to store the information gathered from the user.
3. Create an array of strings variable called `arrStringNameAge`.

Name	Variable type	Scope	Default
arrStringNameAge	String[]	Main	*Enter a VB expression*
strFirstName	String	Main	*Enter a VB expression*
strLastName	String	Main	*Enter a VB expression*
strAge	String	Main	*Enter a VB expression*

4. Add an **Input Dialog** activity to the **Main** panel.
5. In the **Properties** panel, fill in the **Label** and **Title** fields to ask for the user's first name.
6. In the **Result** field, add the `strFirstName` variable. This variable stores the first name of the user.
7. Add another **Input Dialog** activity under the previous one.
8. In the **Properties** panel, fill in the **Label** and **Title** fields to ask for the user's last name.
9. In the **Result** field, type the `strLastName` variable. This variable is going to store the last name of the user.
10. Add another **Input Dialog** activity under the previous one.
11. In the **Properties** panel, fill in the **Label** and **Title** fields to ask for the user's age.
12. In the **Result** field, type the `strAge` variable. This variable is going to store the age of the user.

    Note: We use a string variable and not an integer to store the age, so that we do not have to convert it later on, wehn we add it to the string array variable.

13. Add an **Assign** activity under the last **Input Dialog**.
14. In the **Properties** panel, in the **To** field, type the `arrStringNameAge` variable.
15. In the **Value** field, type `{strFirstName,strLastName,strAge}`. This **Assign**activity enables you to store all the values from the initial string variables in the `arrStringNameAge` one.
16. Add a **Write Text File** activity under the **Assign** one.
17. In the **Properties** panel, in the **FileName** field, type the path of the file you want to write to between quote marks, such as `"C:\Users\MADa\Desktop\array_variable.txt"`.

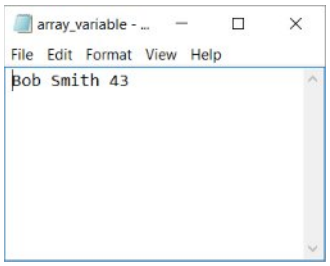
    Note: If the file does not exist at the provided path, it is created.

18. In the **Text** field, type `arrStringNameAge(0) + " " + arrStringNameAge(1) + " " +arrStringNameAge(2) + " "`.

    Note: By adding the index number of the array items you can access their values and write them, in this example, to a text file.

    The final workflow should look as in the following screenshot.

19. Press F5. The workflow is executed.
20. Navigate to the file provided at step 17 and double-click it. A **Notepad** window is displayed with the information you added at step 20.



Date and Time Variables

The date and time variable is a type of variable that enables you to store information about any date and time. This type of variable can be found in the **Browse and Select a .Net Type** window, under the `System` namespace (`System.DateTime`). For more information, see Browsing for .Net Variable Types.

For example, they can be used to append dates to invoices or any other documents you may be working with and are time-sensitive.

Example of Using a Date and Time Variable

To exemplify how you can work with a date and time variable, we are going to build a workflow that get the current date and time, subtracts a specified amount of time and writes the result to a Microsoft Excel spreadsheet.

1. Create a new sequence.
2. Create two DateTime variables, `timToday` and `timLastTime`.
3. Create a TimeSpan variable, called `timSpan`, and in the **Default** field type 1.02:10:04.

   Note: The default value attributed to the `timSpan` variable uses the `day.hh:mm:ss` format.

4. Add an **Assign** activity to the **Main** panel.
5. In the **Properties** panel, in the **To** field, add the `timToday` variable.

6. In the **Value** field, type **Now**. This gives you the date and time when the workflow is executed, in the `dd/MM/yyyy` and `hh:mm:ss` formats.
7. Add another **Assign** activity under the previous one.
8. In the **Properties** panel, in the **To** field, add the `timLastTime` variable.
9. In the **Value** field, type `timToday.Subtract(timSpan)`. This is going to subtract the default value of the `timSpan` variable from the current date and time, stored in the `timToday` variable.
10. Add an **Excel Application Scope** activity under the last **Assign** one.

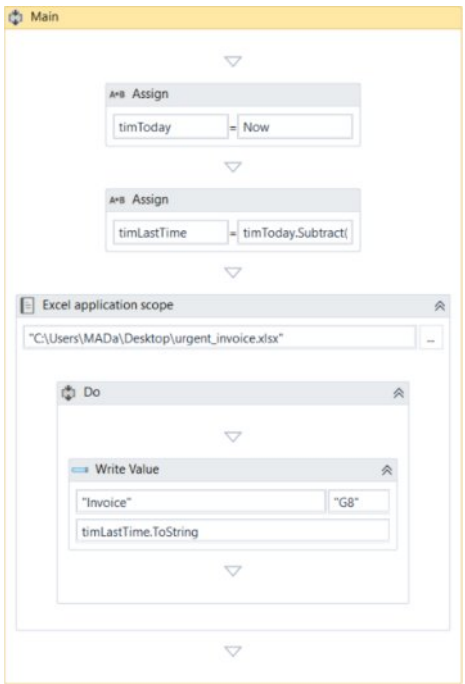
    Note: If you do not have Excel activities installed on your version of UiPath Studio, use the Manage Packages functionality to get them.

11. In the **Properties** panel, in the **WorkbookPath** field, type the path of the Excel file you want to write to, between quotation marks. In our case, `"C:\Users\Username\Desktop\urgent_invoice.xlsx"`.

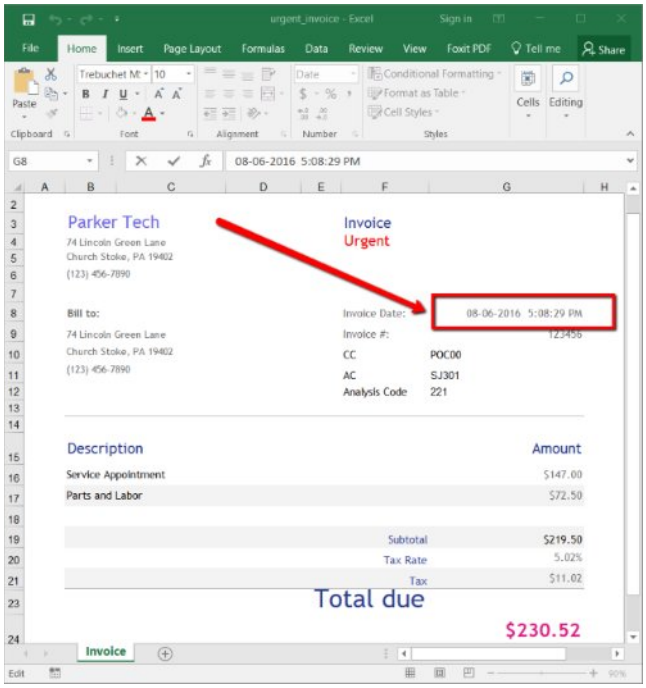
    Note: If the file does not exist at the provided path, it is going to be created.

12. Add a **Write Value** activity in the **Excel Application Scope** activity.
13. In the **Properties** panel, in the **Range** field, type the coordinates of an Excel cell between quotation marks. In our case, "G8."
14. In the **Sheet Name** field, type the name of the sheet in which you want to write. In our case, "Invoice". Note that if the sheet does not exist, it is going to be created.
15. In the **Value** field, type `timLastTime.ToString`. This transforms the value of the `timLastTime` variable to a string and writes it to the coordinates previously given.

    The final workflow should look as in the following screenshot.



16. Press F5. The workflow is executed.
17. Navigate to your Excel file and double-click it. Note that the time and date information is displayed in the cell you pointed towards.



Data Table Variables

Data table variables represent a type of variable that can store big pieces of information, and act as a database or a simple spreadsheet with rows and columns. They can be found in the **Browse and Select a .Net Type** window, under the `System.Data` namespace (`System.Data.DataTable`). For more information, see Browsing for .Net Variable Types.

These variables can be useful to migrate specific data from a database to another, extract information from a website and store it locally in a spreadsheet and many others.

Example of Using Data Table Variables

To exemplify how you can use data table variables, we are going to create a workflow that reads only two out of multiple columns from an Excel spreadsheet, and then transfers them to another spreadsheet that already contains other information.

The initial file is a database of people, their age, location and e-mail address. In this example, we are going to extract their names and e-mail addresses and append them to an Excel spreadsheet that already contains similar information.

1. Create a new sequence.
2. Create two data table variables, `datNamesList` and `DatMailList`. These are going to be used to store information from the initial Excel spreadsheet.
3. Add an **Excel Application Scope** activity to the sequence. This activity is required for most of the Excel-related activities.

   Note: If you do not have Excel activities installed on your version of UiPath Studio, use the Manage Packages functionality to get them.

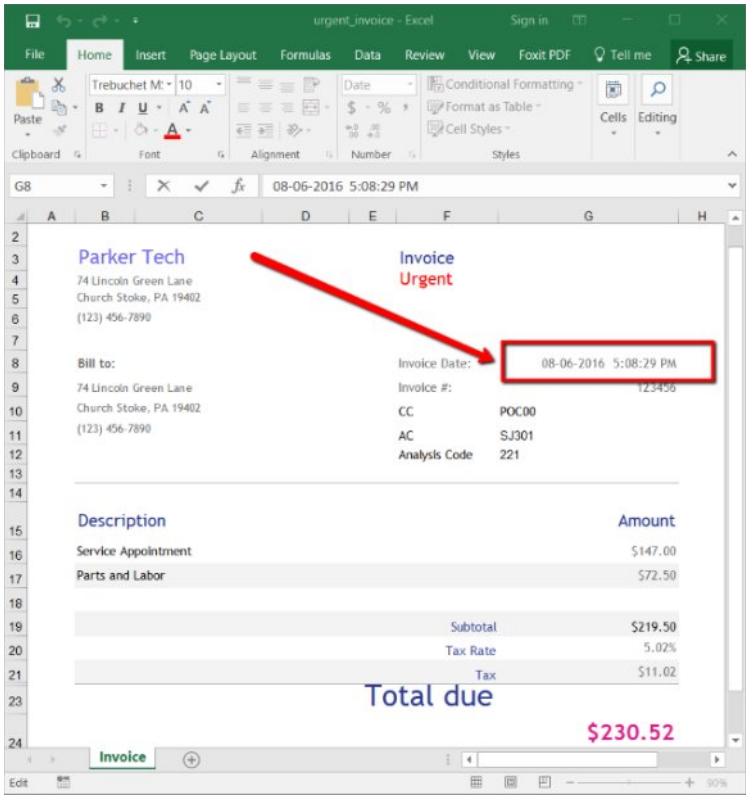
4. In the **Properties** panel, in the **WorkbookPath** field, type the path of the initial Excel file to be used, between quotation marks.
5. Add two **Read Range** activities and place them one under the other, in the **Excel Application Scope** activity. These are used to get information from the initial spreadsheet.

6. Select the first **Read Range** activity and, in the **Properties** panel, in the **Range** field, type "A2:A21.". These are the Excel table coordinates that tell UiPath Studio from where to extract information.
7. In the **SheetName** field, do not make any changes as the name of our sheet is the default one, Sheet1.
8. In the **DataTable** field, type the name of the first data table variable, `datNamesList`. This variable stores all the information available between the A2 and A21 rows.
9. (**Optional**) Change the value in **DisplayName** field to Read Names, so you can easily tell apart this activity from the second one.
10. Select the second **Read Range** activity, and in the **Properties** panel, in the **Range** field, type "D2:D21." These are the Excel table coordinates that contain the e-mail information we want to extract.
11. In the **DataTable** field, specify the `datMailList` variable. This variable retains all the mail information we require.
12. Add a **Write Range** activity to the **Main** panel, under the **Excel Application Scope**. This activity is used to write the stored information to another Excel file.

    Note: The file used with the **Write Range** activity has to be closed when you run the workflow. If it is not closed, an error is displayed and the workflow execution stops.

13. In the **Properties** panel, in the **WorkbookPath** field, type the path of the Excel file to be used to store all the information gathered at the previous steps.
14. In the **DataTable** field, type the `datNamesList` variable.
15. In the **SheetName** field type Database, and in the **StartingCell**, type "C21." This is the starting cell in which information from the initial file is to be added.
16. Add another **Write Range** activity and place it under the first one.
17. In the **Properties** panel, fill in the **WorkbookPath** and **SheetName** fields as for the previous **Write Range** activity.
18. In the **Starting Cell** field, type "D21."
19. In the **DataTable** field, type the `datMailList` variable.

20. Press F5. The workflow is executed.
21. Double-click the final Excel file. Note that the copied information is available, and correctly updated.


urgent_invoice - Excel
Sign in
File
Home
Insert
Page Layout
Formulas
Data
Review
View
Foxit PDF
Tell me
Share
Paste
Clipboard
Font
Alignment
Number
Styles
Cells
Editing
G8
08-06-2016 5:08:29 PM
Parker Tech
74 Lincoln Green Lane
Church Stoke, PA 19402
(123) 456-7890
Invoice
Urgent
Bill to:
74 Lincoln Green Lane
Church Stoke, PA 19402
(123) 456-7890
Invoice Date:
08-06-2016 5:08:29 PM
Invoice #:
123456
CC
POC00
AC
SJ301
Analysis Code
221
Description
Amount
Service Appointment
$147.00
Parts and Labor
$72.50
Subtotal
$219.50
Tax Rate
5.02%
Tax
$11.02
Total due
$230.52
Invoice
Edit

Arguments

Managing Arguments

Arguments are used to pass data from a workflow to another. In a global sense, they resemble variables, as they store data dynamically and pass it on. Variables pass it to other activities, while arguments pass it to other workflows. As a result, they enable you to reuse workflows time and again.

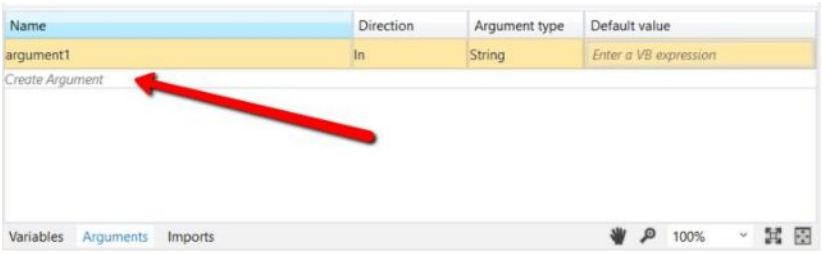
UiPath Studio supports a large number of types of arguments, which coincide with the types of variables. Therefore, you can create generic value, string, boolean, object, array, data table arguments and you can also browse for .Net types, just as you do for variables.

Additionally, arguments have specific directions (**In**, **Out**, **In/Out**, **Property**) that tell the application where the information stored in them is supposed to go.

Creating Arguments

To create a new argument:

1. In the **Main** panel, click **Arguments**. The **Arguments** panel is displayed.



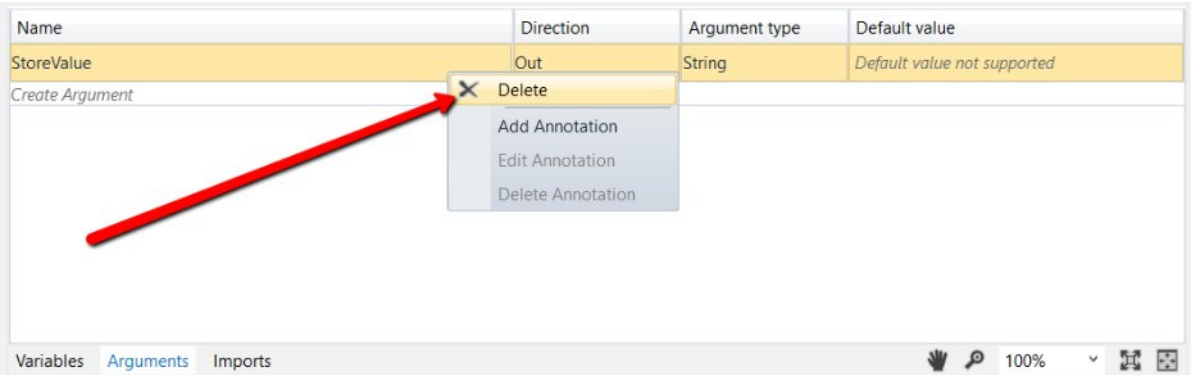
2. Click the **Create Argument** line. A new argument with the default values is displayed.

Note: By default, all arguments are of type **String** and have an **In** direction.

Removing Arguments

To remove an argument:

- In the **Arguments** panel, select an argument and press Delete.
- In the **Arguemtns** panel, right-click an argument and select the **Delete** option.



Using Arguments

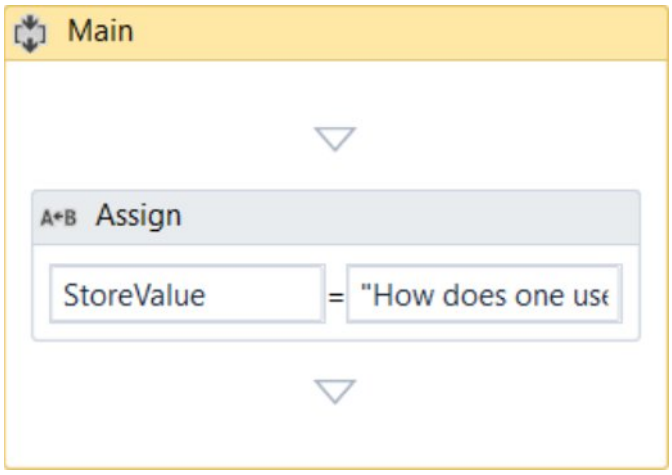
Due to the nature of arguments, you are going to use them a lot in relation with the **Invoke Workflow File** and **Launch Workflow Interactive** activities. They can be found in the **Activities** panel, under **Workflow > Invoke** and they enable you to browse for a workflow, and import and edit their arguments.

Example of Using an Argument

To exemplify how to use an argument in a workflow with an **Invoke Workflow File**activity, we are going to create two separate sequences. A very simple one in which to assign a value to an argument, and a second that invokes it and displays the value in a message box.

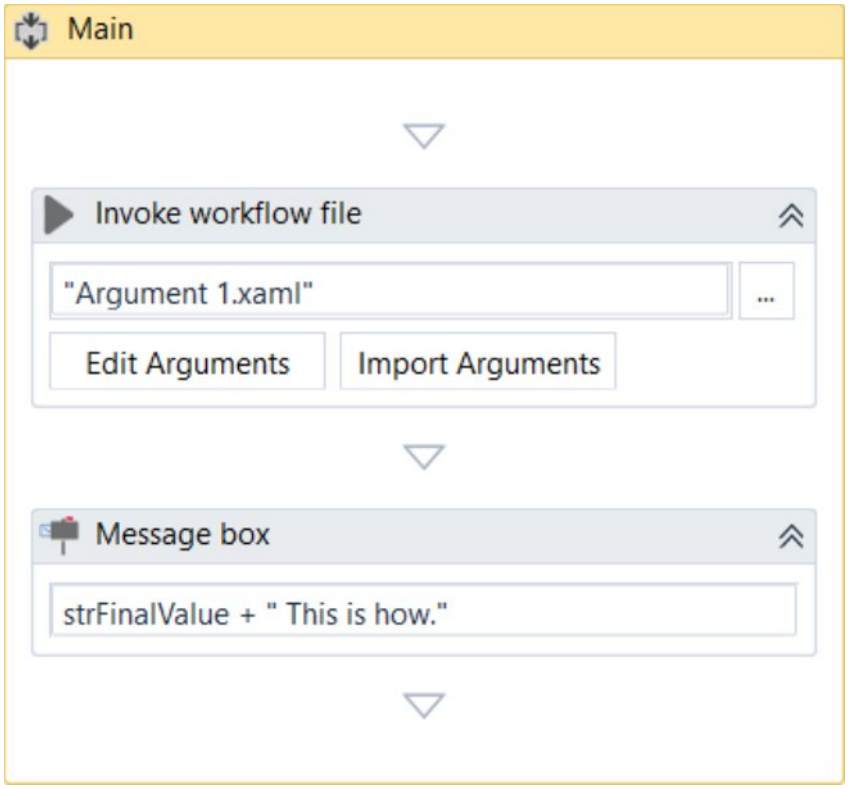
1. Create a new sequence.
2. In the **Arguments** panel, create an argument, StoreValue.
3. From the **Direction** list, select **Out**, and do not change the **Argument Type** from **String**.
4. Add an **Assign** activity to the **Main** panel.
5. In the **Properties** panel, in the **To** field, add the `StoreValue` argument.
6. In the **Value** field, type a string, such as "How does one use an argument?".

The first workflow should look as in the following screenshot.

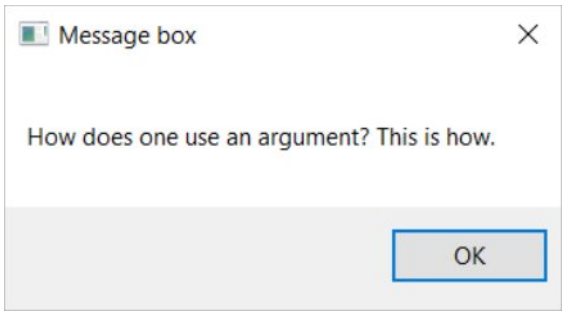


7. Create a new sequence.
8. Create a string variable, `strFinalValue`.
9. Add an **Invoke Workflow File** activity to the **Main** panel.
10. On the activity, click the Ellipses (…) button and browse for the previously created sequence.
11. Click **Import Arguments**. The **Invoked Workflow's Arguments** window is displayed. Note that the argument of the first sequence is displayed here.
12. In the **Value** field, add the `strFinalValue` variable and click **Ok**. The argument is imported and the value from it is going to be stored in the current workflow through the `strFinalValue` variable.
13. Add a **Message Box** activity under the **Invoke Workflow File**.
14. In the **Properties** panel, in the **Text** field, type `strFinalValue + " This is how"`, for example.

The second workflow should look as in the following screenshot.



15. Press F5 in the second sequence. The workflow is executed correctly and the message box displays the desired text.



Imported Namespaces

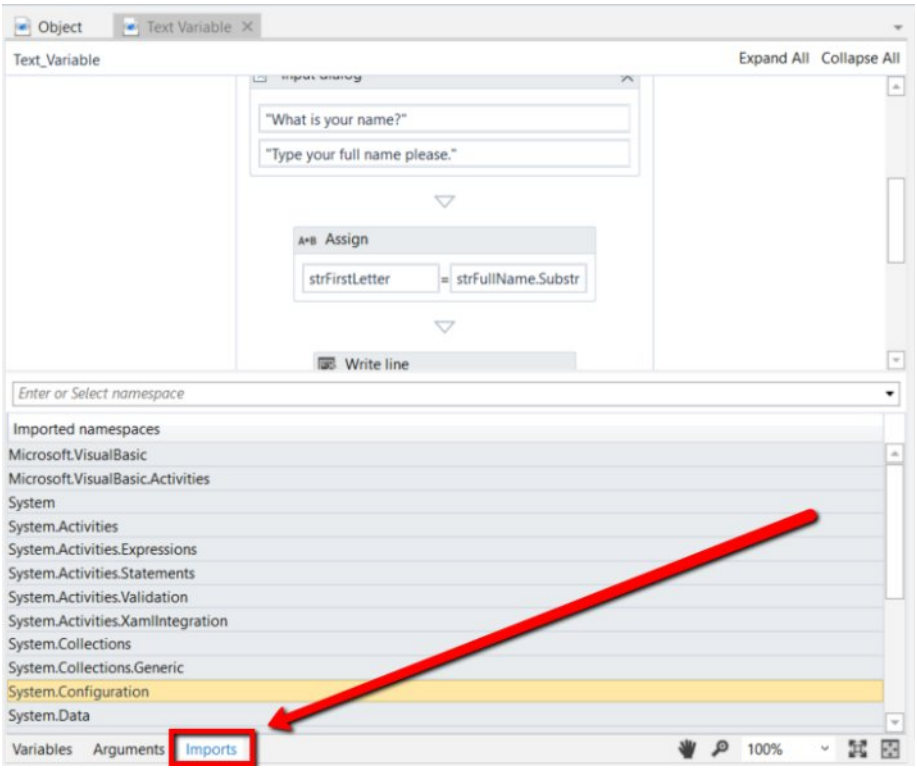
About Imported Namespaces

VB.Net namespaces in UiPath Studio represent containers that store different types of data. They enable you to define the scope of your expressions, variables and arguments.

For example, if you have the `System.Data` namespace imported, you can further use `DataTable`, `DataView`, `DataColumn`, `DataRow` and other classes that are available in it, without having to always type `System.Data.DataTable` and so on.

All imported namespaces are displayed in the **Imports** panel. Note that some namespaces are automatically imported when you browse for a .Net type variable or argument, for example.

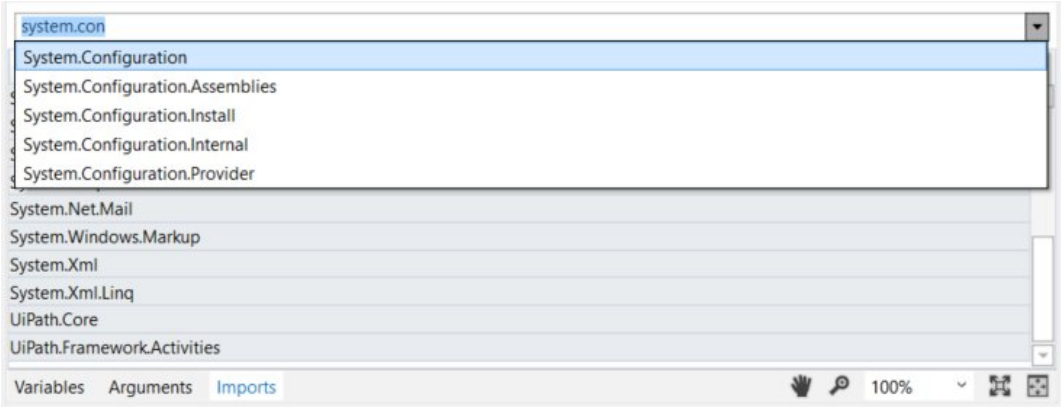
To open this panel, click **Imports** in the **Main** panel.



Importing New Namespaces

To add new namespaces to your library:

1. Open the **Imports** panel.
2. In the **Enter or Select namespace** field, start typing the namespace that interest you. Note that suggestions are provided while you type, in case you are not exactly sure what you are looking for.



3. (**Optional**) Click the drop-down arrow to view and browse all available namespaces.
4. Select the desired namespace. The namespace is added to the **Imported Namespaces**list.

To remove a namespace, select it and press Delete. Note that namespaces can only be deleted if they are invalid. For example, you can delete a namespace if the assembly that contains it is no longer referenced by the project.

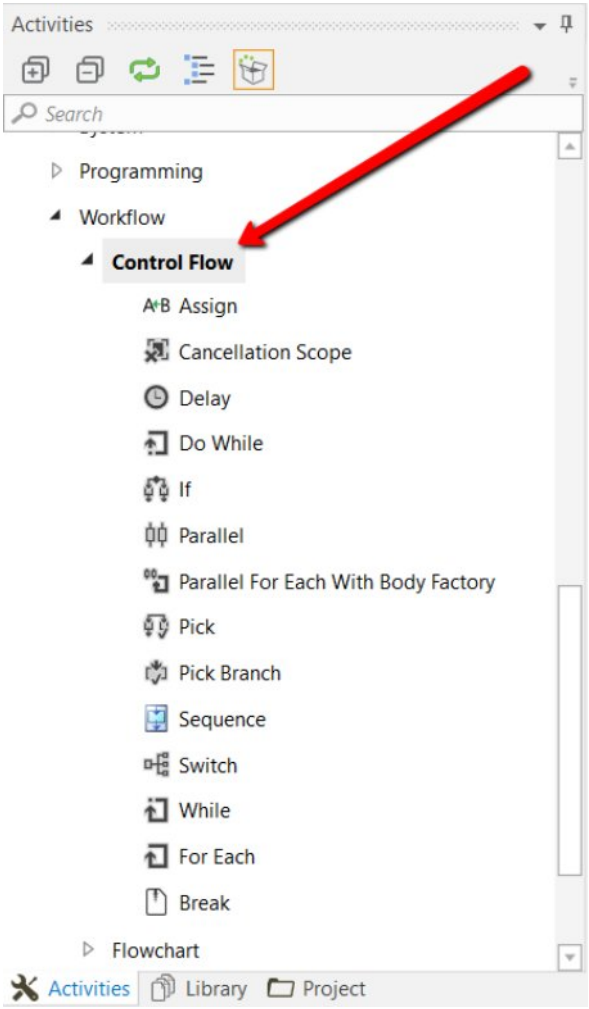
Control Flow

About Control Flow

An important aspect of successfully working with UiPath Studio is understanding and knowing how to control your workflow. As in computer science, in UiPath this concept is referred to as control flow.

A proper control flow can be achieved through the intelligent use of variables, and of certain activities.

All of these activities can be found in the **Activities** panel, under **Workflow** > **Control Flow**.



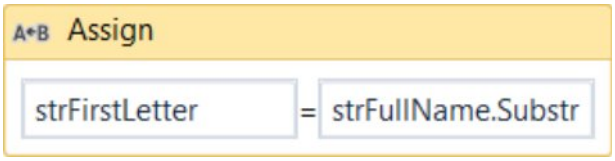
They enable you to define rules and automate decisions for a given workflow, through if…else or for each statements or loops, as well as add delays so that you can perfectly time two activities.

Loops represent an important part of workflows as they enable you to easily check dependencies between variables, activities and conditions. They are created once and enable you to iterate data a specified number of times, until a condition is met, once for each item in a collection or indefinitely.

Control Flow Activities

The Assign Activity

The **Assign** activity is a pretty important activity that is going to be used quite often, as it enables you to assign a value to a variable.



You can use an **Assign** activity to increment the value of a variable in a loop (see the example in the Do While Activity chapter), sum up the value of two or more variables and assign the result to another variable (see the example in the Generic Value Variables chapter), assign values to an array (see the Array Variables chapter) and so on.

By default, this activity is also included in the **Favorites** group. To remove it, right-click it and select **Remove**.

The Delay Activity

The **Delay** activity enables you to pause the workflow for a custom period of time (in the `hh:mm:ss` format). This activity proves itself quite useful in workflows that require good timing, such as waiting for a specific application to start or waiting for some information to be processed so that you can use it in another activity.

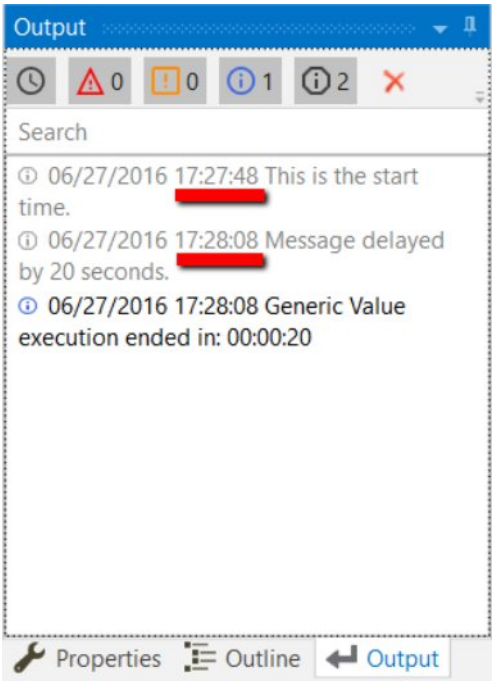
Example of Using the Delay Activity

To exemplify how you can use the **Delay** activity, lets create a workflow that writes two messages to the **Output** panel, with a delay of 20 seconds between them.

1. Create a new flowchart.
2. Add a **Write Line** activity and connect it to the **Start** node.
3. Select the activity, and in the **Text** field, type "This is the start time.".
4. Add a **Delay** activity and connect it to the previously added activity.
5. Select the activity, and in the **Properties** panel, in the **Duration** field, type 00:00:20. This is the 20 seconds delay that is going to be between the two logged messages.
6. Add another **Write Line** activity and connect it to the workflow.
7. In the **Text** field, type "Message delayed by 20 seconds.".

The final workflow should look as in the following screenshot.

8. Press F5. The workflow is executed. Note that, in the **Output** panel, the two messages added in the Write Line activities are written twenty seconds apart.



The Do While Activity

The **Do While** activity enables you to execute a specified part of your workflow while a condition is met. When the specified condition is no longer met, the workflow exists the loop.

This type of activity can be useful to step through all the elements of an array, or execute a particular activity multiple times. You can increment counters to browse through array indices or step through a list of items.

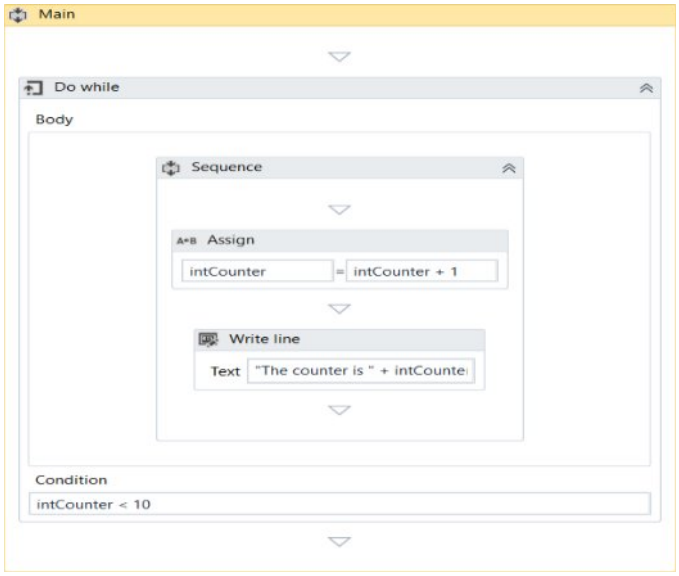
Note: Do While activities are evaluated only after the body has been executed once.

Example of Using a Do While Activity

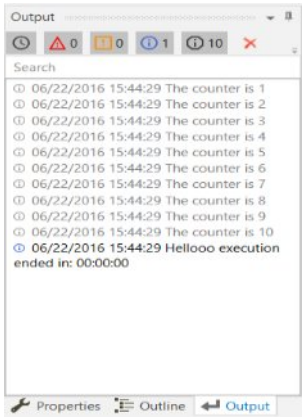
To exemplify how to use a **Do While** activity, let's create a workflow that increments an integer variable from 0 to 10, and displays a message every time it is incremented.

1. Create a new sequence.
2. Create an integer variable, `intCounter`, with a default value of 0.
3. Add a **Do While** activity to the **Main** panel.
4. Select the **Assign** activity, and in the **Properties** panel, in the **To** field, add the `intCounter` variable.
5. In the **Value** field, type `intCounter + 1`. This helps you increment the value of the variable with one.
6. Add a **Write Line** activity, under the **Assign** one.
7. In the **Text** field, type `"The counter is " + intCounter.ToString`. This writes the value of the counter in the **Output** panel each time it is incremented.
8. In the **Condition** section of the **Do While** activity, type `intCounter < 10`. The body of the **Do While** activity is repeated until the value of the `intCounter` variable is bigger than 10.

   The final workflow should look as in the following screenshot.



9. Press F5. The workflow is executed. Note that the **Output** panel displays the message indicated in the **Write Line** activity.



The If Activity

The **If** activity contains a statement and two conditions. The first condition (the activity in the **Then** section) is executed if the statement is true, while the second one (the activity in the **Else** section) is executed if the statement is false.

If activities can be useful to make decisions based on the value of variables.

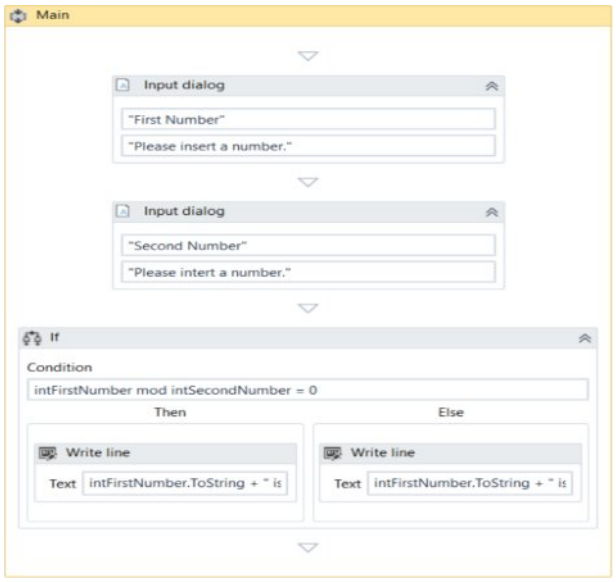
Note: The **If** activity is almost identical to the **Flow Decision** one. However, the latter can only be used in flowcharts.

Example of Using an If Activity

To exemplify how you can use the **If** activity, let's create a workflow that asks the user for two numbers, checks to see if one is divisible by the other, and depending on the result, displays a different message in the **Output** panel.

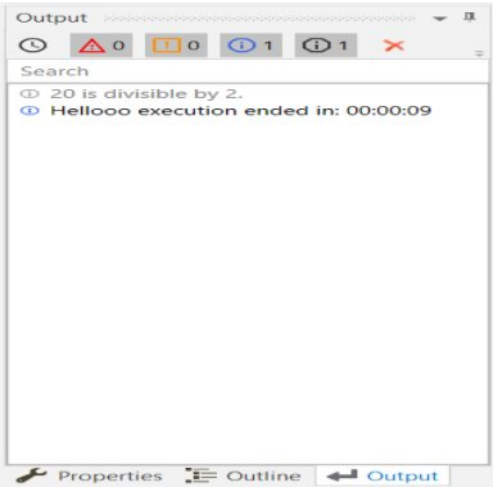
1. Create a new sequence.
2. Create two integer variables, `intFirstNumber` and `intSecondNumber` for example.
3. Add two **Input Dialog** activities to the **Main** panel.
4. In the **Properties** panel, type labels and titles for both activities and, in the **Result**fields, add the `intFirstNumber` and `intSecondNumber` variables.
5. Add an **If** activity to the **Main** panel, under the previously added **Input Dialog** ones.
6. In the **Condition** section, type `intFirstNumber mod intSecondNumber = 0`. This expression checks if the first number is divisible to the second one, using the mod operator.
7. In the **Then** section, add a **Write Line** activity.
8. In the **Text** field, type `intFirstNumber.ToString + " is divisible by "+ intSecondNumber.ToString + "."`. This is the message that is displayed if the first number is divisible by the second one.
9. In the **Else** section, add another **Write Line** activity.
10. In the **Text** field, type `intFirstNumber.ToString + " is NOT divisible by "+ intSecondNumber.ToString + "."`. This is the message that is displayed if the first number is not divisible by the second one.

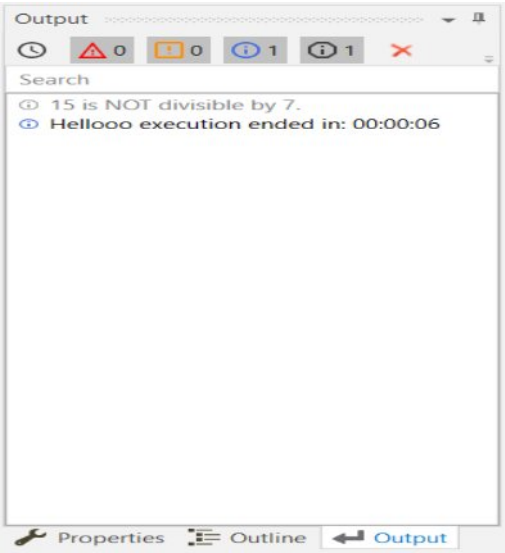
    The final workflow should look as in the following screenshot.



11. Press F5. The workflow is executed.

12. Add numbers when prompted. Note that the **Output** panel displays the result, depending on the values added in the **Input Dialog** windows.





The Switch Activity

The **Switch** activity enables you to select one choice out of multiple, based on the value of a specified expression. This activity supports multiple types of arguments, such as integer, string or array, and more complex ones such as data tables.

By default, **Switch** uses the integer argument, yet you can change it from the **Properties**panel, from the **TypeArgument** list.

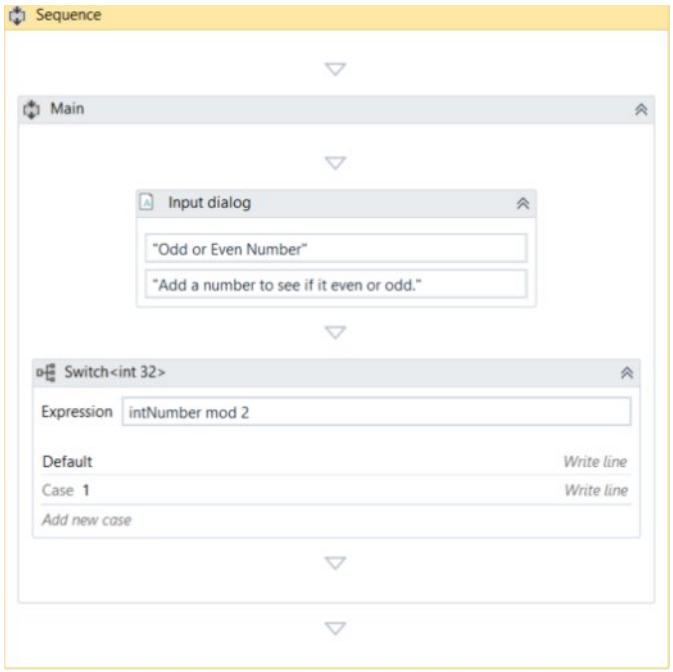
The **Switch** activity can be useful to categorize data according to a custom number of cases. For example, you can use it to store data into multiple spreadsheets or sort through names of employees.

Example of Using a Switch Activity

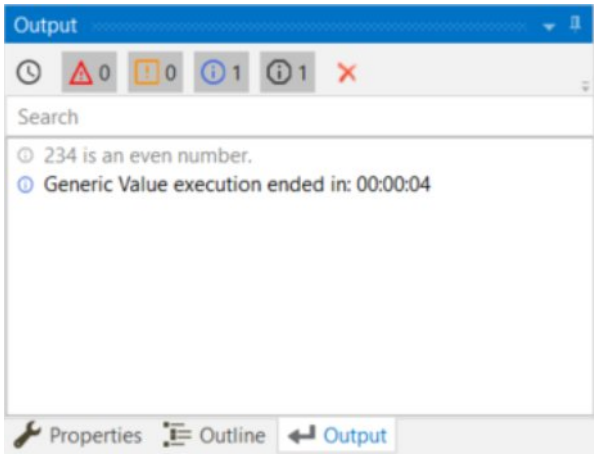
To exemplify how to use the Switch activity, we are going to create a workflow that asks the user for a number, checks if is odd or even, and depending on that, a different message is written to the **Output** panel. Since all odd numbers divided by two have a remainder equal to 1, this workflow needs only two cases (0 and 1), yet keep in mind that this activity supports multiple cases.

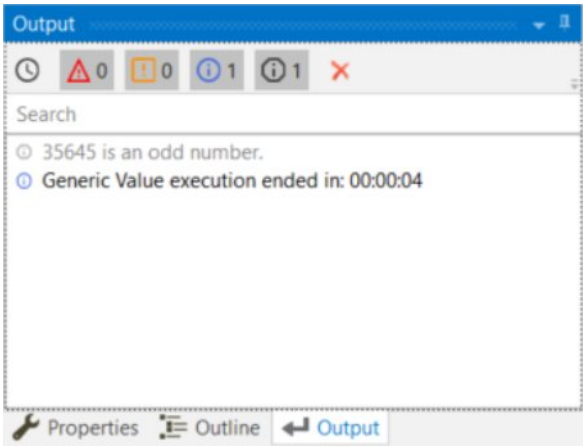
1. Create a new sequence.
2. Create an integer variable, `intNumber`.
3. Add an **Input Dialog** activity to the **Main** panel.
4. Add a **Title** and **Label** to prompt the user for a number.
5. In the **Result** field, add the `intNumber` variable.
6. Add a **Switch** activity, under the **Input Dialog**.
7. In the **Expression** field, type `intNumber mod 2`. This verifies if the user's number is divisible by 2.
8. In the **Default** section, add a **Write Line** activity.
9. In the **Text** field, type `intNumber.ToString + " is an even number."`.
10. Click the **Add new case** line, and in the **Case Value** field, type 1.
11. Add a **Write Line** activity to this case.
12. In the **Text** activity, type `intNumber.ToString + " is an odd number."`.

    The final workflow should look as in the following screenshot.



13. Press F5. The workflow is executed. Note that the **Output** panel displays the data correctly.





The While Activity

The **While** activity enables you to execute a specific process repeatedly, while a specific condition is met. The main difference between this and the **Do While** activity is that, in the first one, the condition is evaluated before the body of the loop is executed.

This type of activity can be useful to step through all the elements of an array, or execute a particular activity multiple times. You can increment counters to browse through array indices or step through a list of items.

Example of Using a While Activity

To exemplify how to use a **While** activity, let's create a workflow that increments an integer variable from 10 to 100, and writes all the numbers to a Microsoft Word document.

1. Create a new sequence.
2. Create a new integer variable, `intCounter, with the default value of 10.`
3. Add a **While** activity to the **Main** panel.
4. In the **Condition** field, type `intCounter < 100`. This means that the body of the loop is going to be repeated until the value of the `intCounter` variable is going to be bigger than 100.
5. In the **Body** section of the **While** activity, add an **Assign** activity.
6. In the **Properties** panel, in the **To** field add the `intCounter`.
7. In the **Value** field, type `intCounter + 1`. This increments the value of the `intCounter` with one.
8. Add an **Append Text** activity under the **Assign** one.

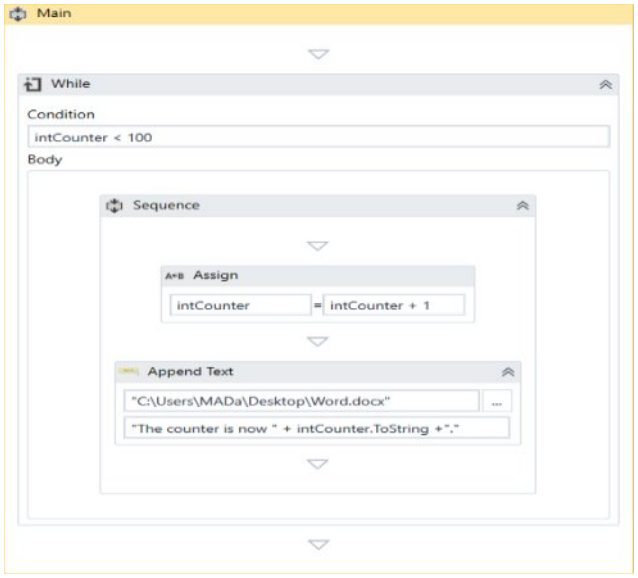
   Note: This activity is part of the Word activities package. If you do not have it, use the package manager functionality to install it.

9. In the **FilePath** field, type the path of a Word document in between quotation marks.

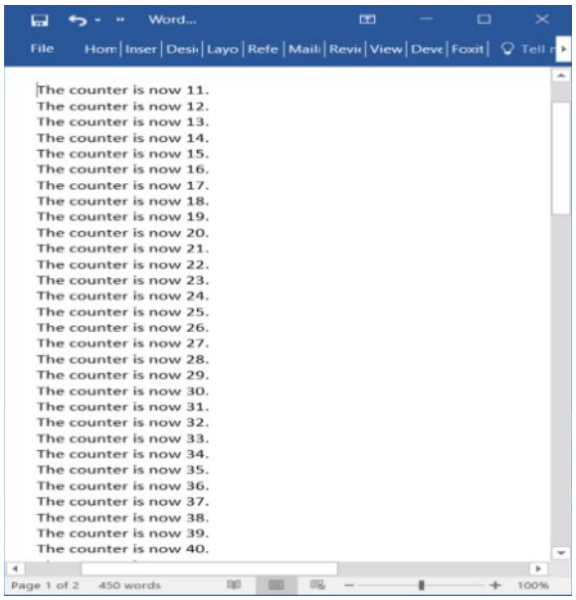
   Note: Make sure that the Word document is not used when running the workflow, otherwise a message error is displayed and the execution is stopped.

10. In the **Text** field, type `"The counter is now " + intCounter.ToString +".".`

    The final workflow should look as in the following screenshot.



11. Press F5. The workflow is executed.
12. Double-click the Word document specified at step 9. Note that all the numbers between 10 and 100 are written, as expected.



The For Each Activity

The **For Each** activity enables you to step through arrays, lists, data tables or other types of collections, so that you can iterate through the data and process each piece of information individually.

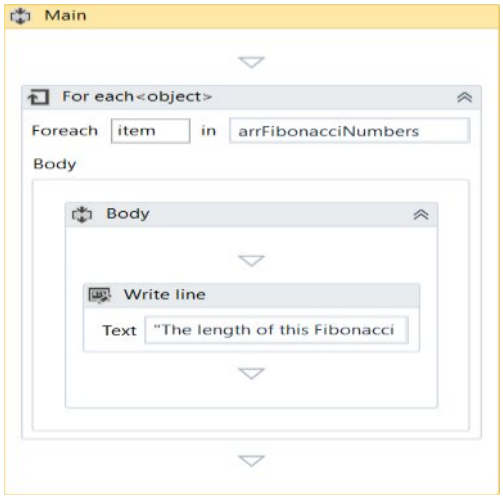
Example of Using a For Each Activity

To exemplify how to use a **For Each** activity, we are going to create a workflow that goes through each element of an array of integers and writes the length of the array and each element to the **Output** panel.

1. Create a new sequence.
2. Create an array of integers variable, `arrFibonacciNumbers`.

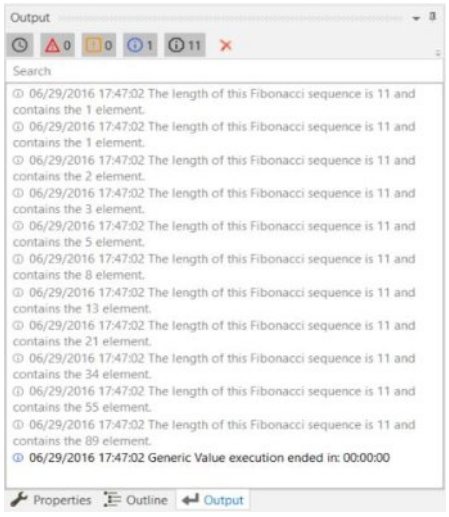
3. In the **Default** field, type the Fibonacci sequence until a desired value, such as {1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89}.
4. Add a **For Each** activity in the **Main** panel.
5. Do not make any changes to the Foreach field.
6. In the **In** field, add the `arrFibonacciNumbers` variable. This activity looks at each individual item in the provided variable.
7. In the **Body** section of the **For Each** activity, add a **Write Line** activity.
8. In the **Text** field, type `"The length of this Fibonacci sequence is " + arrFibonacciNumbers.Length.ToString + " and contains the " + item.ToString + " element."`. This expression enables you to write the total number of array elements and each element of the array in the **Output** panel.

   The final workflow should look as in the following screenshot.



9. Press F5. The workflow is executed. Note that the **Output** panel displays the correct message for each element of the array.

   Note: The `Length` property enables you to find out the total number of array elements.



The Break Activity

The **Break** activity enables you to stop the loop at a chosen point, and then continues with the next activity.

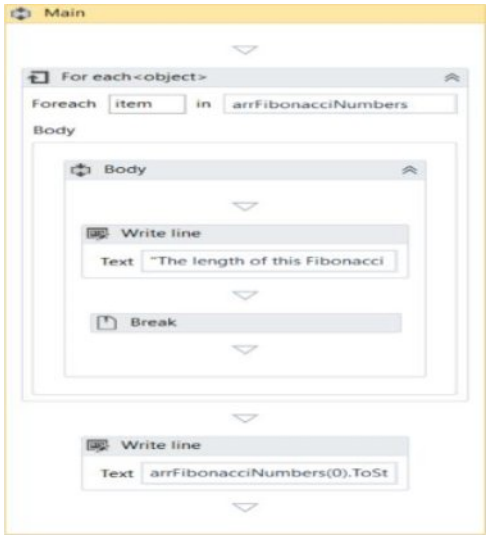
Note: The **Break** activity can only be used within the **For Each** activity.

Example of Using a Break Activity

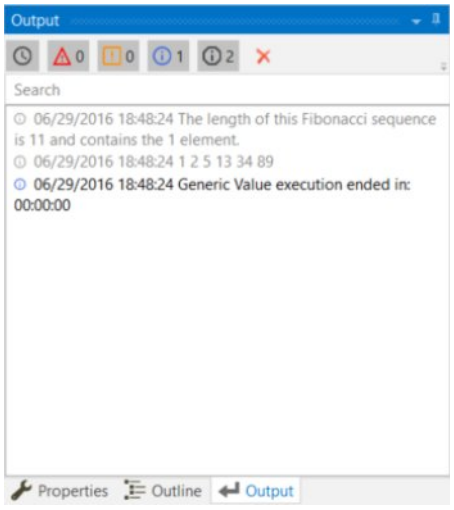
To exemplify how to use the **Break** activity we are going to build upon the workflow created for the For Each activity. This new workflow writes only the first iteration of the loop and a few elements of the array to the **Output** panel.

1. In the **Body** of the **For Each** activity, under the **Write Line**, add a **Break** activity.
2. Under the **For Each**, add a new **Write Line** activity.
3. In the **Text** field, type `arrFibonacciNumbers(0).ToString + " " + arrFibonacciNumbers(2).ToString + " " + arrFibonacciNumbers(4).ToString + " " + arrFibonacciNumbers(6).ToString +" " + arrFibonacciNumbers(8).ToString +" " + arrFibonacciNumbers(10).ToString + " "`. This means that only the indicated elements of the array are going to be written to the **Output** panel.

   The final workflow should look as in the following screenshot.



4. Press F5. The workflow is executed. Note that the **Output** panel only displays the first iteration of the loop and the specified array elements from the **Write Line** activity.



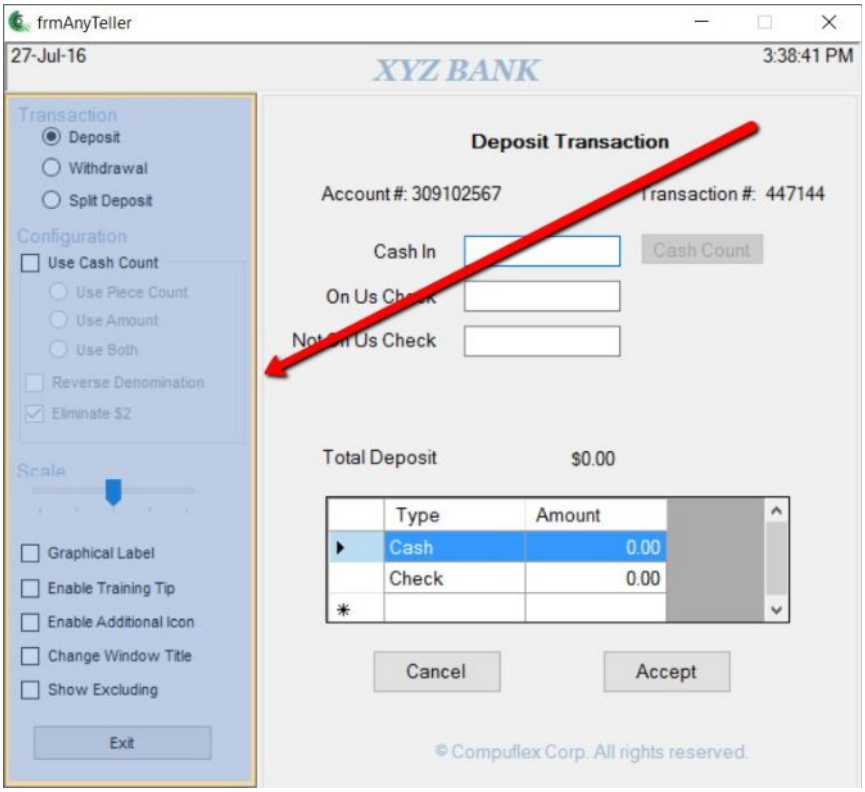
Recordings

About Recording

Recording is an important part of UiPath Studio, that can help you save a lot of time when automating your business processes. This functionality enables you to easily capture a user's actions on the screen and translates them into sequences.

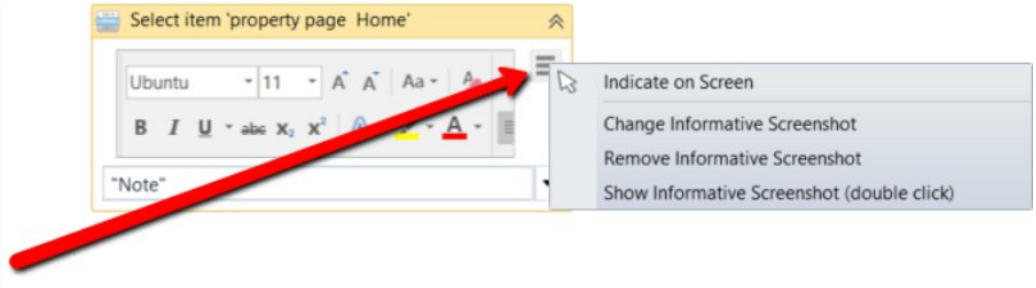
These workflows can be modified and parametrized so that you can easily replay and reuse them in as many other processes as you need.

All user interface elements are highlighted while you record, as you can see in the following screenshot, so that you can be sure the correct buttons, fields or menus are selected.



Interactions with UI elements yield informative screenshots in the workflow. These can be changed, hidden, removed or shown in full size by selecting the respective action from the Options menu.

All screenshots are automatically saved as .png files in the same location as your project, in a separate folder named ".screenshot." By default, the path is: C:\Users\your_user_name\Documents\UiPath\your_project_name\.screenshots.



Regardless of the type of recording selected, some actions are recordable and some are not.

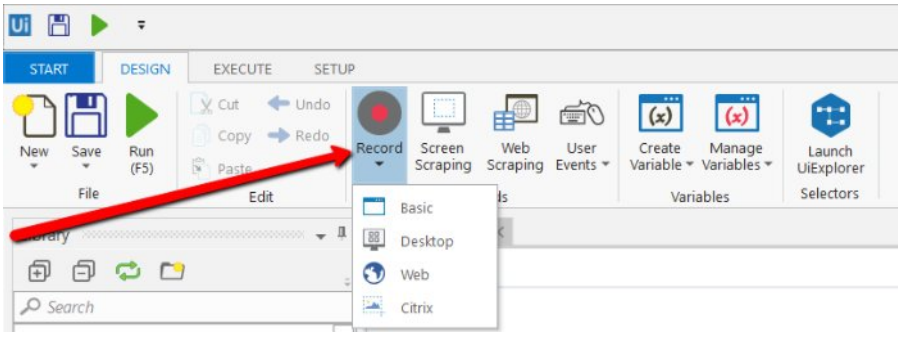
Recordable	Non-recordable
• Left-click on buttons, check boxes, drop-down lists and other GUI elements • Text typing	• Keyboard shortcuts • Modifier keys • Right-click • Mouse hover

About Recording Types

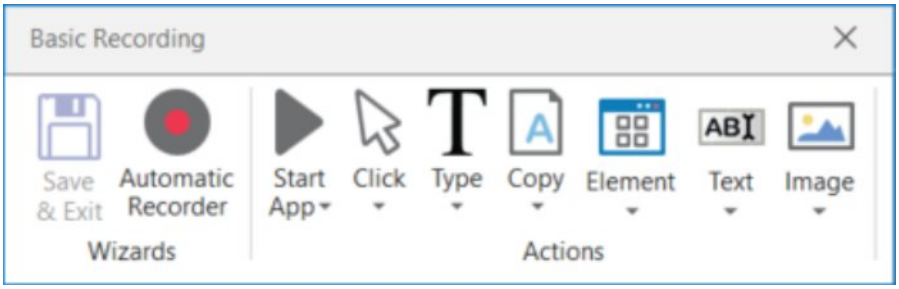
There are four types of recordings available in UiPath Studio:

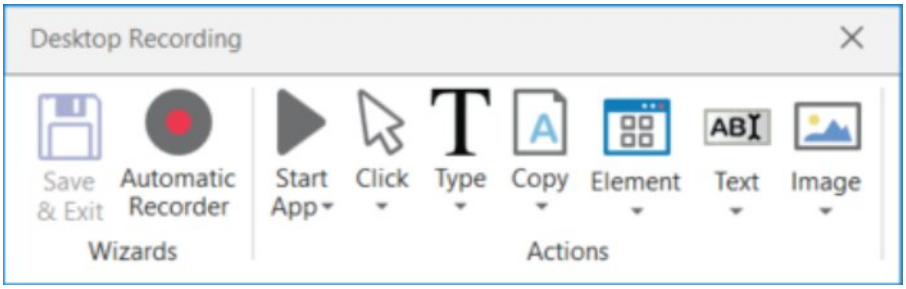
- **Basic** – generates a full selector for each activity and no container, the resulted workflow is slower than one that uses containers and is suitable for single activities.
- **Desktop** – suitable for all types of desktop apps and multiple actions; it is faster than the Basic recorder, and generates a container (with the selector of the top level window) in which activities are enclosed, and partial selectors for each activity.
- **Web** – designed for recording in web apps and browsers (supported: Internet Explorer, Google Chrome), generates containers and uses the **Simulate Type/Click**input method by default.
- **Citrix** – used to record virtualized environments (VNC, virtual machines, Citrix, etc.) or SAP, permits only image, text and keyboard automation, and requires explicit positioning.

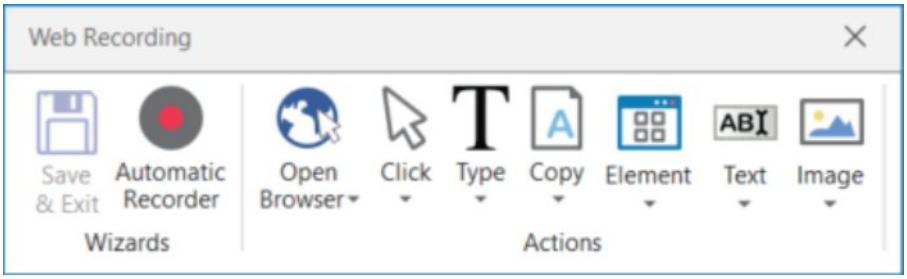
To see all the available types of recordings and select the one most suited for your workflow, click **Record**, in the **Wizards** group of the **Design** ribbon tab.



All recording types come with their own controllers (or toolbar) that give you access to actions particular to each environment, but also some common ones.

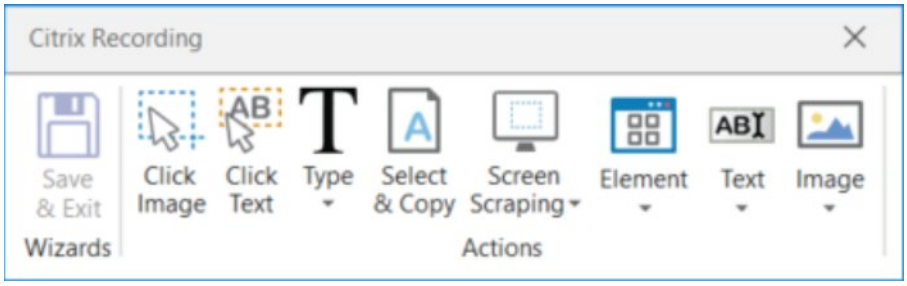






The **Desktop**, **Basic** and **Web Recording** toolbars are quite similar and enable you to:

- Automatically record multiple actions performed on the screen
- Manual recording (single actions):
  - Start or close an application or web browser
  - Click an interface element
  - Select an option from a drop-down list
  - Select a check box
  - Simulate keystrokes or keyboard shortcuts
  - Copy text from a UI element or perform screen scraping
  - Look for elements or wait for them to vanish
  - Find an image
  - Activate a window



The **Citrix Recording** toolbar enables you to:

- Click an image or text
- Simulate keystrokes or hotkeys
- Select and copy text from a window
- Scrape UI elements
- Look for elements or wait for them to vanish
- Find an image or wait for it to vanish
- Activate a window

Note: The Citrix Recording toolbar supports only manual recording (single actions).

To figure out if you should use automatic or manual recording in your workflow, you should better understand the differences between them and their capabilities.

Automatic Recorder	Manual Recorder
• Left-clicks on windows, buttons, check boxes, drop-down lists etc. • Text typing	• Keyboard shortcuts • Modifier keys • Right-click • Mouse hover • Getting text • Find elements and images • Copy to Clipboard

Keyboard shortcuts that you can use:

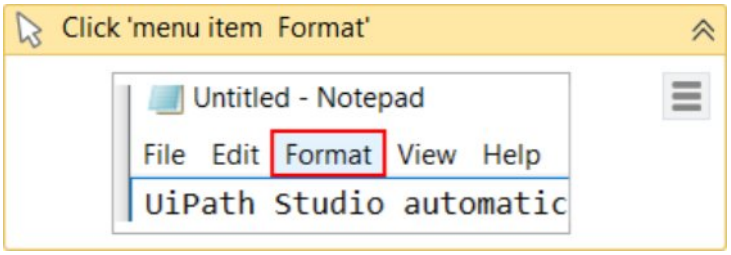
- F2 – pauses for 3 seconds. A countdown timer is displayed in the bottom left corner of the screen. Can be useful with menus that automatically hide.
- Esc – exits the automatic or manual recording. If you press the Escape key again, the recording is saved as a sequence, and you return to the main view.
- Right-click – exit the recording.

Automatic Recording

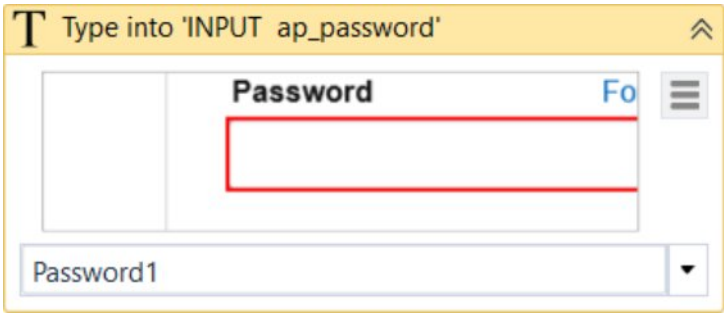
Automatic recording is very useful and time-saving as it can provide you with a skeleton for your business processes, and can be easily customized and parametrized.

As you can see in the examples below, for the actions that are recordable with the **Automatic Recording**, some activities are automatically generated:

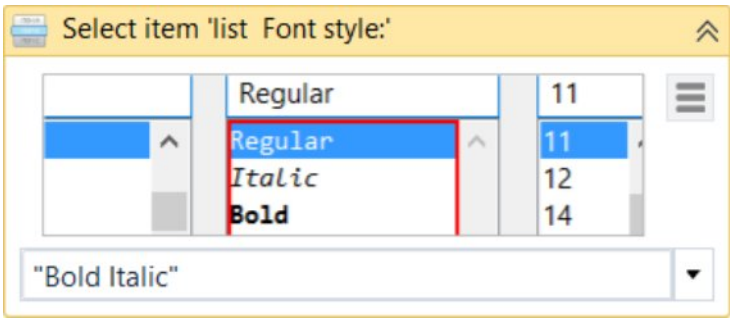
- **Click** – it is generated when you click a button (Basic and Desktop) or a link (Web). The options available in the **Properties** panel enable you to add a time delay before or after the action, change the click type and add key modifiers.



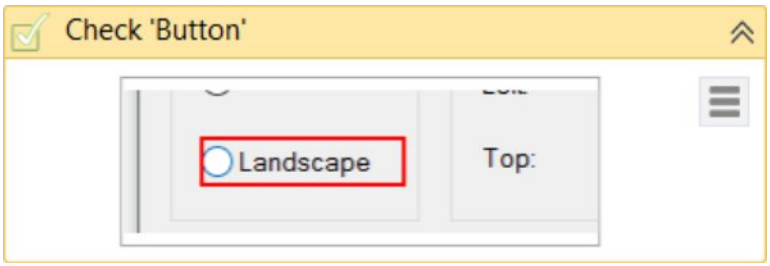
- **Type Into** – generated when typing into a text field or any editable UI element. The options available in the **Properties** panel enable you to add a time delay before or after the action or between key strokes, change the text at any point, and erase the entire field before writing to it (**EmptyField**).



- **Select Item** - generated when you select an item from a drop-down list or combo box. The options available in the **Properties** panel enable you to add a time delay before or after the action, and change the selected item.



- **Check** - generated when a radio button or check box is clicked. The options available in the **Properties** panel enable you to add a time delay before or after the action, and select or unselect the check box.

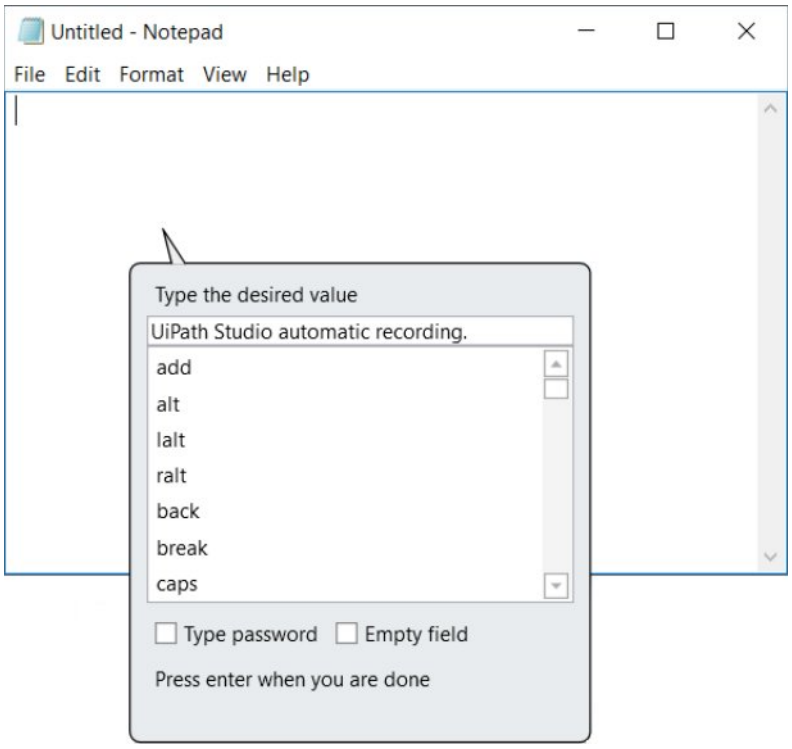


Example of Automatic Recording with Basic and Desktop

To exemplify how you can use the automatic recording and understand more about the differences between **Basic** and **Desktop**, let's create the same workflow for the two.

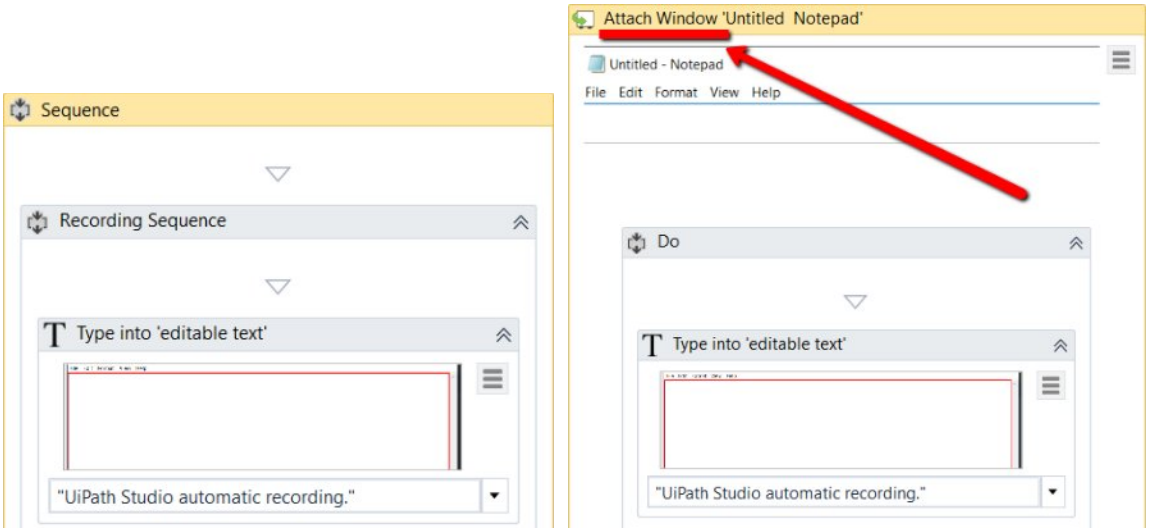
1. Open Notepad.
2. In UiPath Studio, create a new sequence.
3.
   a. In the **Design** ribbon tab, in the **Wizards** group, **select Record > Basic**. The **Basic Recording** toolbar is displayed and the main view is minimized.
   b. In the **Design** ribbon tab, in the **Wizards** group, **select Record > Desktop**. The **Desktop Recording** toolbar is displayed and the main view is minimized.

4. In the **Wizards** group, click **Automatic Recorder**. The automating recording process starts.
5. In Notepad, click in the main panel. A pop-up window is displayed.

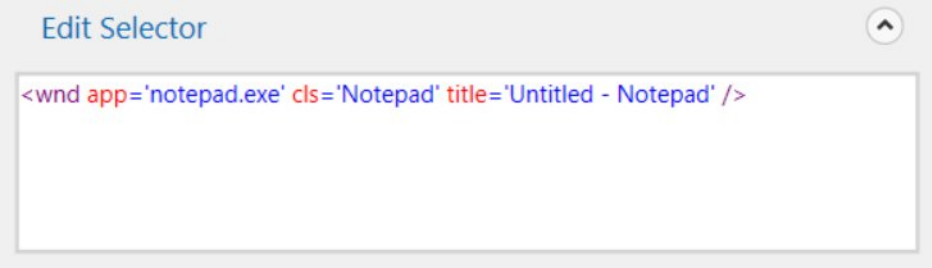


6. Type a custom text and press Enter. The string is displayed in Notepad.
7. **Note:** Select the **Empty field** check box to delete previously existing text. You can also select this option after the recording is finished, in the **Properties** panel of the **Type Into** activity.
8. From the **Format** menu, select **Font**. The **Font** window is displayed.
9. Select a different font style, such as Bold Italic, and click **OK**.
10. Press Esc two times. You exit the recording view and the saved workflow is displayed in the **Main** panel.
11. Press F5. The workflow is executed as expected.

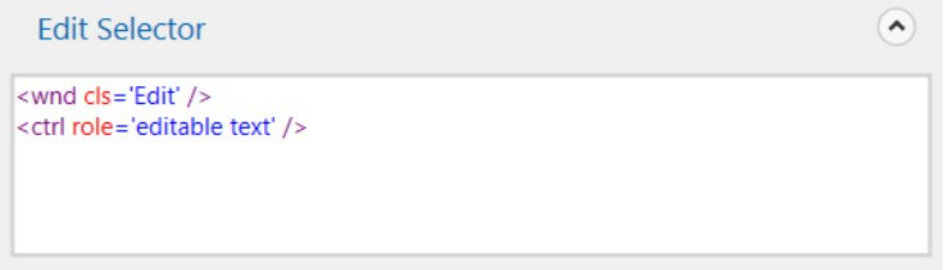
The two screenshots below display part of the resulted workflows for the **Basic** (on the left) and **Desktop** (on the right) automatic recordings. As you can see, the second one generates an **Attach Window** container, while the **Desktop** one does not.



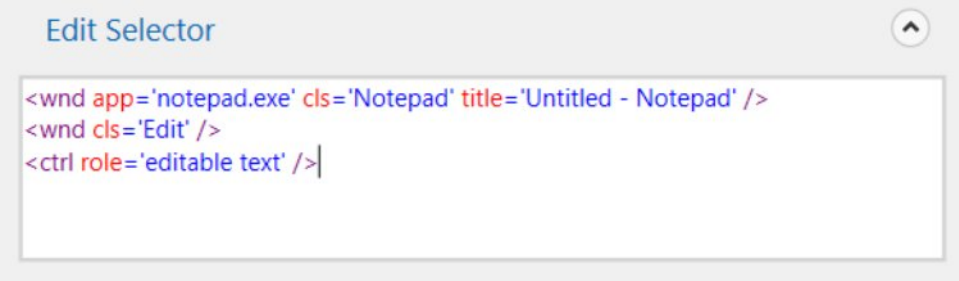
Desktop recorder - The top level window selector from the **Attach Window** container:



Desktop recorder - The partial selector for the **Type Into** activity:



Basic recorder – The full selector for the **Type Into** activity:



Click here to download the Basic recording example.

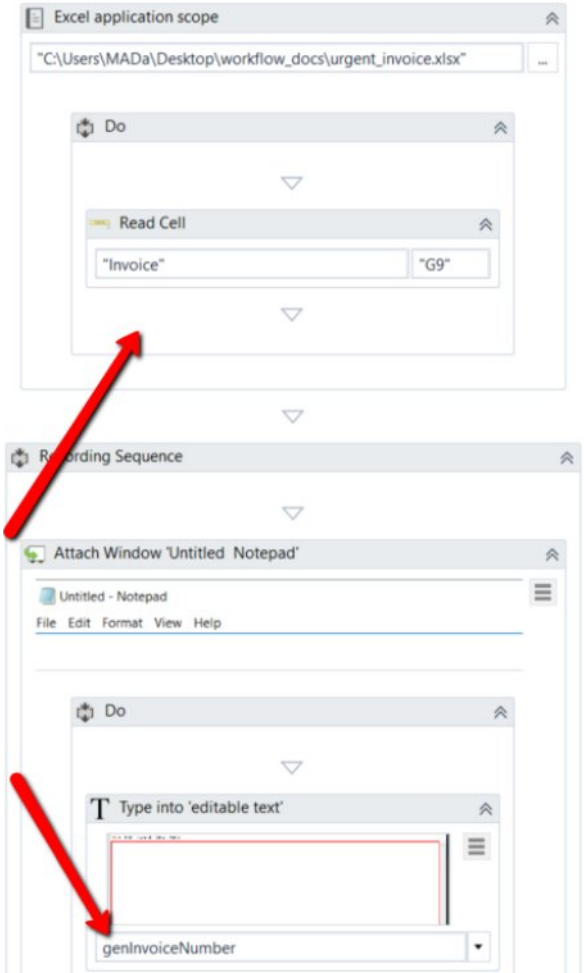
Click here to download the Desktop recording example.

You can also customize and parametrize this workflow after it is recorded. To exemplify this, let's take the **Desktop** recording example and build upon it.

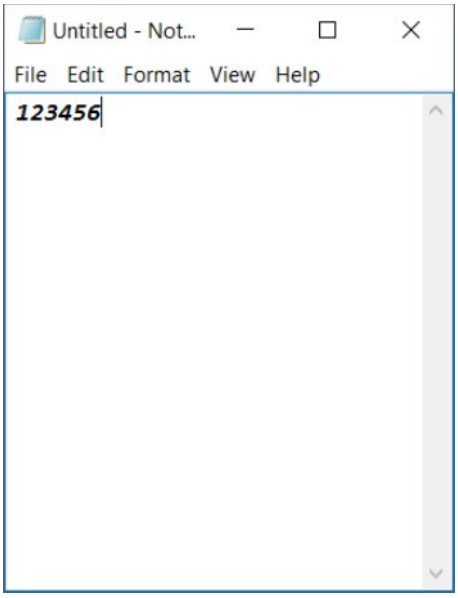
For example, let's assume that we want to extract the number of an invoice from an Excel file, copy it to the Notepad window used in the previous example and continue the workflow as before.

1. Add an **Excel Application Scope** activity before the recording sequence.
2. In the **WorkbookPath** field, type the path of the Excel file you need to extract information from.
3. Add a **Read Cell** activity in the **Excel Application Scope**.
4. In the **Properties** panel, add the **Sheet Name** and **Cell** information from the Excel file used.
5. Right-click in the **Result** field, and click **Create Variable**. The **Set Name** field is displayed.
6. Fill in the name, such as `genInvoiceNumber`, and press Enter. The variable is created and displayed in the **Result** field and **Variables**
7. Change the scope of the variable to **Main**.
8. In the recording sequence, in the **Type Into** activity, in the **Text** field, add the **genInvoiceNumber** variable. This copies the value stored in the variable to Notepad.

   What was added to the workflow should look as in the following screenshot.



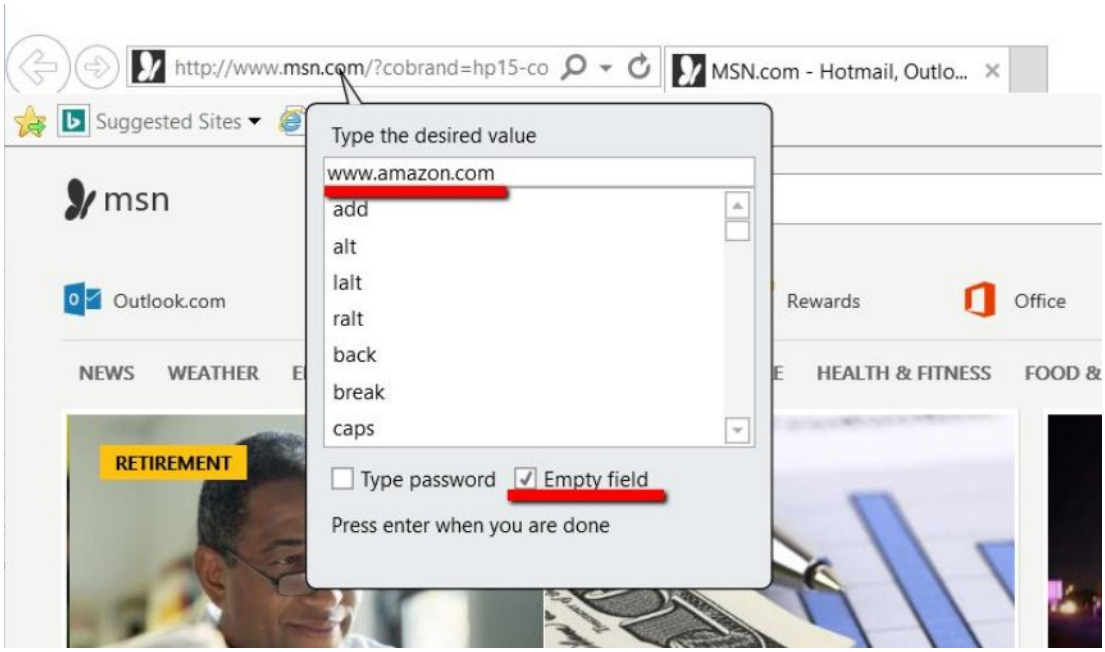
9. Press F5. The workflow is executed as expected.



Example of Automatic Recording with Web

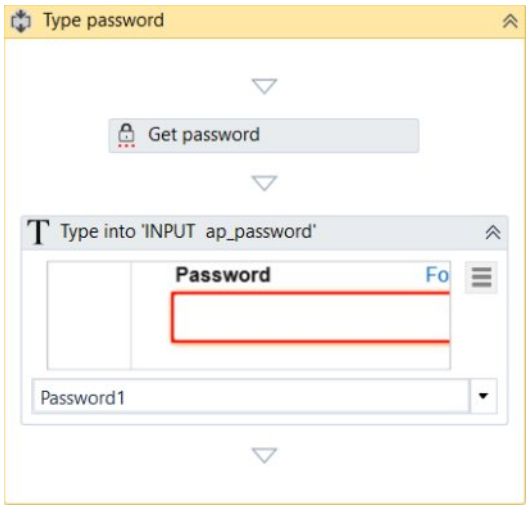
To exemplify how you can use the web recording and understand how it works, let's create a workflow that enables you to go to Amazon and sign in to your account.

1. Open an Internet Explorer instance.
2. In UiPath Studio, create a new sequence.
3. In the **Design** tab, in the **Wizards** group, select **Record** > **Web Recording**. The **Web Recording** toolbar is displayed and the main view is minimized.
4. Click **Automatic Recording**. The automating recording process starts.
5. Navigate to www.amazon.com.



6. Go to the Sign In page and input your e-mail and password.

Note: When the **Type Into** pop-up is displayed for your password, make sure that you select the **Type Password** check box. Besides the **Type Into** activity, another activity, **Get Password**, is created in the sequence. This activity hides the password behind asterisks (*) and stores it in a string variable.



7. Click **Sign In** and press Esc two times. The recording is saved and displayed as a workflow in the **Main** panel.
8. Close and open Internet Explorer manually.
9. In Studio, press F5. The workflow is executed as expected.

As you can see, the workflow requires you to close and open Internet Explorer manually. If you want to automate this part too, you need to manually add the **Open Browser** and **Close Tab** activities at the begging and end of the workflow.

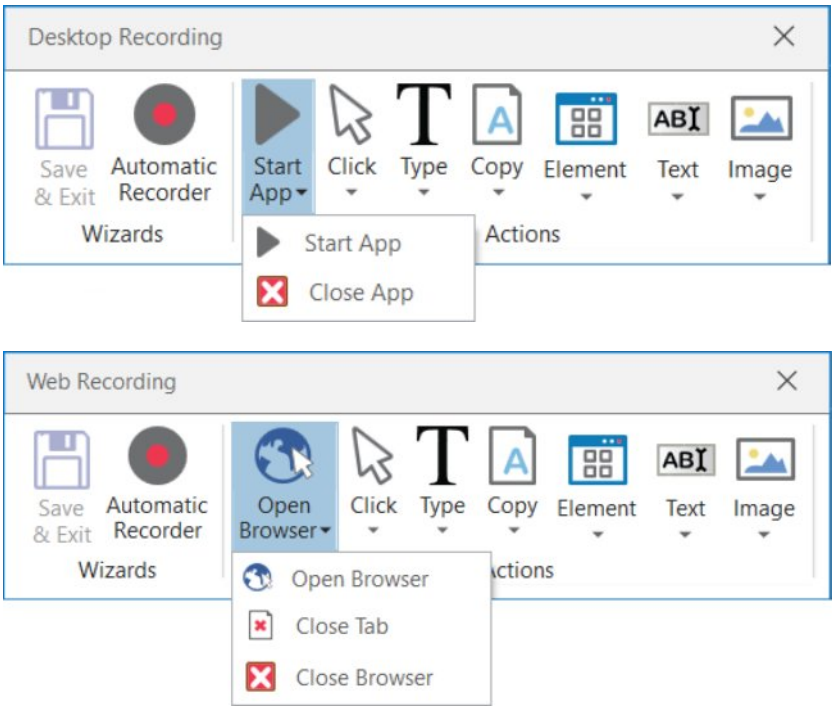
Manual Recording

As explained in the About Recording Types chapter, there are some actions that cannot be handled by the automatic recorder. We refer to these as single actions or manual recordings.

You can use both manual and automatic recording in workflows to achieve full automation of a task. Single actions can be found in the **Actions** group of any recording toolbar.

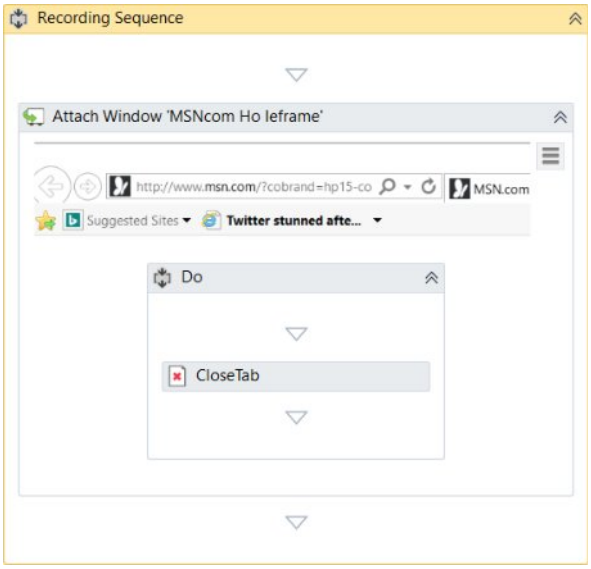
Types of Single Actions

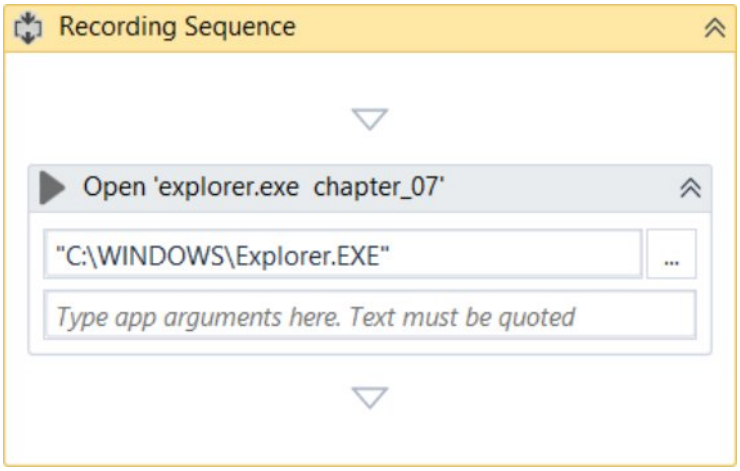
1. Start and Stop an App or Browser



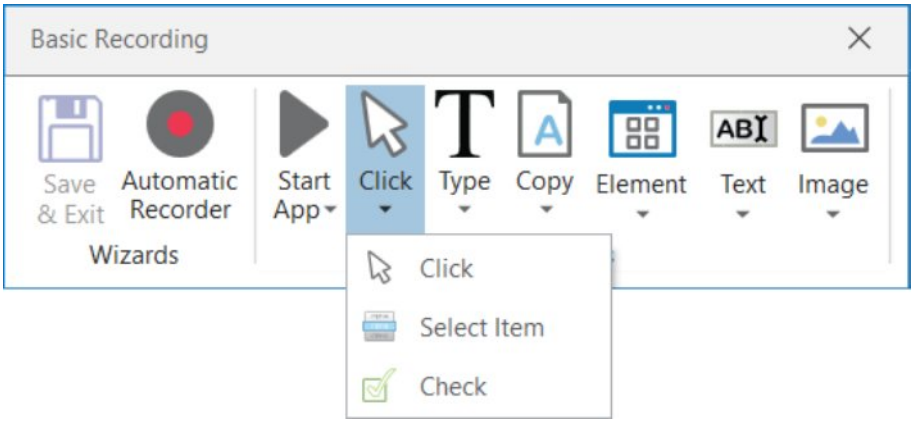
These single actions enable you to open an app or browser, as well as close them, by pointing and clicking them.

The activities generated using the desktop and web manual recorders contain partial selectors and containers (first screenshot), while the activities generated by the basic recorder contains a full selector and no container (second screenshot), just like with the automatic recording.



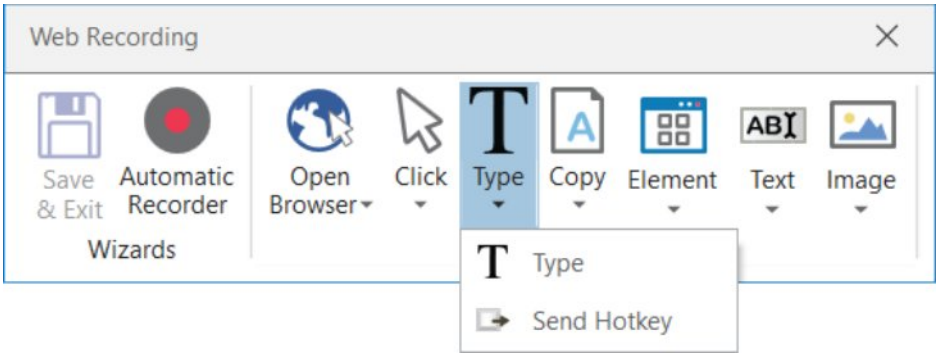


2. Click

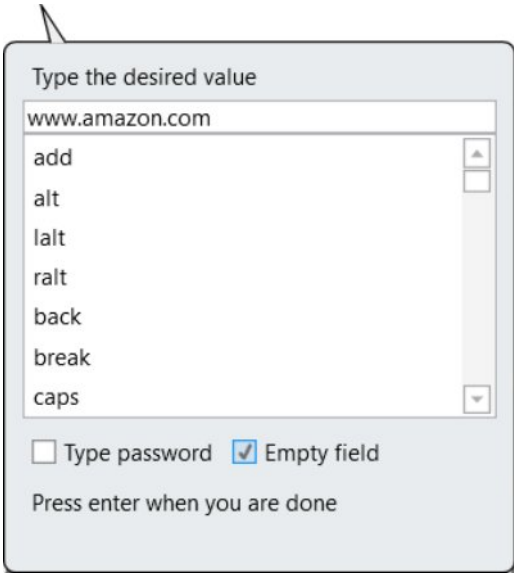


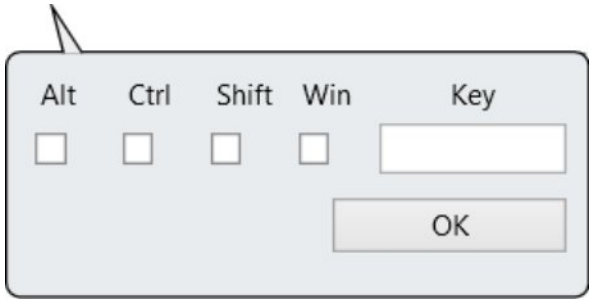
These types of actions enable you to record clicks on the desktop or a running application, select an option from a drop-down list or combo box, and select a check box or a radio button.

3. Type

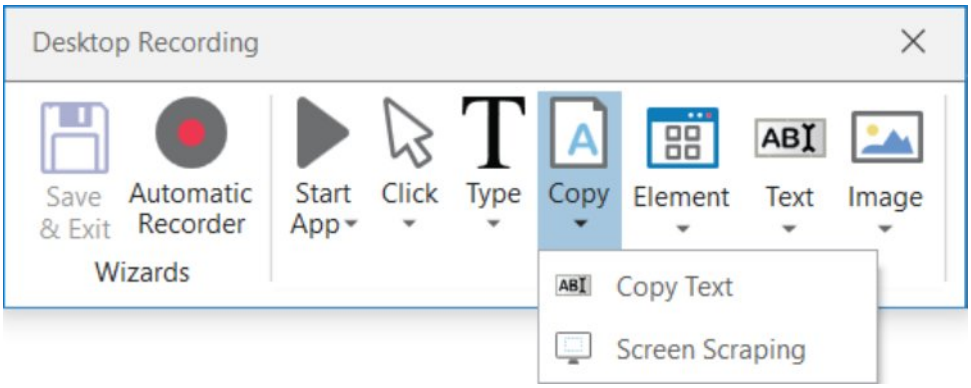


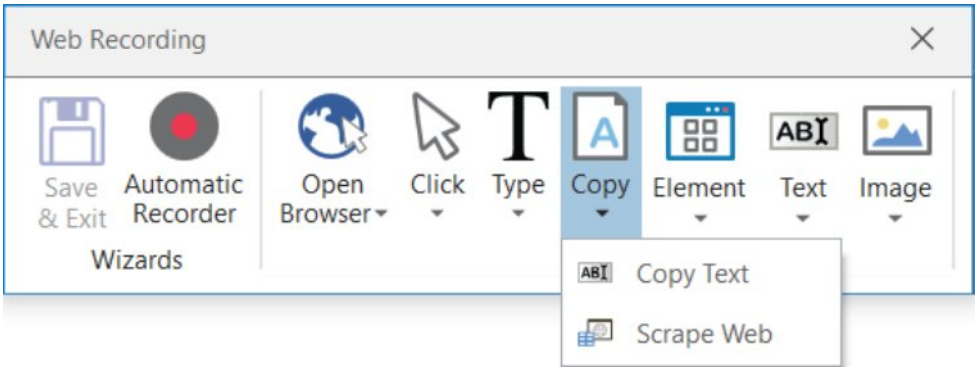
These single actions include those that require input from the keyboard, such as keyboard shortcuts and keypresses. To achieve this, two pop-up windows are used to retrieve your keyboard input.





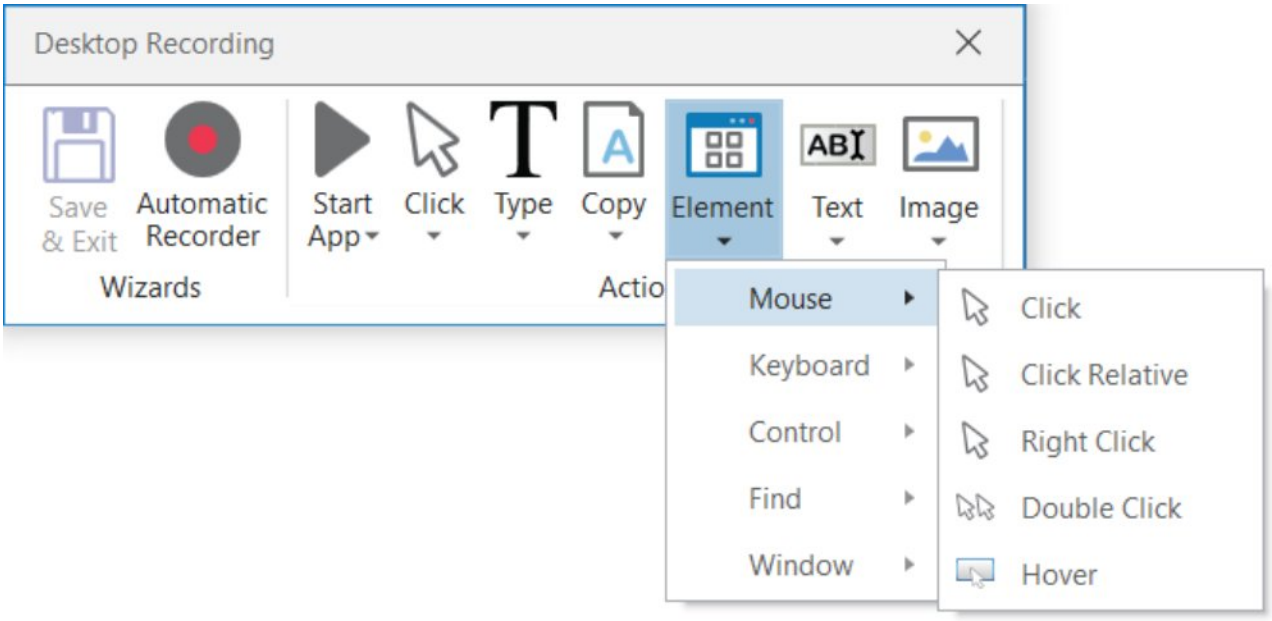
4. Copy





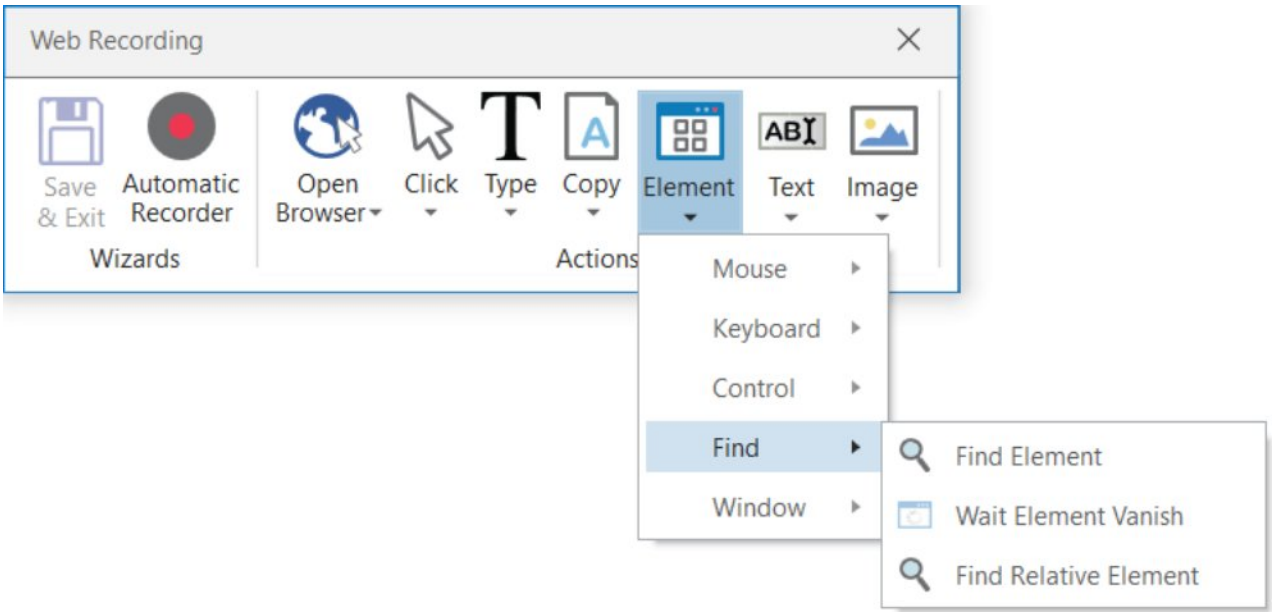
These actions enable you to copy a selected text from an opened application or web browser, so that you can use it later in the workflow. Screen scraping is also available under the **Copy** menu, as it enables you to extract images and text from an app or browser.

5. Mouse Element



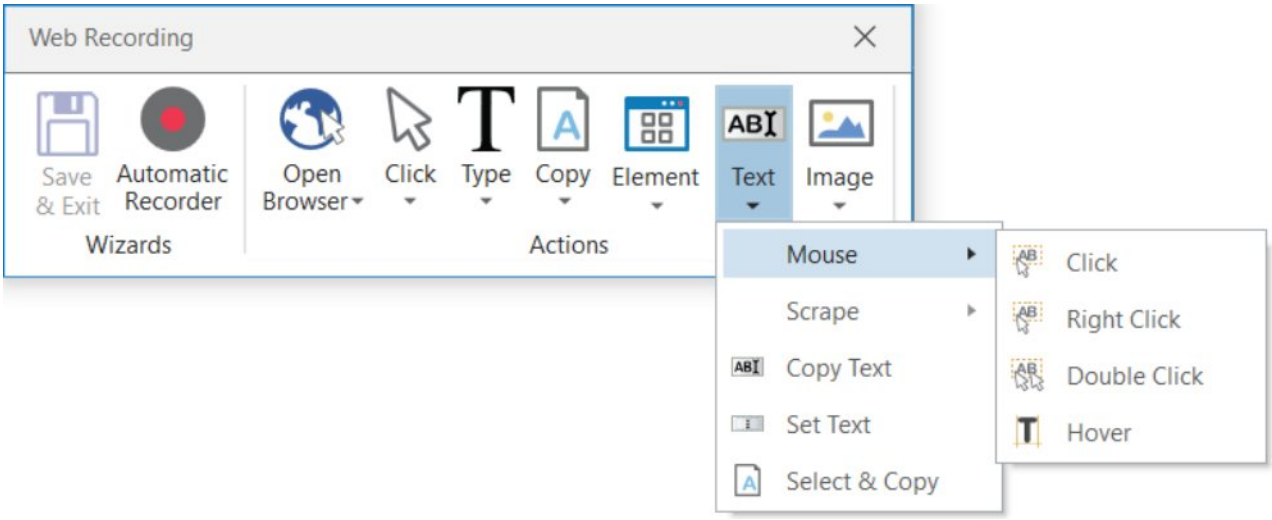
These types of actions enable you to simulate mouse movements that cannot be recorded but give you access to more functionalities, such as right-clicking, hovering or double-clicking.

6. Find Element



These types of single actions enable you to identify specific UI elements or pause the workflow until a particular window closes or an UI element is no longer displayed. The find relative element action is useful with apps that do not allow direct interaction with UI elements, such as Citrix.

7. Text



Text single actions enable you to select or hover over text to make tooltips visible for scraping, right-click to make the context menu visible, copy and paste text and many others.

8. Image

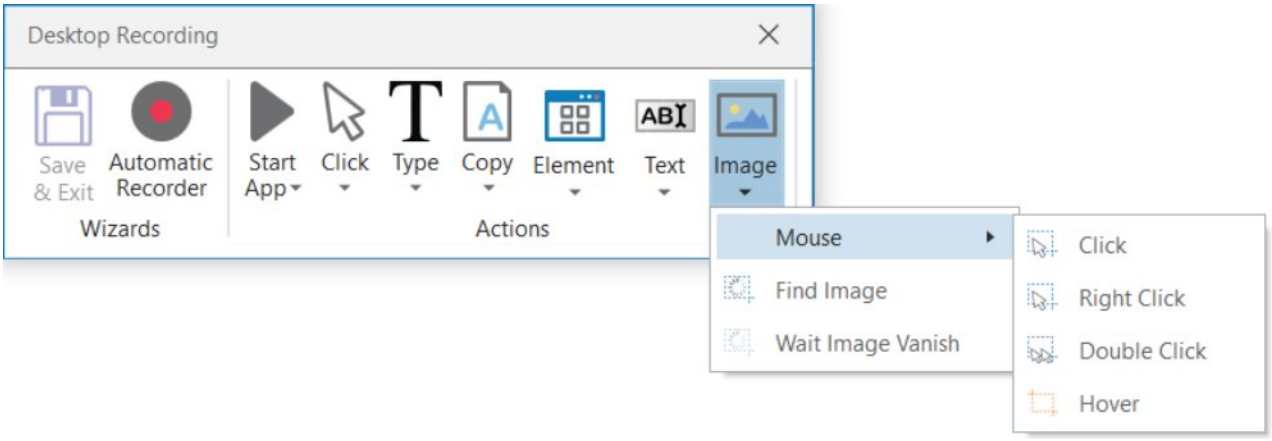


Image single actions enable you to wait for a specified image to disappear, to find a specific image in an app or website, right-click or hover over an image and others. This type of manual recording can be useful with UI elements that are saved as graphics, as they cannot be highlighted as normal fields or text.

UI Elements

About UI Elements

UI elements refer to all graphical user interface pieces that construct an application, be they windows, check boxes, text fields or drop-down lists, and so on. Knowing how to interact with them enables you to implement UI automation much faster and easier.

All interactions with the UI can be split into input and output. This categorization helps you better understand which actions to use in different scenarios, when to use them, and the technology behind them. These are also going to be useful when trying to deal with scraping. For more information, see Input Methods and Output or Screen Scraping Methods.

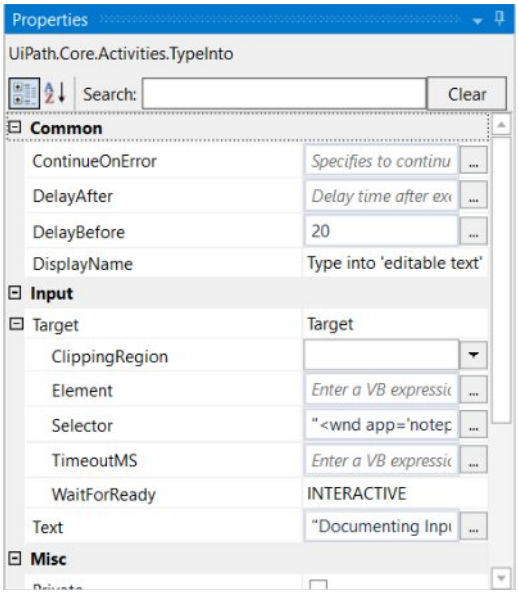
Input Actions	Output Actions
• Clicks • Text Typing • Keyboard shortcuts • Right-clicks • Mouse hover • Clipboard actions • Etc.	• Getting text • Finding elements and images • Clipboard actions • Etc.

UI Activities Properties

There are multiple activities that can be used to automate apps or web-apps and you can find them in the **Activities** panel, under the **UI Automation** category.

All of these activities have multiple properties in common:

- **ContinueOnError** – specifies if the workflow should continue, even if the activity throws an error. This field only supports boolean values (True, False).
- **DelayAfter** – adds a pause after the activity, in milliseconds.
- **DelayBefore** – adds a pause before the activity, in milliseconds.
- **TimeoutMS** – specifies the amount of time (in milliseconds) to wait for a specified element to be found before an error is thrown. The default value is 30000 milliseconds (30 seconds).
- **WaitForReady** – wait for the target to become ready, before performing the activity. There are three available options:
  - **None** – does not wait for the target to be ready.
  - **Interactive –** waits until only a part of the app is loaded.
  - **Complete –** waits for the entire app to be loaded.
- **Target** – identifies the UI element the activity works with.



The target is composed of multiple pieces, namely the container, selector and clipping region, to ensure that you correctly identify a UI element.

A container gives you a little more context for the button or field you want to use, so that you can tell windows apart or different areas of the same app. They are automatically generated, but you can make changes to them in the **Properties** panel.

The following are containers:

- **Attach Window**
- **Open Application**
- **Attach Browser**
- **Open Browser**
- **Get Active Window**

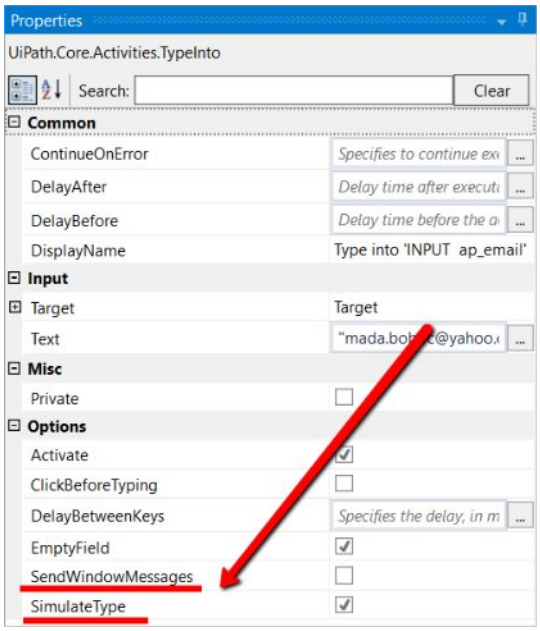
Input Methods

Input actions require you or the robot to directly interact with an opened application or web page. There are three types of input methods for click and type actions, that differ in terms of compatibility and capability.

We generally recommend the **Simulate Type/Click** method as it is the fastest of the three and works in the background, but only if you do not need to send special keyboard shortcuts. If this does not work for you, try the **Windows Messages** method and then the **Default** one, as it is the slowest.

Method\Capability	Compatibility	Background execution	Speed	Hotkey Support	Auto Empty Field
Default	100%	no	50%	yes	no
Window Messages	80%	yes	50%	yes	no
Simulate Type/Click	99% - web apps 60% - desktop apps	yes	100%	no	yes

The input method can be changed at any point from the **Properties** panel of the selected activity. If the **SimulateType** or **SendWindowMessages** check boxes are not selected, then the **Default** method is applied.

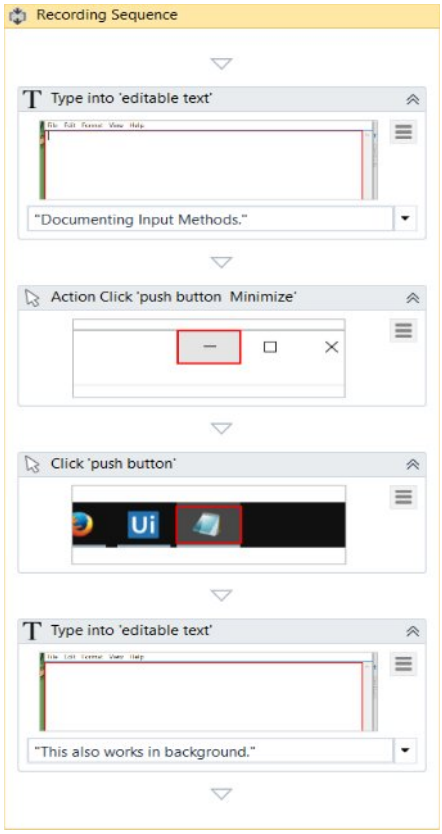


The **Default** application simulates a click or type with the help of the hardware driver, while the **Simulate Type/Click** method uses the technology of the target application. Lastly, the **SendWindowMessages** works by sending a specific message directly to the target application.

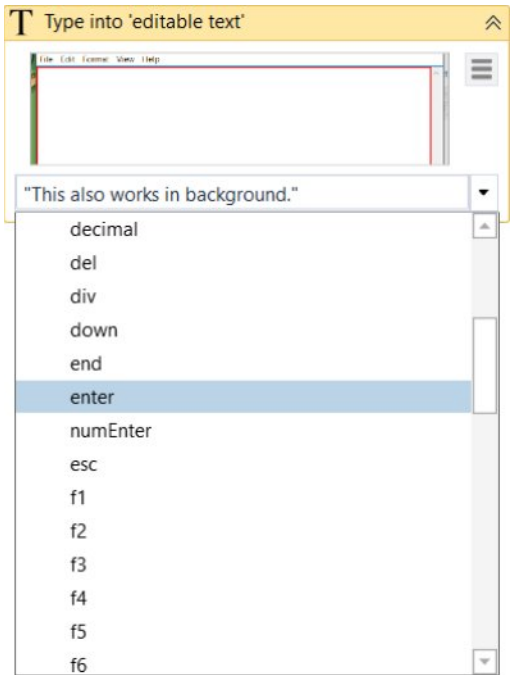
Example of Using Input Methods

To get a clearer picture of how the three input methods work, let's create a simple workflow that writes something in a Notepad window and switch between the methods.

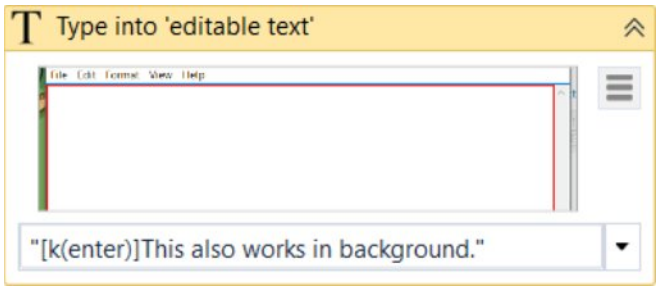
1. Open a Notepad window.
2. In Studio, from the **Basic Recording** toolbar, start the automatic recorder.
3. Type something into the Notepad window.
4. Minimize the window and restore it.
5. Type something else in the Notepad window.
6. Press Esc two times. The workflow is saved and displayed in the **Main** panel. It should look as in the following screenshot.



7. Move the activity that restores the Notepad window after the second **Type Into** one. We do this to check if the type of input method selected can also write to Notepad in background mode.
8. From the drop-down of the second **Type Into** activity, select **enter**. A special key string is displayed at the end of the previously-existing text.

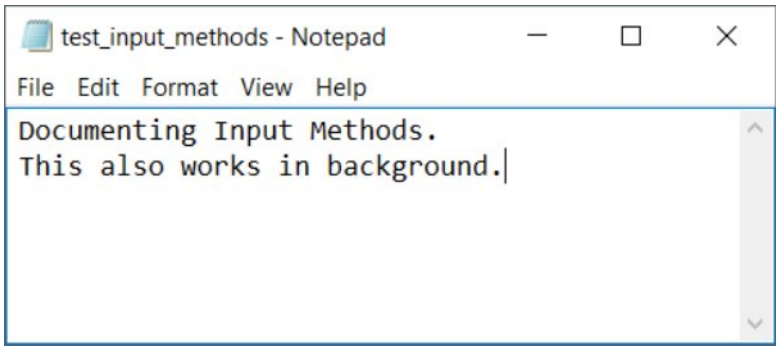


9. Copy the special key string at the beginning of the sentence. This enables you to test special keys, such as Enter that adds a new line in a text editor.

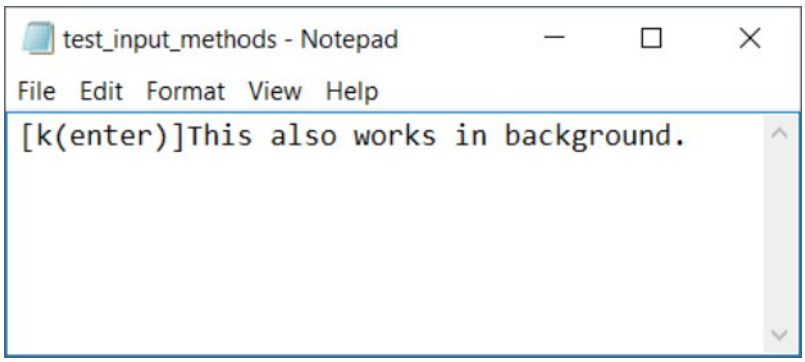


10. Run the workflow once with every input method. Note the differences:

    - The **Default** method – it does not automatically erase previously written text, supports special keys, but writing in the background does not work;
    - The **Window Messages** method – works in the background, supports special keys, but it does not erase pre-existing text (you have to manually select the **Empty Field** check box in the **Properties** panel);



    - The **Simulate Type/Click** method – works in the background, but it automatically erases pre-existing text, and does not support special keys.



Therefore, be careful to choose the method that best suits your needs. If special keys are a must, you might want to avoid the **Simulate Type/Click** method, or if speed is what matters most, then maybe **Simulate Type/Click** is the right one.

Output or Screen Scraping Methods

Output or screen scraping methods refer to those activities that enable you to extract data from a specified UI element or document, such as a .pdf file.

To understand which one is better for automating your business process, let's see the differences between them.

Method\Capability	Speed	Accuracy	Background Execution	Extract Text Position	Extract Hidden Text	Support for Citrix
FullText	10/10	100%	yes	no	yes	no
Native	8/10	100%	no	yes	no	no
OCR	3/10	98%	no	yes	no	yes

FullText is the default method, it is fast and accurate, yet unlike the **Native** method, it cannot extract the screen coordinates of the text.

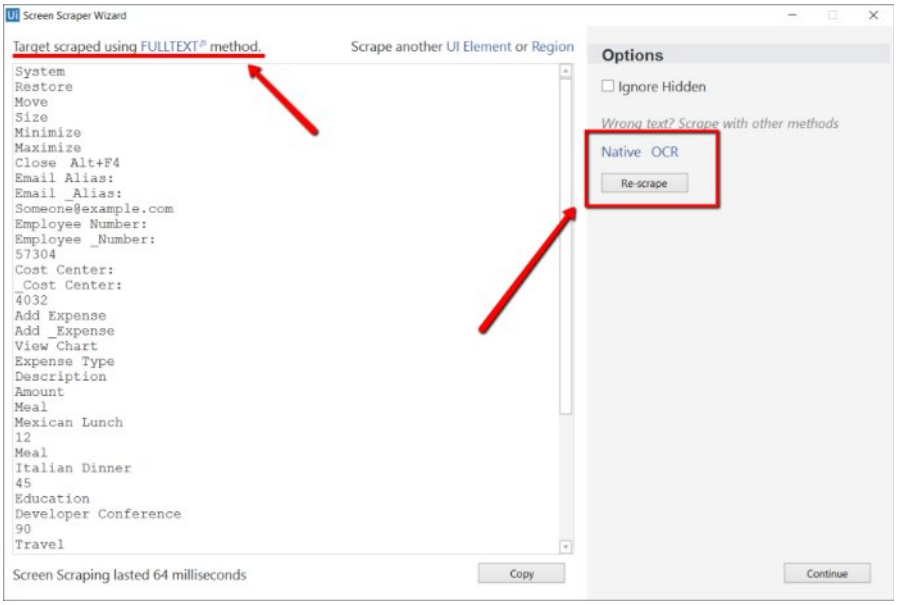
Both these methods work only with desktop applications, but the **Native** method cannot work with apps that are not built to render text with the Graphics Device Interface (GDI).

OCR is not 100% accurate, but can be useful to extract text that the other two methods could not, as it works with all applications including Citrix. Studio uses two OCR engines, by default: Google Tesseract and Microsoft Modi.

Method\Capability	Multiple languages support	Preffered area size	Support for color inversion	Set expected text format	Filter allowed characters	Best with Microsoft fonts
Google Tesseract	Can be added	Small	yes	yes	yes	no
Microsoft Modi	Supported by default	Large	no	no	no	yes

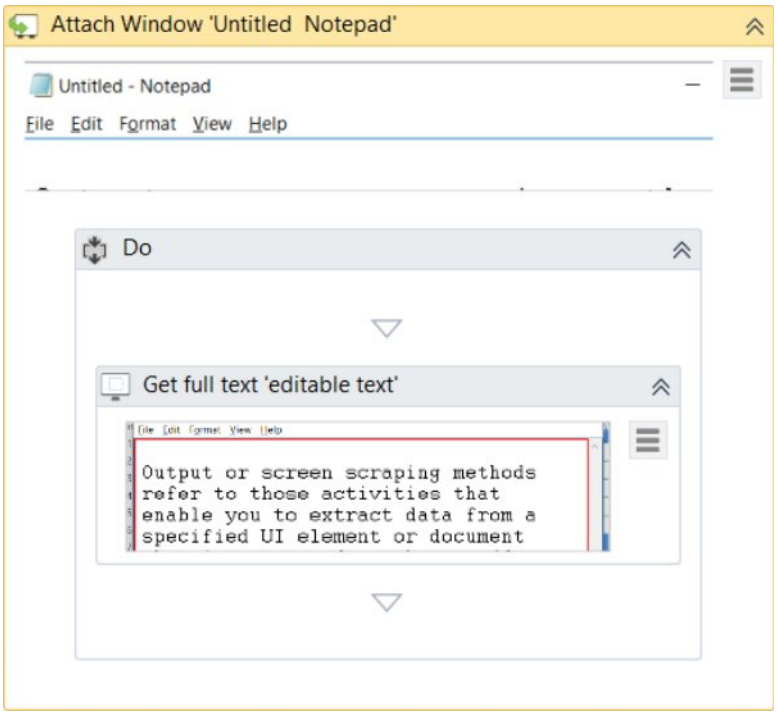
To start extracting text from various sources, click the **Screen Scraping** button, in the **Wizards** group, on the **Design** ribbon tab.

The screen scraping wizard enables you to point at a UI element and extract text from it, using one of the three output methods described above. Studio automatically choses a screen scraping method for you, and displays it at the top of the **Screen Scraper Wizard**window.



To change the method of screen scraping, select another one from the **Options** panel and then click **Re-scrape**.

When you are satisfied with the scraping results, click **Continue** or **Copy**. The latter option copies the extracted text to the Clipboard, while the first one saves your information to the **Main** panel and, just as with desktop recording, generates a container (with the selector of the top level window) in which activities are enclosed, and partial selectors for each activity.



Each type of screen scraping comes with different features in the **Screen Scraper Wizard**, in the **Options** panel:

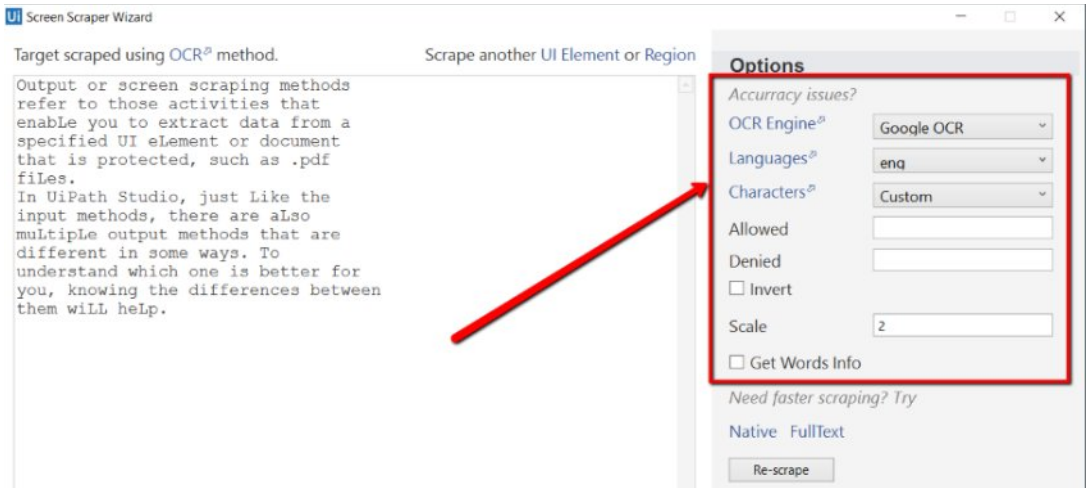
FullText

- **Ignore Hidden** – when this check box is selected, the hidden text from the selected UI element is not copied.

Native

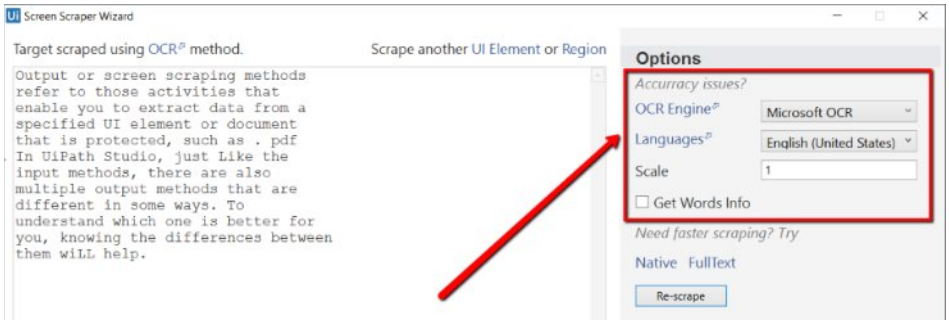
- **No Formatting** – when this check box is selected, the copied text does not extract formatting information from the text. Otherwise, the extracted text's relative position is retained.
- **Get Words Info** – when this check box is selected, Studio also extracts the screen coordinates of each word. Additionally, the **Custom Separators** field is displayed, that enables you to specify the characters used as separators. If the field is empty, all known text separators are used.

Google OCR



- **Languages** – only English is available by default.
- **Characters** – enables you to select which types of characters to be extracted. The following options are available: **Any character**, **Numbers only**, **Letters**, **Uppercase**, **Lowercase**, **Phone numbers**, **Currency**, **Date** and **Custom**. If you select **Custom**, two additional fields, **Allowed** and **Denied**, are displayed that enable you to create custom rules on which types of characters to scrape and which to avoid.
- **Invert** - when this check box is selected, the colors of the UI element are inverted before scraping. This is useful when the background is darker than the text color.
- **Scale** – the scaling factor of the selected UI element or image. The higher the number is, the more you enlarge the image. This can provide a better OCR read and it is recommended with small images.
- **Get Words Info** – gets the on-screen position of each scraped word.

Microsoft OCR



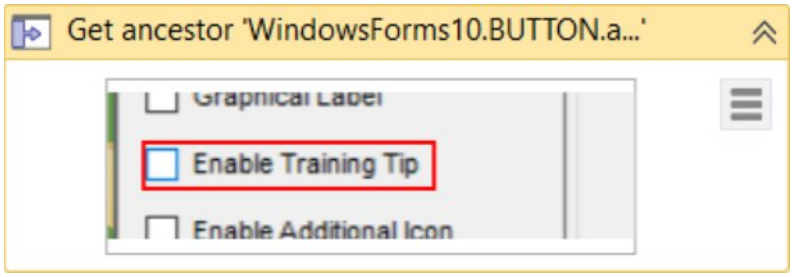
- **Languages** - enables you to change the language of the scraped text. By default, English is selected.
- **Scale** – the scaling factor of the selected UI element or image. The higher the number is, the more you enlarge the image. This can provide a better OCR read and it is recommended with small images.
- **Get Words Info** - gets the on-screen position of each scraped word.

Besides getting text out of an indicated UI element, you can also extract the value of multiple types of attributes, its exact screen position and its ancestor.

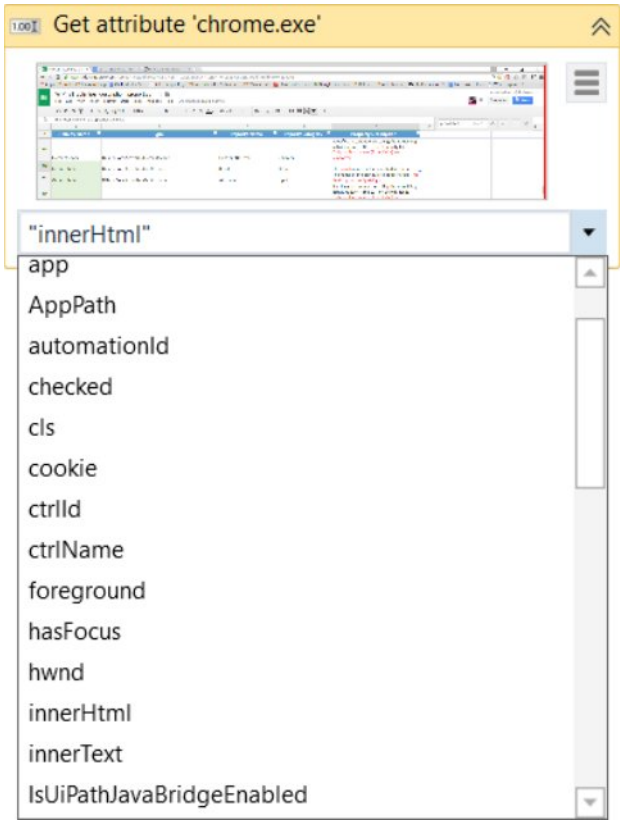
This type of information can be extracted through dedicated activities that are found in the **Activities** panel, under **UI Automation > Element > Find** and **UI Automation > Element > Attribute**.

These activities are:

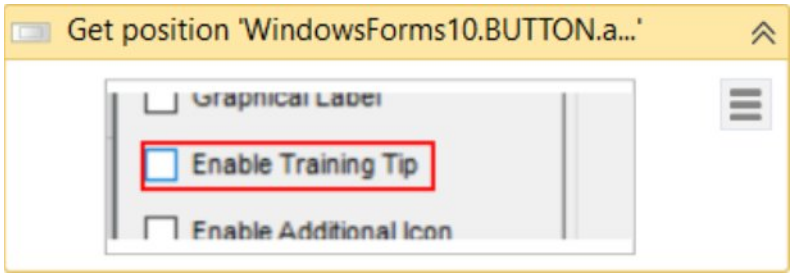
- **Get Ancestor** – enables you to retrieve an ancestor from a specified UI element. You can indicate at which level of the UI hierarchy to find the ancestor, and store the results in a UiElement variable.



- **Get Attribute** – retrieves the value of a specified UI element attribute. Once you indicate the UI element on screen, a drop-down list with all available attributes is displayed.

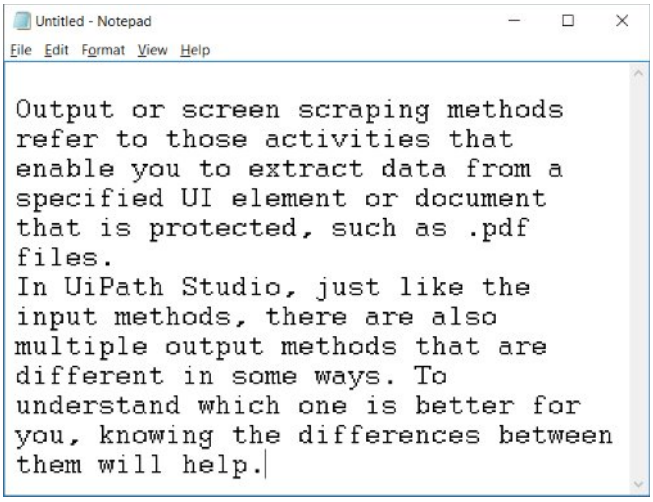


- **Get Position** – retrieves the bounding rectangle of the specified UiElement, and supports only Rectangle variables.

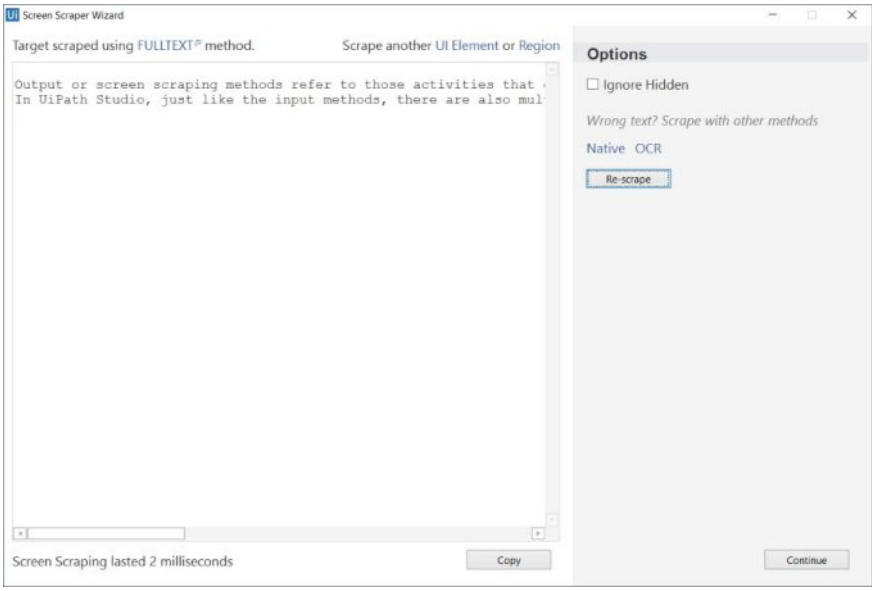


Examples of Using Output or Screen Scraping Methods

To exemplify how to use the three screen scraping methods and the practical differences between them, let's first scrape a Notepad window with some text and see what results we have. The following screenshot is what we used.

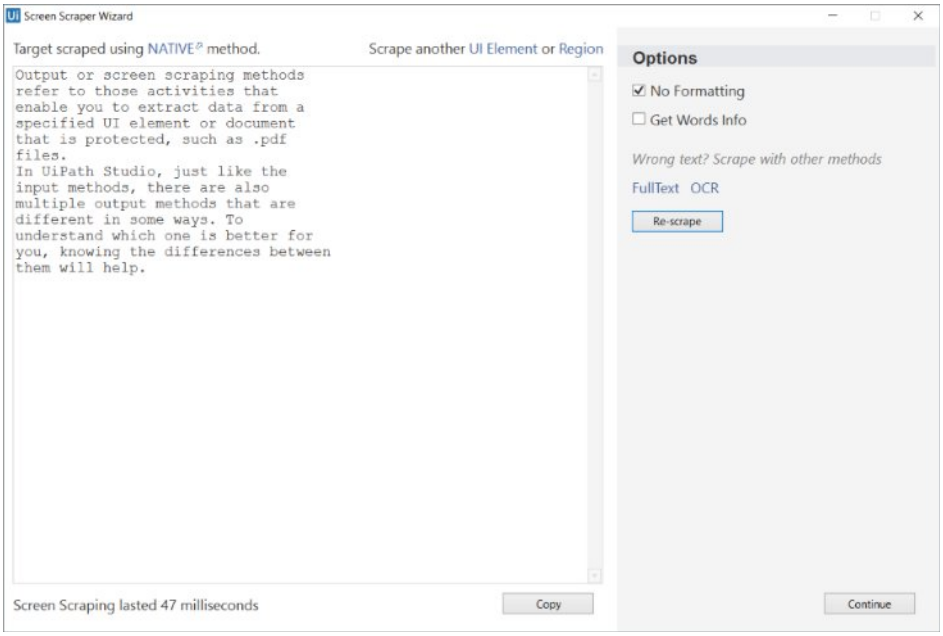


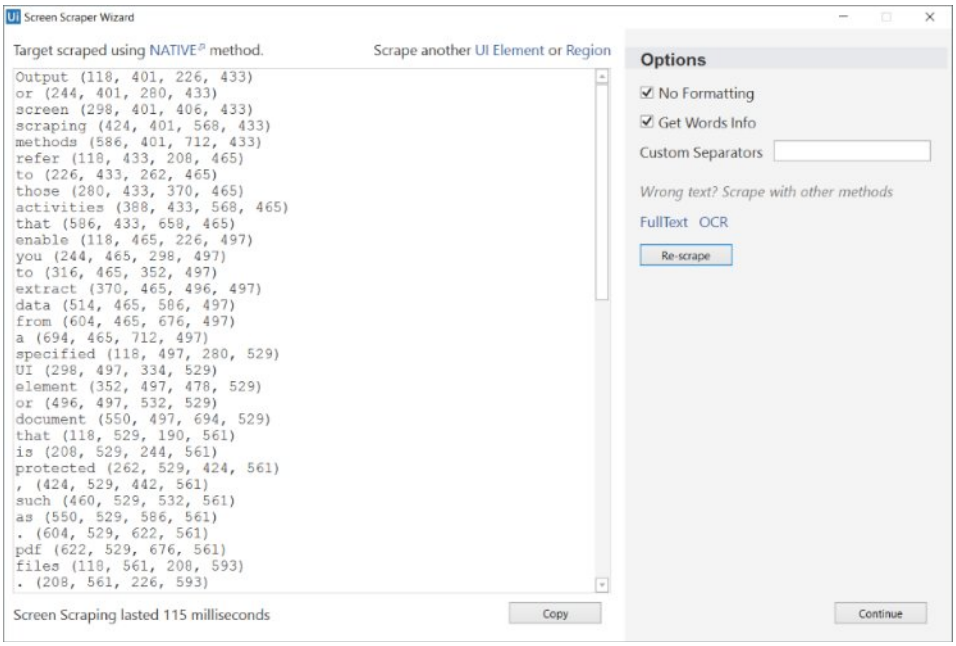
The FullText method



As you can see, no formatting is retained, but if you hide the Notepad window while scraping, the text is still retrieved. This is the fastest method.

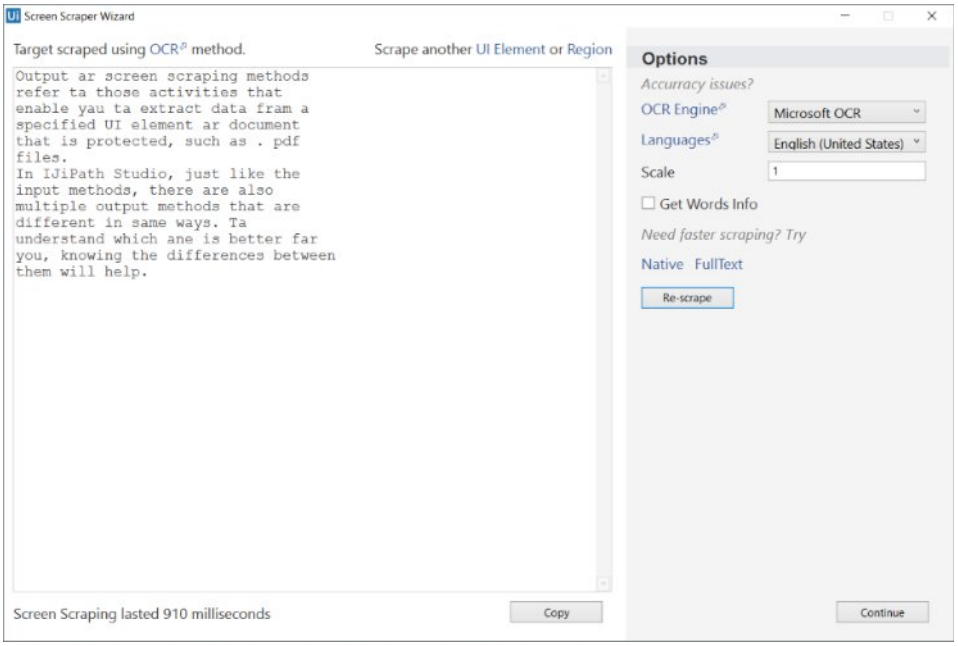
The Native method





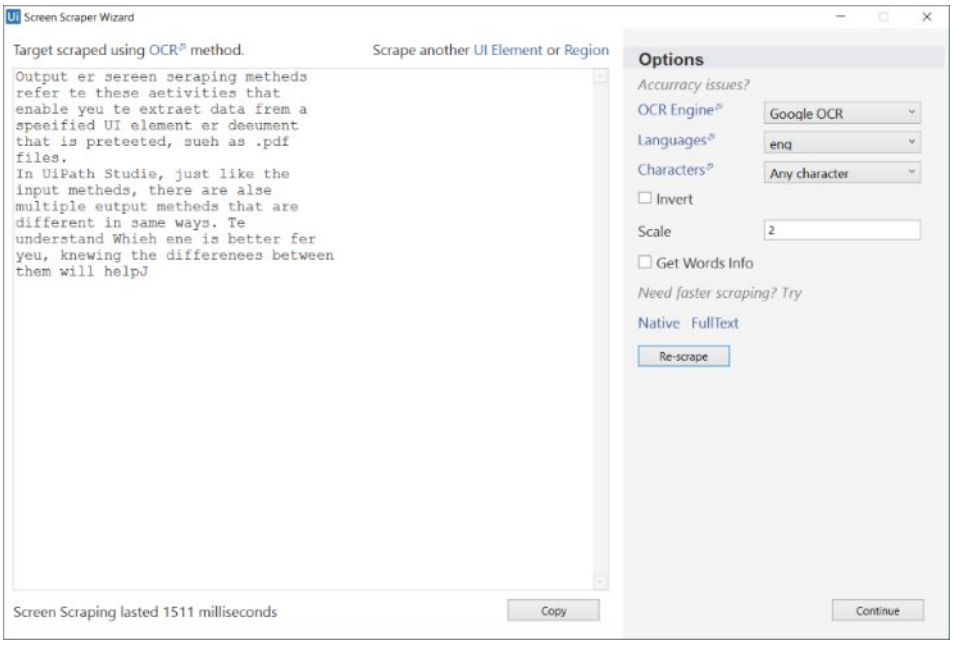
As you can see in the first screenshot, you can extract the text with its position on the screen, as well as retrieve the exact position of each word (second screenshot).

The Microsoft OCR method



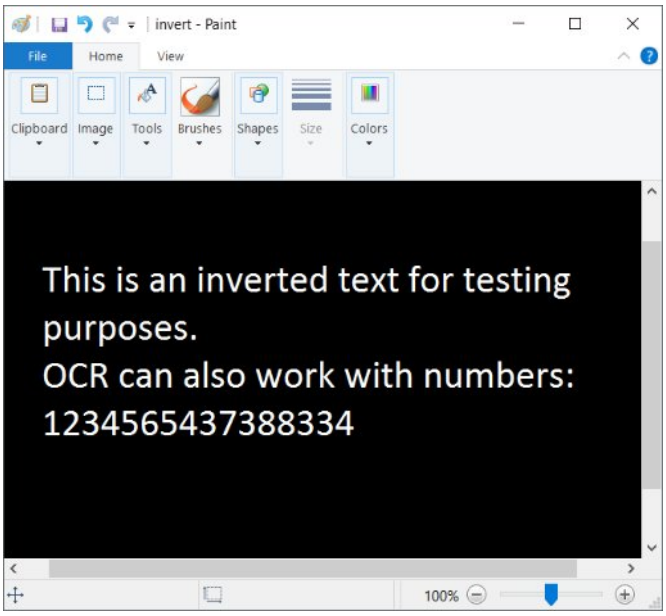
As you can see, the accuracy of this output method is not 100%, but it still manages to keep the position of the text. Getting the exact on-screen position, in pixels, is also available yet as you can see, it is not the fastest of the output methods.

The Google OCR method

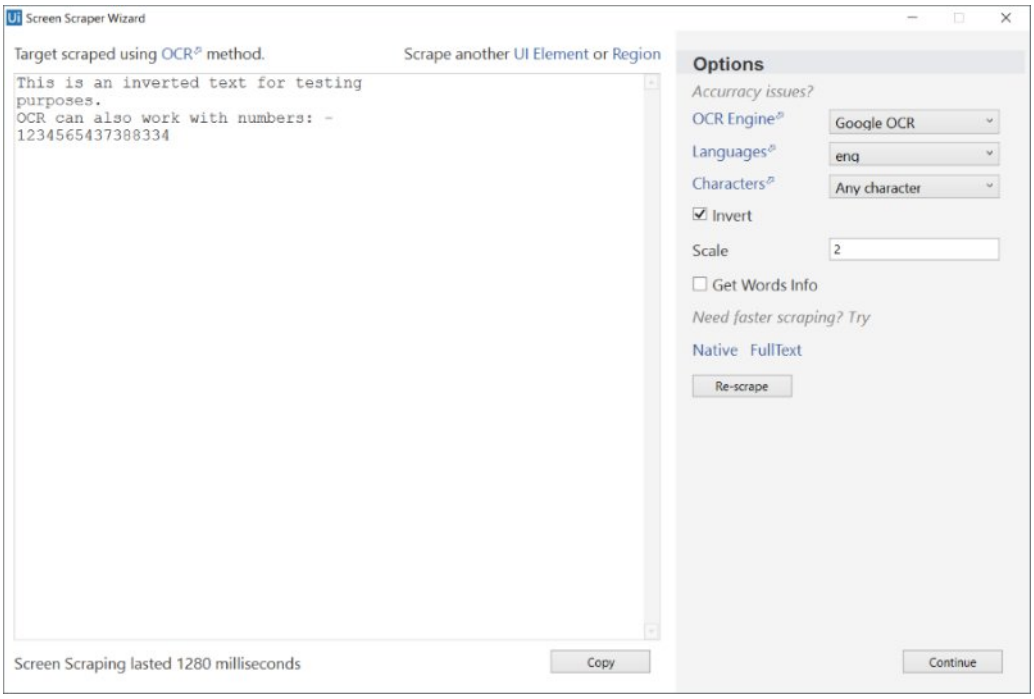


As with Microsoft's Modi, the Google OCR method is not 100% accurate and takes longer when compared with the others. However, it retrieves the position within the window of the text.

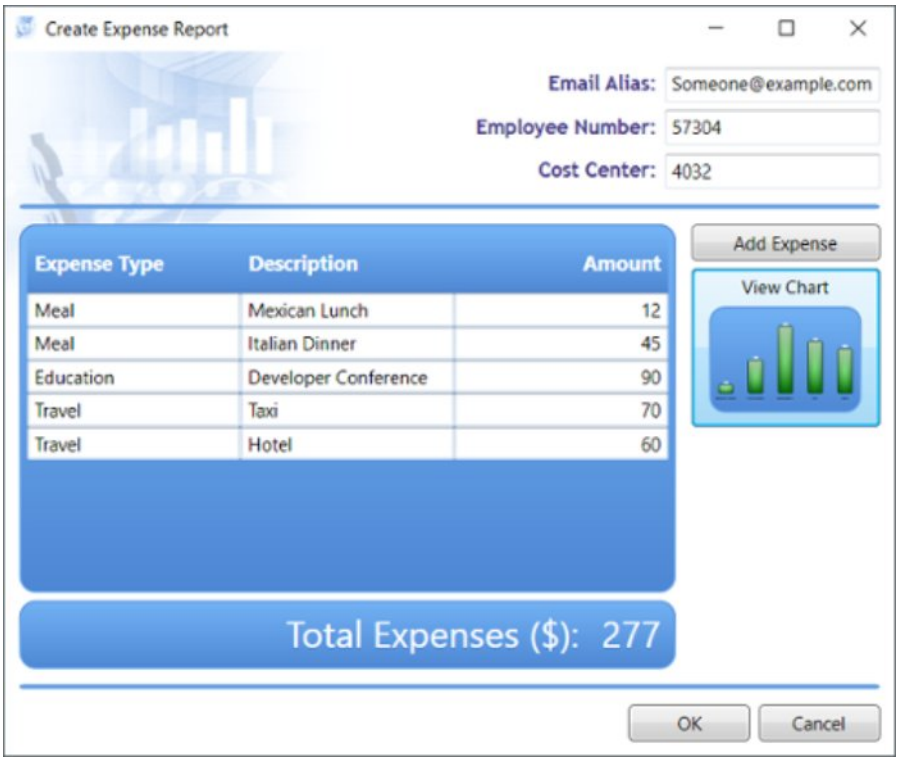
Now, add some white text over a black page in Paint, for example, and try to scrape it.



As you can see, only the OCR methods work in this scenario.

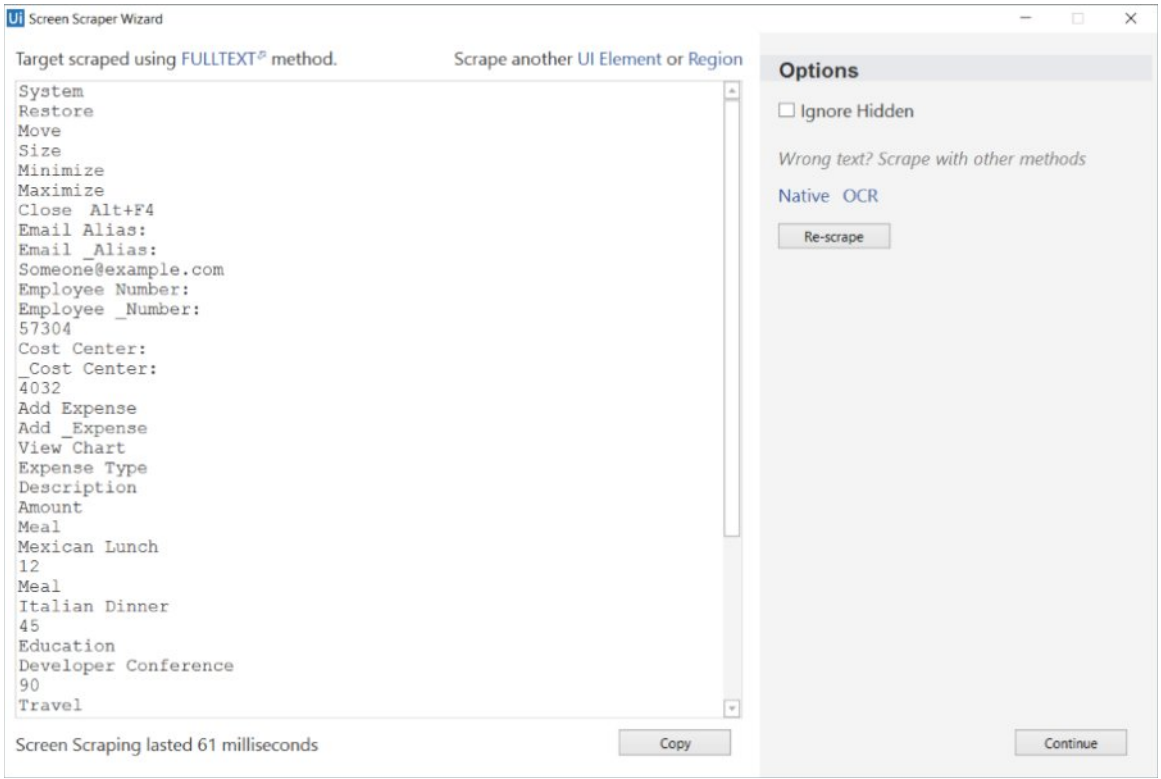


Now let's try scraping an application and see the results. We use a dummy expense app, which you can [download here.]

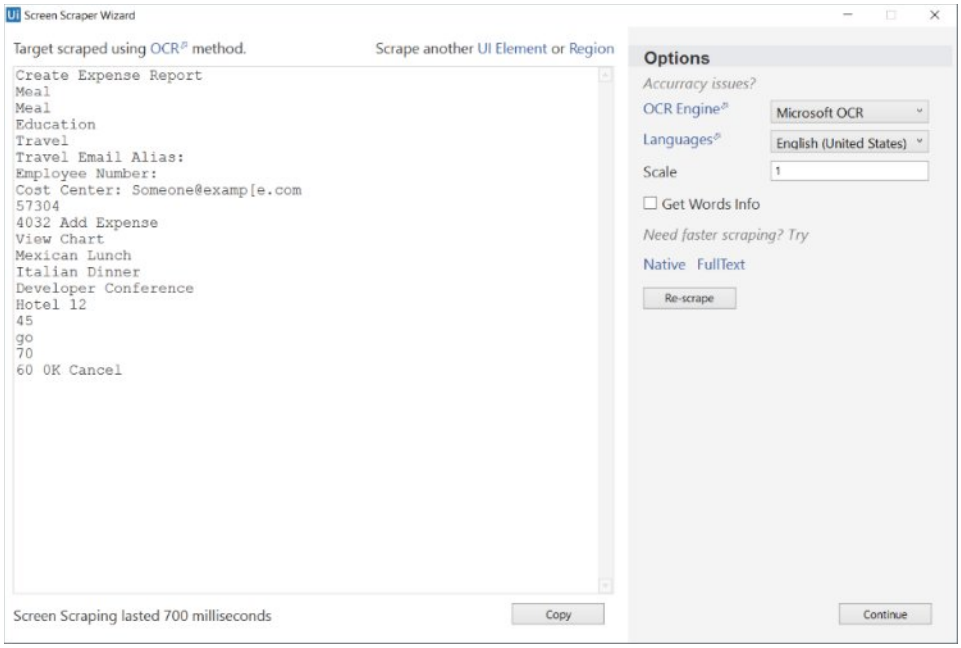


If we scrape this entire window, we receive the following results:

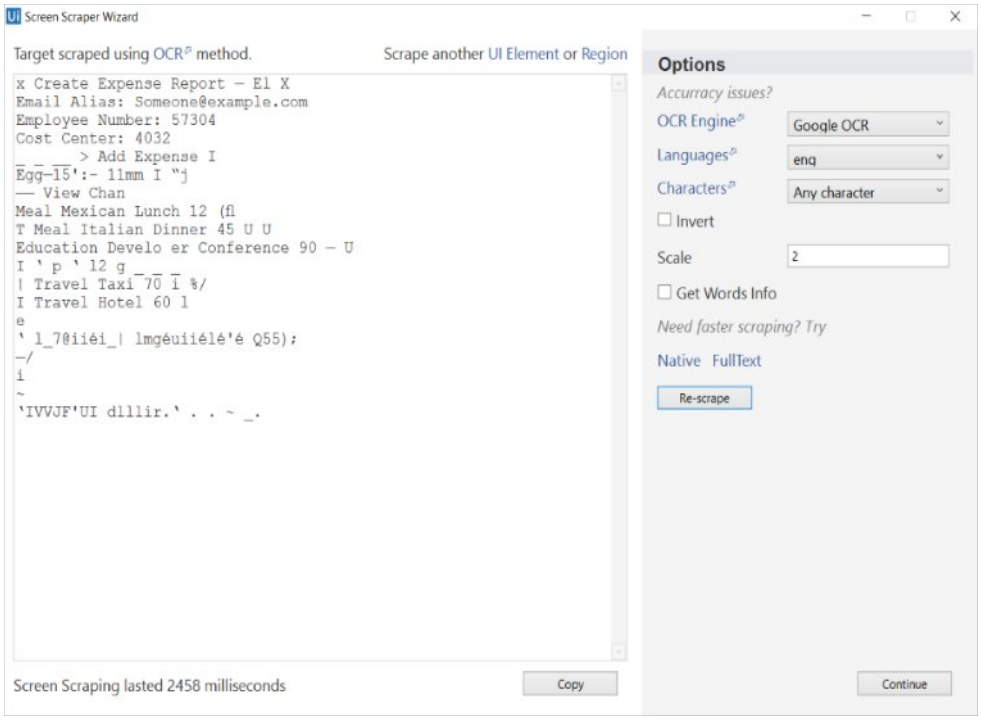
1. **FullText** with hidden text works really well, being able to read even the minimize and restore buttons.



2. **Native** does not work on this UI as it does not make use of GDI to render text.
3. **Microsoft OCR** works pretty well, although accuracy is still not 100%.



4. **Google OCR** does not handle this UI very well, as the scraped area us quite large.



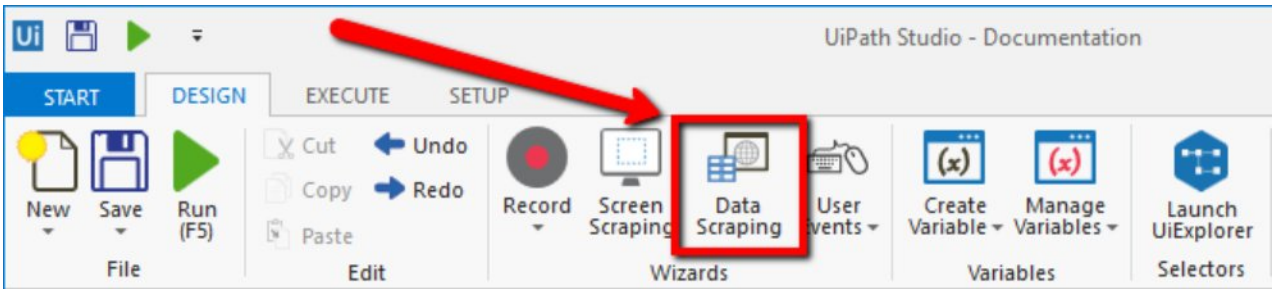
Data Scraping

About Data Scraping

Data scraping enables you to extract structured data from your browser to a database, .csv file or even Excel spreadsheet.

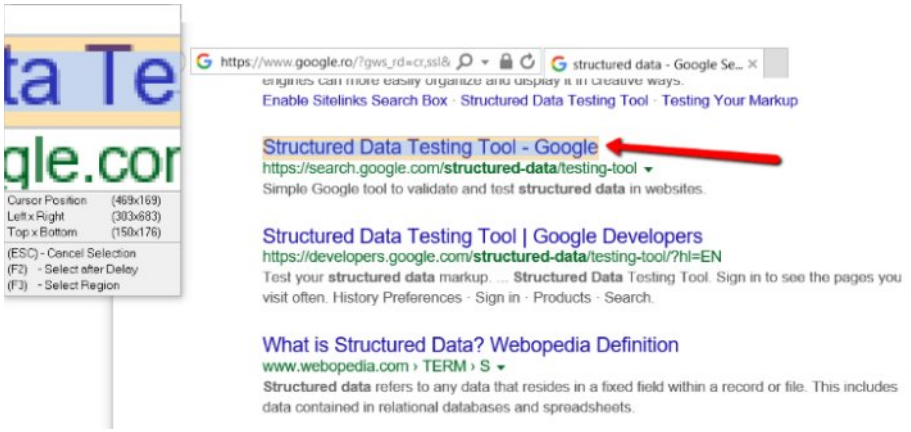
Structured data is a specific kind of information that is highly organized and is presented in a predictable pattern. For example, all Google search results have the same structure (a link at the top, a string of the URL and a description of the web page), which enables Studio to easily extract the information, as it always knows where to find it.

The scraping wizard can be opened from the **Design** tab, by clicking the **Data Scraping**button.

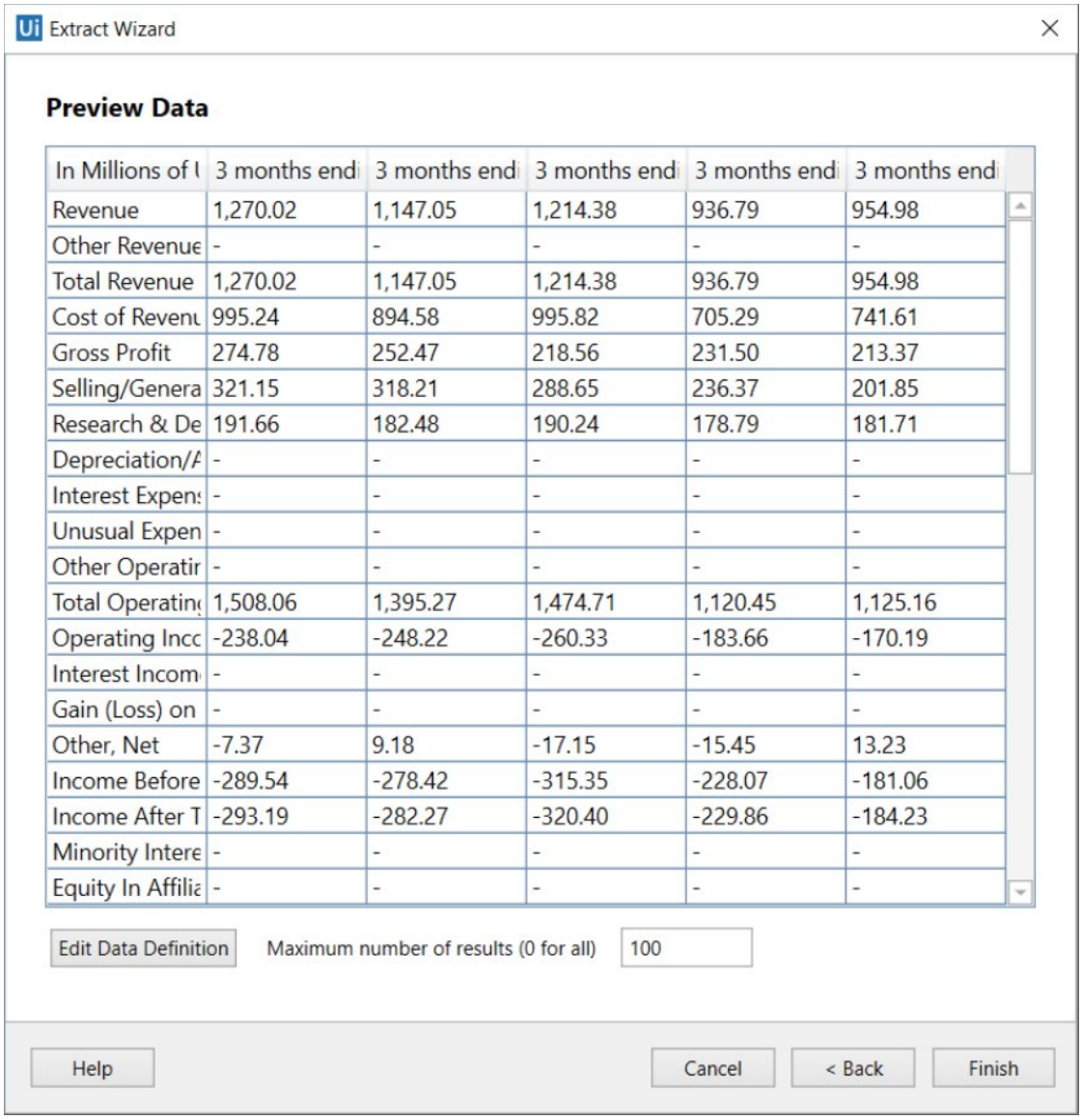


The main steps of the data scraping wizard are:

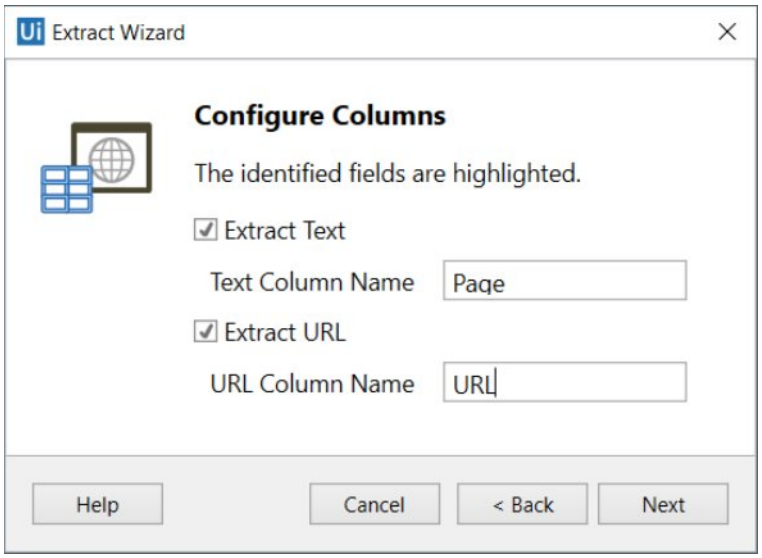
1. Select the first and last fields in the web page that you want to extract data from, so that Studio can deduce the pattern of the information.



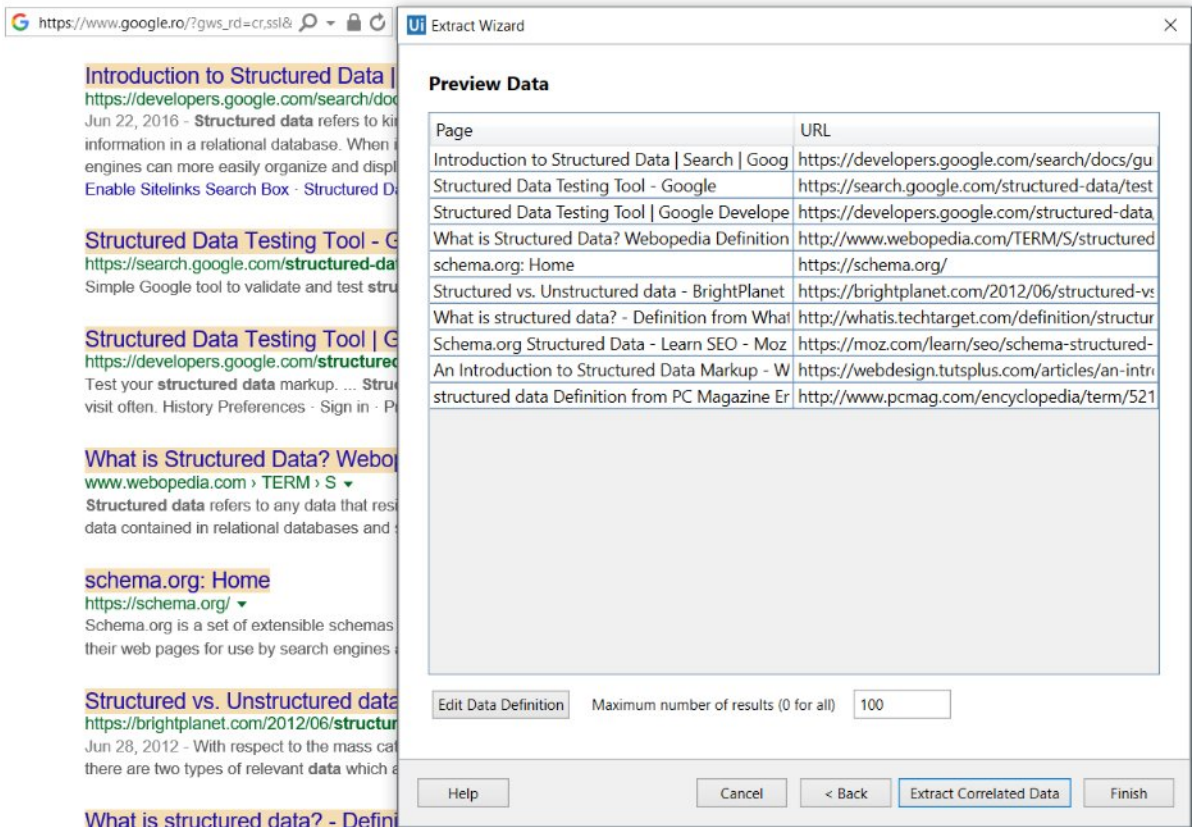
Note: Studio automatically detects if you indicated a table cell, and asks you if you want to extract the entire table. If you click **Yes**, the **Extract Wizard** displays a preview of the selected table data.



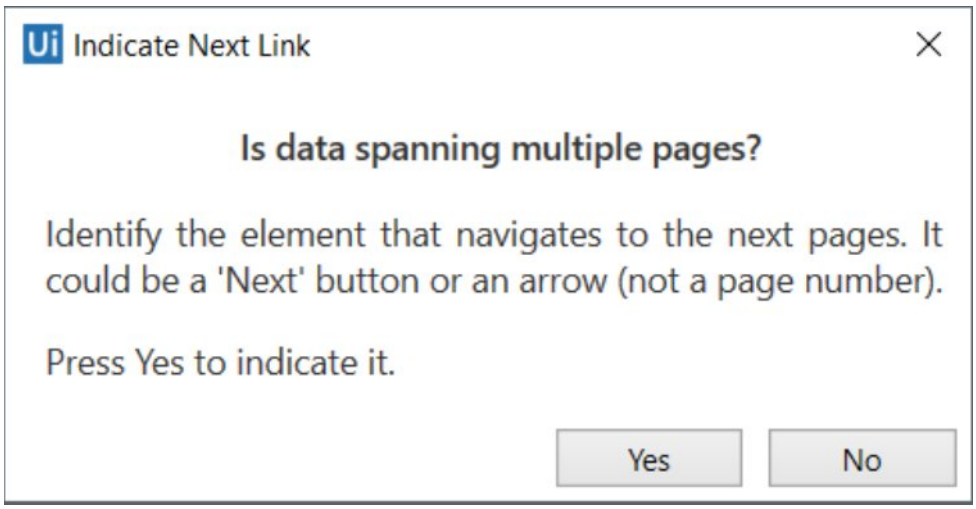
2. Customize column headers and choose whether or not to extract URLs.



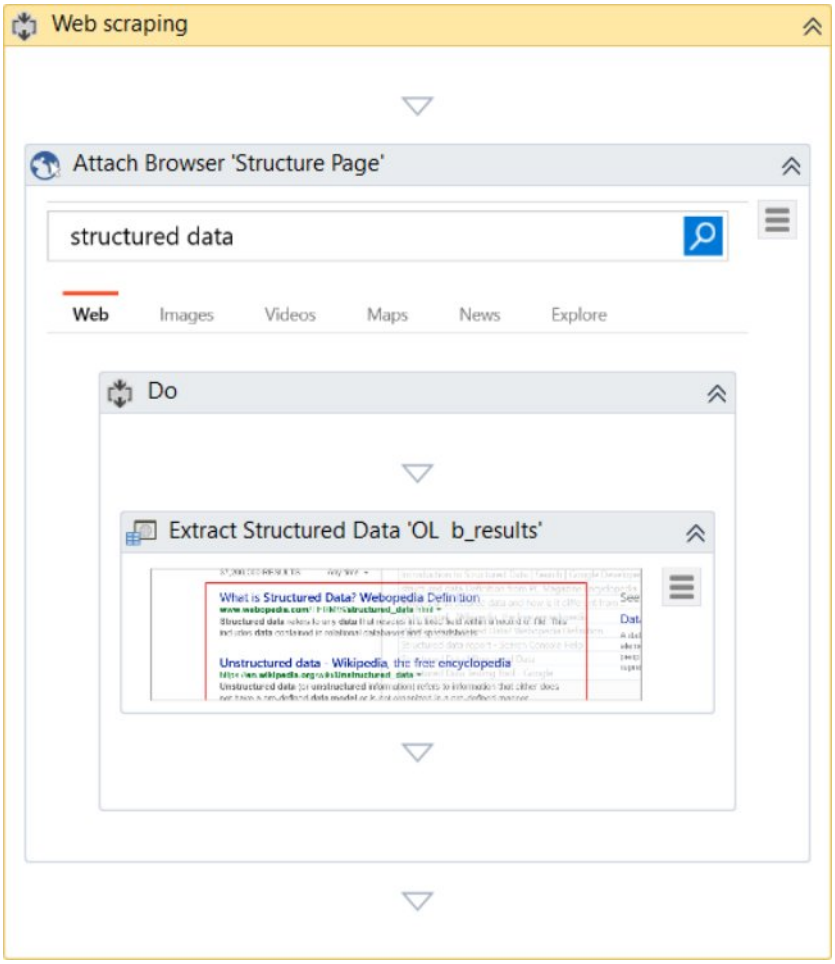
3. Preview the data, edit the number of maximum results to be extracted and change the order of the columns.



4. **Optionally** click **Extract Correlated Data**. This enables you to go through the **Extract Wizard** again, to extract additional info and add it as a new column in the same table.
5. Indicate the **Next** button in the web page (if the information you want to extract spans multiple pages).



After you are finished with the wizard, a workflow is generated in Studio.



Data scraping always generates a container (**Attach Browser** or **Attach Window**) with a selector for the top-level window and an **Extract Structured Data** activity with a partial selector, thus ensuring a correct identification of the page to be scraped.

Additionally, the **Extract Structured Data** activity also comes with an automatically generated XML string (in the **ExtractMetadata** property) that indicates the data to be extracted.

Lastly, all the scraped information is stored in a Data Table variable, that you can later use to populate a database, a .csv file or an Excel spreadsheet.

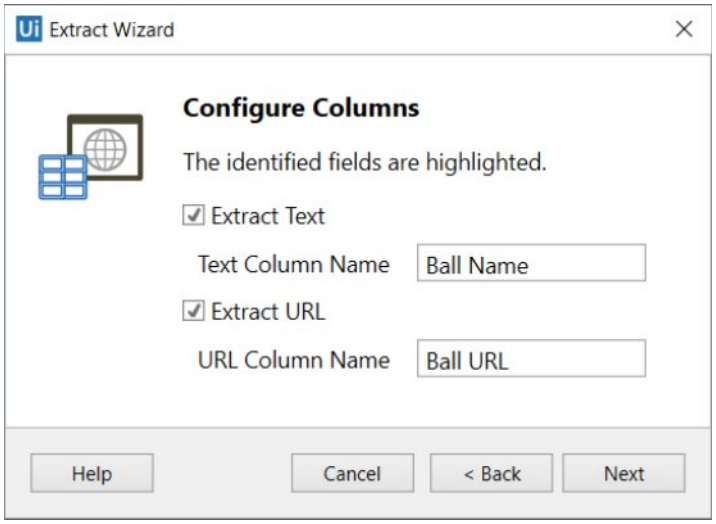
Example of Using Data Scraping

To better understand how you can take advantage of the data scraping functionality, let's create a workflow that extracts some specific information from Amazon.

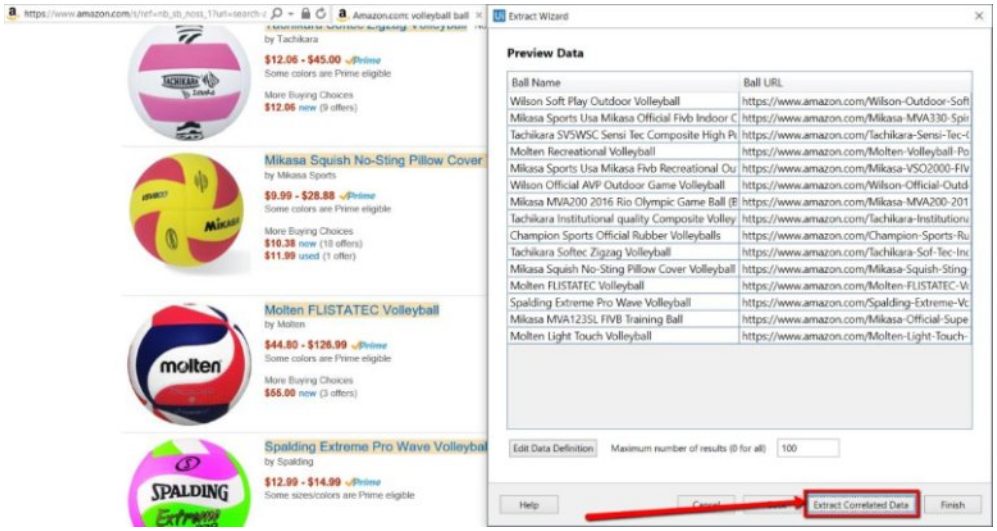
Let's say you are a sports gear vendor and are interested in finding out the latest prices for volleyball balls on Amazon. You can do the following:

1. Open Internet Explorer and navigate to www.amazon.com.
2. In the search box type "volleyball ball" and press Enter. Results are displayed in the web page.
3. In Studio, on the **Design** tab, in the **Wizards** group, click **Data Scraping**. The **Extract Wizard** is displayed.

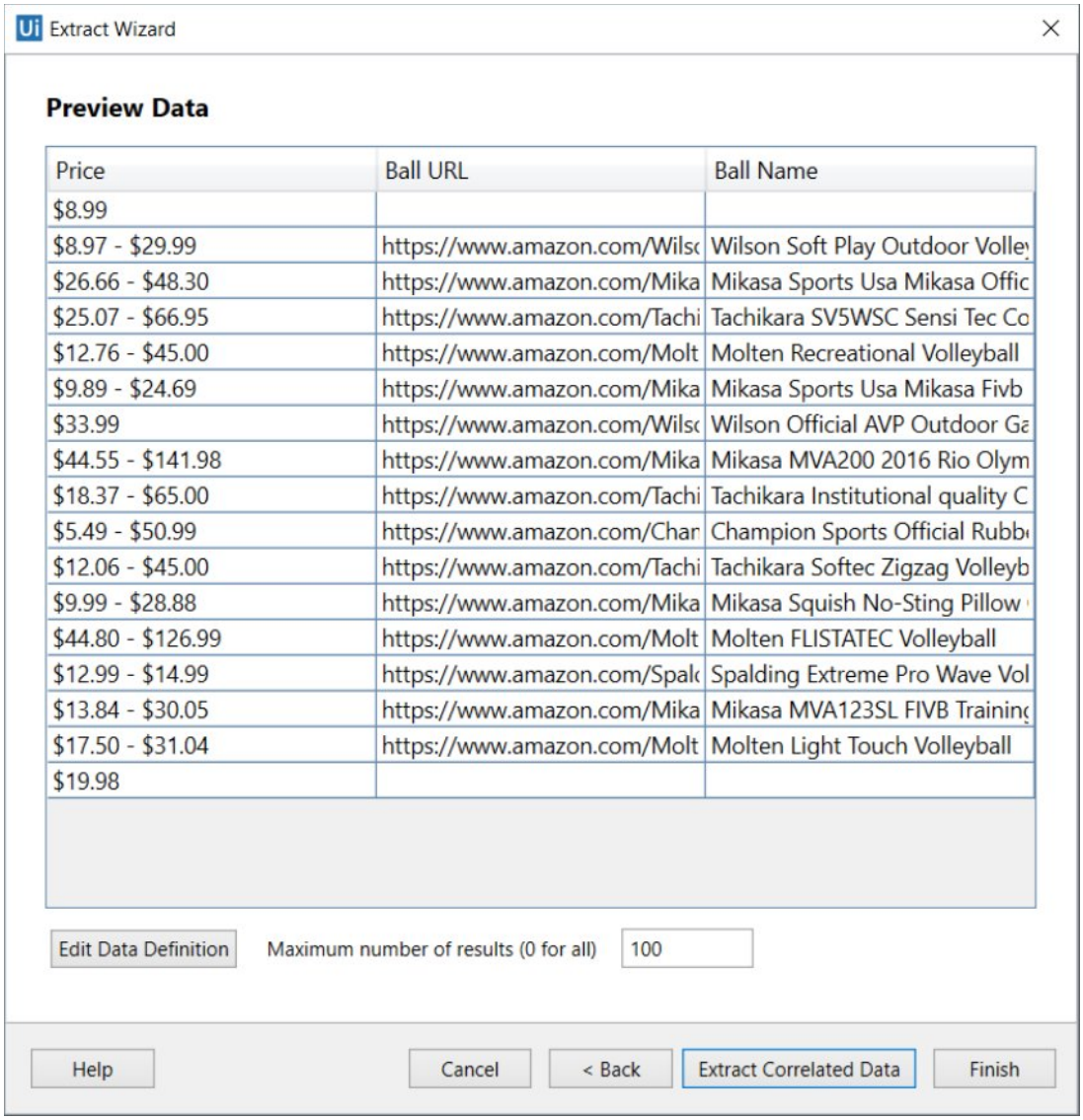
4. Following the wizard, select the first and last items in the web page. The **Configure Columns** wizard step is displayed.
5. Select the **Extract URL** check box.
6. Change the name of the column headers.



7. Click **Next**. A preview of the data is displayed and the fields you selected are highlighted in the web browser.



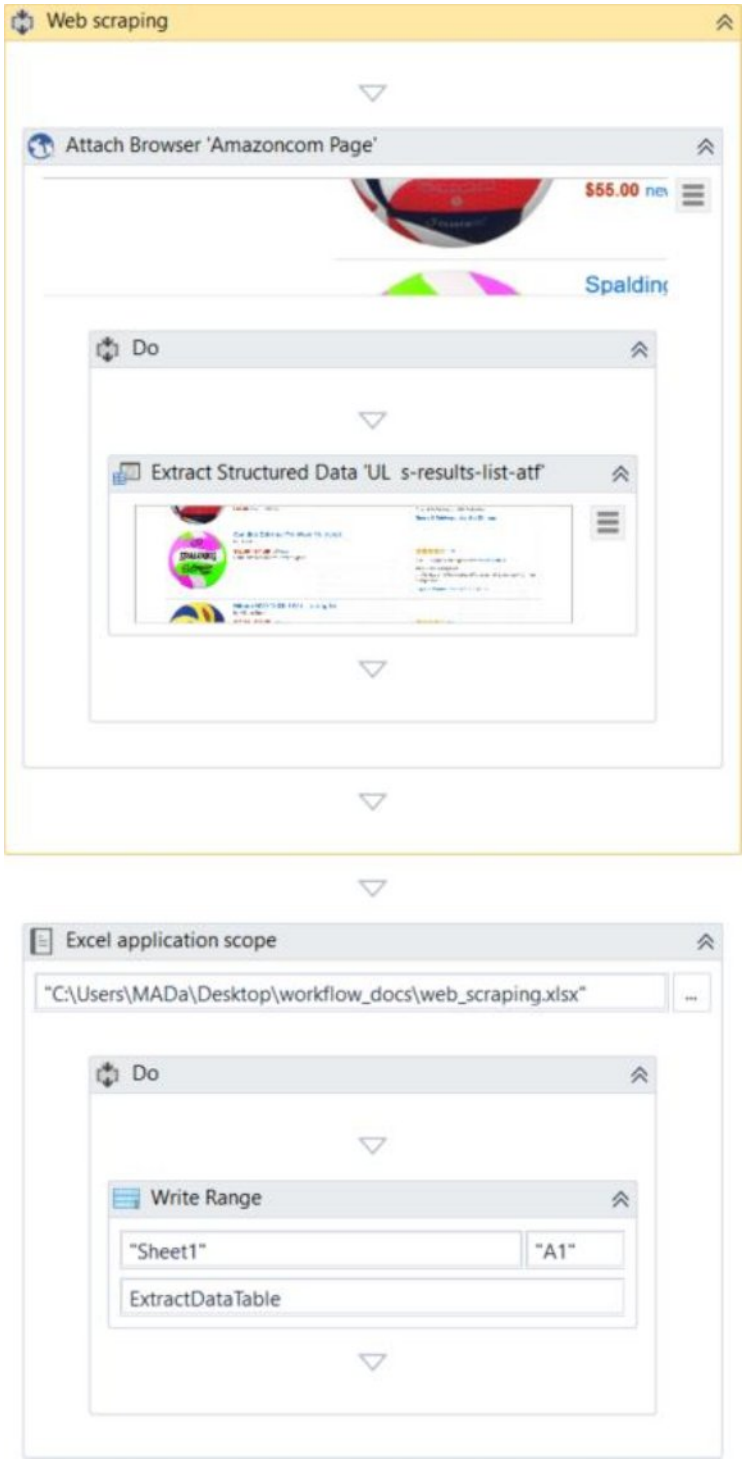
8. Click the **Extract Correlated Data**. The **Extract Wizard** starts again.
9. Following the wizard again indicate the prices of the items. You get to the **Configure Columns** step.
10. Change the name of the new column, and click **Next**. The data preview is displayed.



11. (Optionally) Change the order of the columns by dragging them in place.
12. Click **Finish**. The **Indicate Next Link** window is displayed prompting you to indicate the **Next** button if the spans more than one page.
13. Click **Yes** and select the **Next Page** button in Amazon. The workflow is saved and displayed in the **Main** panel. Note that a data table variable, **ExtractDataTable**, has been automatically generated.
14. Drag an **Excel Application Scope** activity under the **Data Scraping** container.

    Note: Install the Excel activities package using the **Manage Packager** to have access to these activities.

15. In the **Properties** panel, in the **WorkbookPath** field, type the file path of an existing Excel file to which you want to write the data.
16. In the **Variables** panel, change the scope of the automatically generated data table variable to **Main**.
17. In the **Excel Application Scope**, drag a **Write Range** activitiy.
18. In the **Properties** panel, in the **DataTable** field, add the **ExtractDataTable** variable. The final workflow should look as in the following screenshot.



19. Press F5. The workflow is executed.
20. Open the Excel file you used at step 15. Note that all columns are populated correctly.

	A	B	C
3	$26.66 - $48.30	Mikasa Sports Usa Mikasa Official Fivb Indoor Club Volleyballs	https://www.amazon.com/Mikasa-MVA330-Spiral-Volleyball-Yellow/dp/B001F51WFQ/ref=sr_1_4?ie=UTF8&qid=1475675296&sr=8-4&keywords=volleyball+ball
4	$25.07 - $66.95	Tachikara SV5WSC Sensi Tec Composite High Performance Volleyball	https://www.amazon.com/Tachikara-Sensi-Tec-Composite-Performance-Volleyball/dp/B00099YZNU/ref=sr_1_5?ie=UTF8&qid=1475675296&sr=8-5&keywords=volleyball+ball
5	$12.76 - $45.00	Molten Recreational Volleyball	https://www.amazon.com/Molten-Volleyball-Positions-Recreational-Colors/dp/B00JMB3FMS/ref=sr_1_6?ie=UTF8&qid=1475675296&sr=8-6&keywords=volleyball+ball
6	$9.89 - $24.69	Mikasa Sports Usa Mikasa Fivb Recreational Outdoor Volleyballs	https://www.amazon.com/Mikasa-VSO2000-FIVB-Replica-Volleyball/dp/B00091PQOA/ref=sr_1_7?ie=UTF8&qid=1475675296&sr=8-7&keywords=volleyball+ball
7	$33.99	Wilson Official AVP Outdoor Game Volleyball	https://www.amazon.com/Wilson-Official-Outdoor-Game-Volleyball/dp/B00171JNZO/ref=sr_1_8?ie=UTF8&qid=1475675296&sr=8-8&keywords=volleyball+ball
		Mikasa MVA200 2016 Rio Olympic Game Ball	https://www.amazon.com/Mikasa-MVA200-2016-Olympic-Yellow/dp/B001F51TYK/ref=sr_1_9?ie=UTF8&qid=14756

Sheet1

Selectors

About Selectors

To automate specific actions in the user interface, you are required to interact with various windows, buttons, drop-down lists and many others. Most applications do this by relying on the screen position of UI elements, a method that is not at all dependable.

To overcome this problem, UiPath uses what we call selectors. These store the attributes of a graphical user interface element and its parents, in the shape of an XML fragment. Most of the times, selectors are automatically generated by Studio and do not require further input from you, especially if the apps you are trying to automate have a static user interface.

However, some software programs have changing layouts and attribute nodes with volatile values, such as some web-apps. UiPath cannot predict these changes and therefore, you might have to manually generate some selectors.

A selector has the following structure:

```
<node_1><node_2>...<node_N>
```

The last node represents the GUI element that interests you, and all the previous ones represent the parents of that element. <node_1> is usually referred to as a root node. Each node has one or more attributes that help you correctly identify a specific level of the selected application.

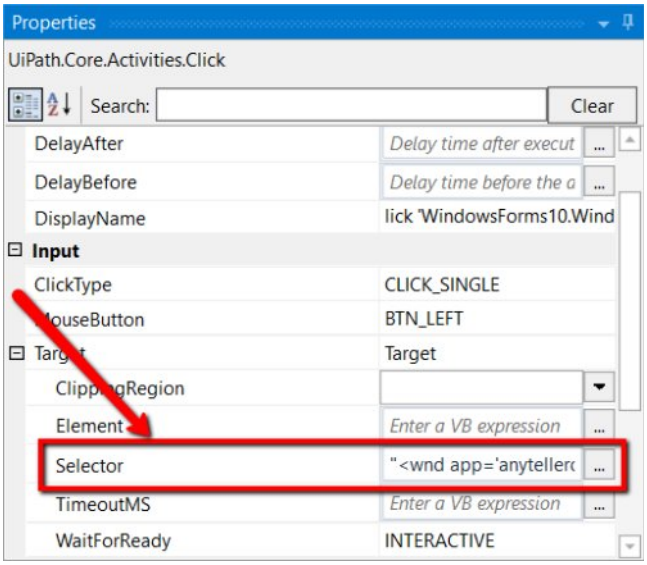
Each node has the following format:

```
<ui_system attr_name_1='attr_value_1' ... attr_name_N='attr_value_N'/>
```

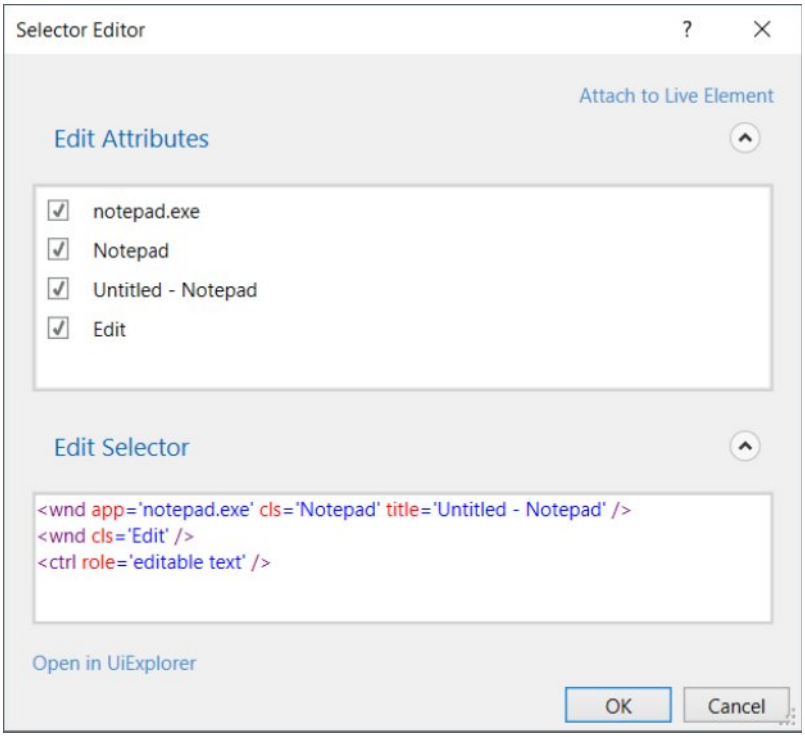
Every attribute has an assigned value which represents a unique identifier.

You have to pick attributes with a constant value. If the value of an attribute changes, then the selector will not be able to correctly identify the element.

Selectors are stored in the **Properties** panel of activities, under **Input** > **Target** > **Selector**. All activities related to graphical elements have this property.



The **Selector Editor** window enables you to see the automatically-generated selector and edit it and its attributes. To open this window, click the Ellipsis button next to the **Selector** field, in the **Properties** panel.

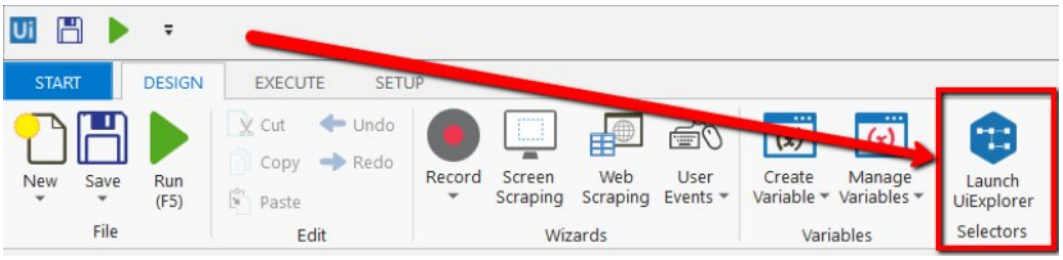


The **Edit Attributes** section contains all the application components needed to identify the target application (a window, a button etc.). The **Edit Selector** section holds the actual selector. Both of these sections are editable.

UiPath Explorer

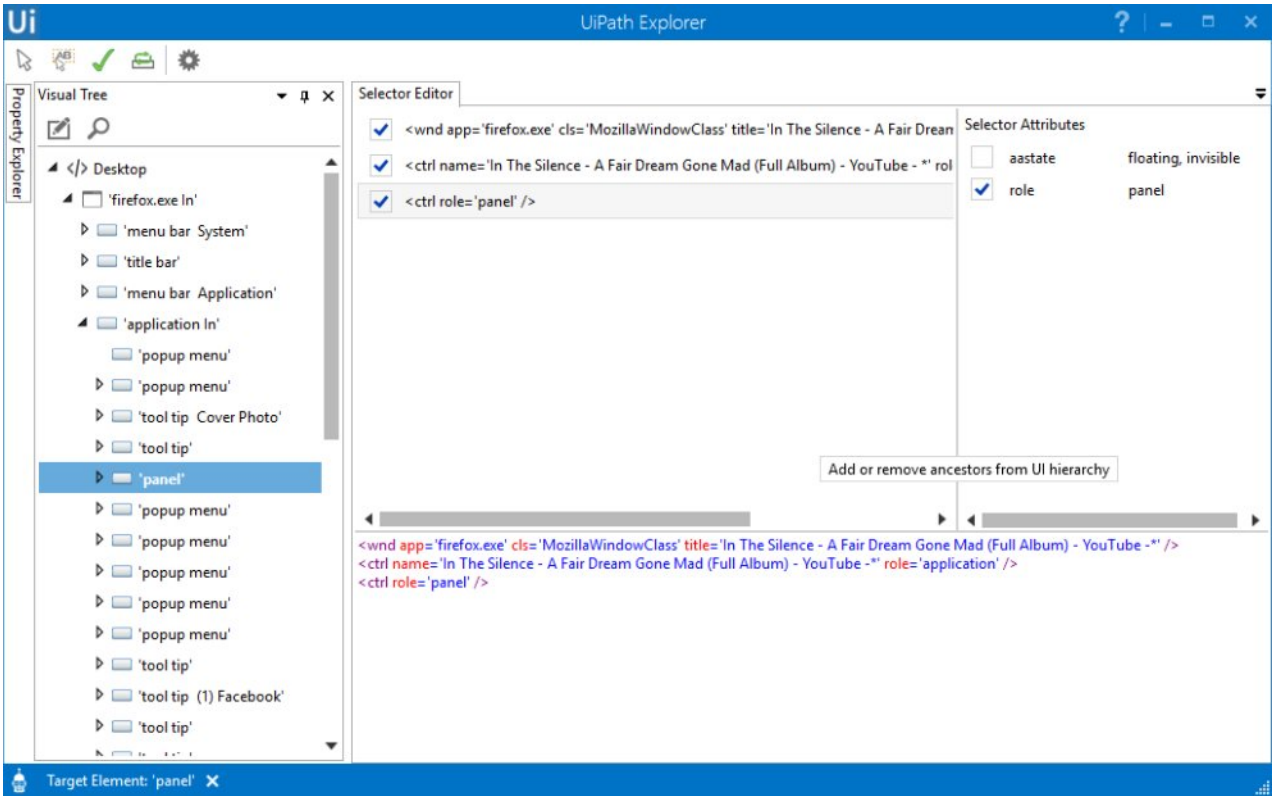
UiPath Explorer is an advanced tool that enables you to create a custom selector for a specific UI element.

To open the **UiPath Explorer** window, click **Launch UiExplorer** in the **Design** tab.



To be sure that you choose the best selector, remember to:

- Add or remove attributes
- Add parent or children tags
- Use wildcards to replace common values



Field Descriptions for the UiPath Explorer Window

Field	Description
Select Target Element	Automatically generate a selector by indicating a UI element on your screen.
Select Relative Element	Enables you to find an anchor in a UI element, so that you can find a better selector.

Validate	Verifies if your selector is valid or not. A dialog box is displayed letting you know about the result.
Reset	Resets all the panels from the UiPath Explorer window to their default states.
UiFrameworks	Changes the technology used to determine UI elements and their selectors. The following options are available: • **Default** – UiPath proprietary method. Usually works fine with all types of user interfaces. • **Active Accessibility** – an eariler solution from Microsoft for making apps accessible. It is recommended that you use this option with legacy software, when the **Default** one does not work. • **UI Automation** – the improved accessibility model from Microsoft. It is recommended that you use this option with newer apps, when the **Default** one does not work.

The Visual Tree Panel

Displays a tree of the UI hierarchy and enables you to navigate through it, by clicking the arrows in front of each node.

By default, the first time when you open **UiPath Explorer** or after you click the **Reset**button, this panel displays all opened applications, in alphabetical order.

Double-clicking a UI element (or right-clicking and selecting **Set as Target Element**) from the tree, populates the **Selector Editor**, **Selector Attributes** and **Property Explorer** panels.

Field	Description
Highlight	Highlights the target element and/or anchor.
Show Search Options	Displays the search box and search filter options.
Search box	Enables you to look for a specific string. If an exact match is not found, nodes containing the nearest match are displayed. Wildcards (*,?) are supported. Depending on the attribute selected from the **Search by** drop-down list, the search can be case sensitive. **Note:** The search only looks for matches in the tree structure under the selected UI object.
Search by	Filters your search to a selected attribute or a selector. The contents of this drop-down list change according to the selected UI element.

	Note: If **Search by** is set to **Selector**, you can only input one node in the `<attribute name1='value1' ... />` format.
Children Only	Limit your search to the first level children of the selected node. By default, this check box is not selected.

The Selector Editor Panel

Displays the selector for the specified UI object and enables you to customize it.

The top part of the panel displays the actual XML fragment that you have to use in a workflow. Once you find the selector you want, you can copy it from here and paste it in the **Properties** panel of an activity, in the **Selector** field.

The bottom part of this panel enables you to view all the nodes in a selector and eliminate the ones that are not necessary by clearing the check box in front of them.

Selecting a node here, displays its attributes in the **Selector Attributes** and **Property Explorer** panels.

The Selector Editor Panel

Displays all the available attributes of a selected node (from the Selector Editor panel).

You can add or eliminate some of the node attributes by selecting or clearing the check box in front of each attribute.

Additionally, you can change the value of each attribute yet this modification is retained only if the new selector points at the originally selected UI object.

The Property Explorer Panel

Displays all the attributes that a specified UI object can have, including the ones that do not appear in the selector. They cannot be changed.

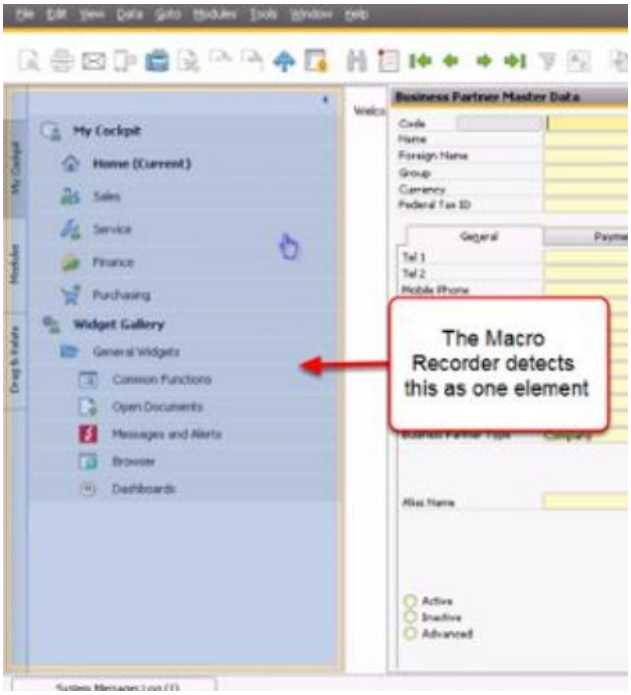
SAP Automation & Mainframe

How to Automate SAP Applications - The Quick Guide

SAP (Systems, Applications and Products in Data Processing) is a well known enterprise software company that makes applications that manage business operations and customer relations.

How does UiPath work with SAP?

There are elements on the **SAP GUI**, just like **Citrix**, that are detected by the recorder as a single block, so it's impossible to use a simple recording or automation tool with them. UiPath is well adapted and very capable of creating an automation, even with these types of interfaces. UiPath has a powerful screen scraping engine that helps you in extracting data from the GUI in less than a second! This method is 100% accurate.



Most elements of the **SAP GUI** can be detected by the **Macro Recorder** individually, like the Standard Buttons, Menus and Submenus.

The Basic Workflow

Let's say you want to add sales or member data into the application database. Manually, you have to pull up the right form and then start inserting data manually.

In order to achieve this in UiPath, 2 GUI automation techniques will be used:

- automation through keyboard entries like **tab**, **arrow keys** and the **return** key
- automation by scraping text on the screen and clicking a text event

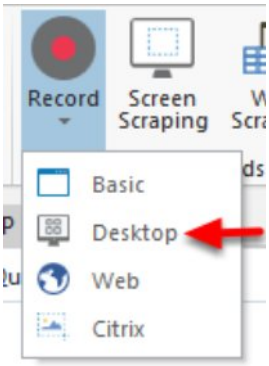
1. Automation through Keyboard entries makes it easier and faster to move between different text fields

2. Scraping the text allows us you to build **Activities** from individual elements in a block element.

The Process

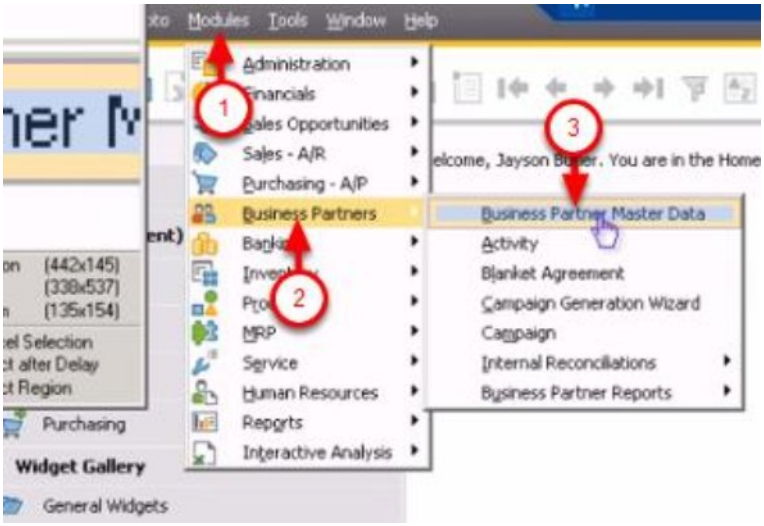
Let's assume that the UiPath is installed on the same machine as the SAP application.

1. With the **SAP Business One** already pulled up, start building the **Workflow** by pulling up the **Macro recorder**. Select **Desktop**.

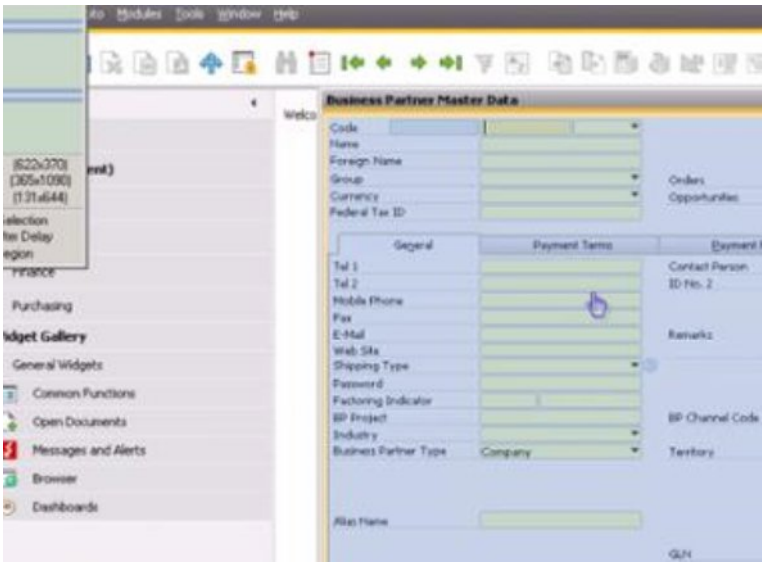


2. Select the **Automatic Recorder** from the Wizard.

3. To pull-up the data form, we can simply use a left mouse click, using the **Recorder**.

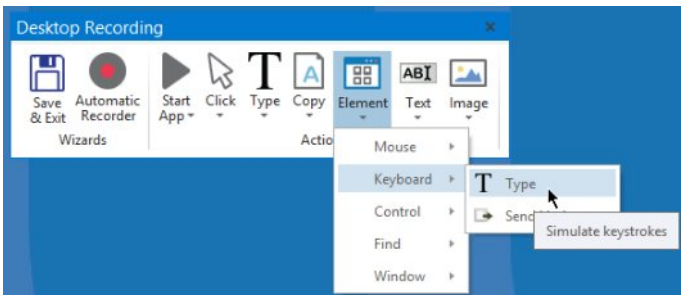


4. Now the form is ready. The individual elements in this form cannot be identified by the **Recorder**. You will use a different method to fill in the data. Press **Escape**. The previous activities are temporarily saved in the queue.

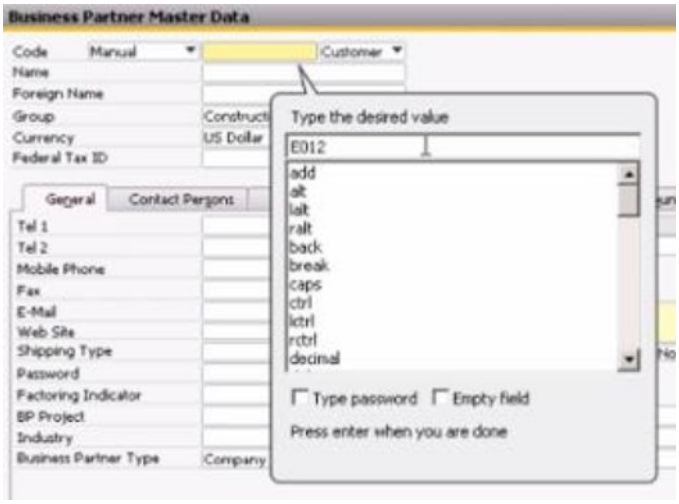


5. The next step is to start filling in the data. The cursor is now positioned in the place where you can start putting in the information ("Code").

Click on **Element->Keyboard->Type.**

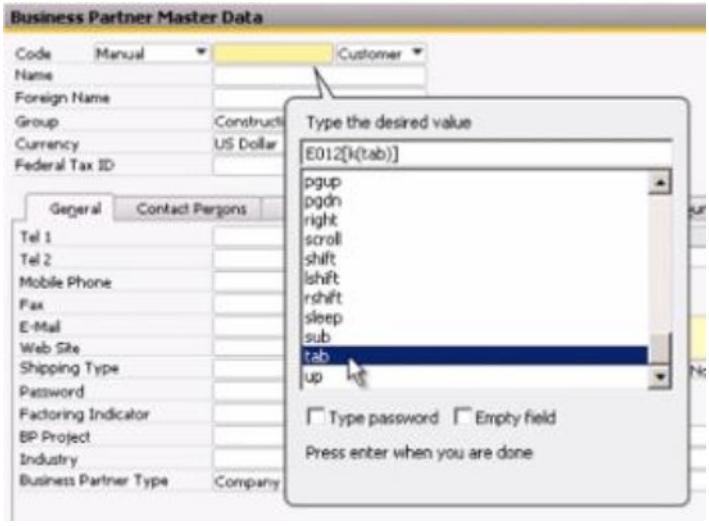


6. Just click anywhere in the form and it will initiate the input dialog box in the field where the cursor is in.



7. You can start by typing in initial data. Remember that you can use variables later to manipulate the data, so you can insert your own data sources.

The text dialog box also allows you to add keyboard commands such as **Return** and **Tab**. Let's add a **Tab** after the "Code" section. This will take you to the next field, which is a dropdown.



8. You can notice that it creates a code right next to the text you entered. It's the same thing you can apply when adding more keyboard commands. This is how you can manipulate the movement of the cursor:

Arrow Down: **[k(down)]**

Enter: **[k(enter)]**

Tab: **[k(tab)]**

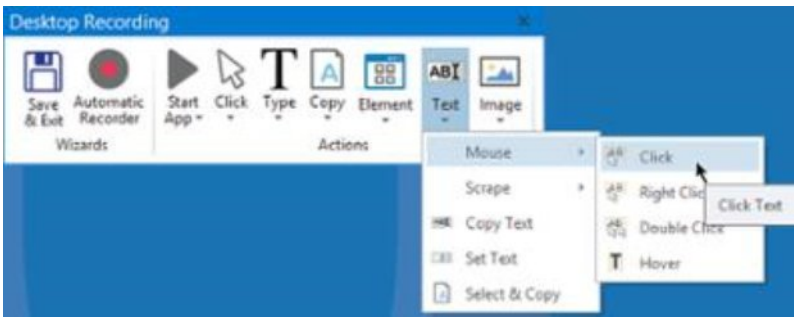
You can follow the same steps from step 5 to fill in any other input fields.

Automating SAP via Click on Text and Screen Scraping

The keyboard commands are very helpful when moving to and manipulating input fields. If you want to jump to a different field from within the form it could be hard to do so using keyboard activities. That's where the UiPath built-in screen scraping comes in.

You have to run an OCR which reads the text in the form and captures the targeted text.

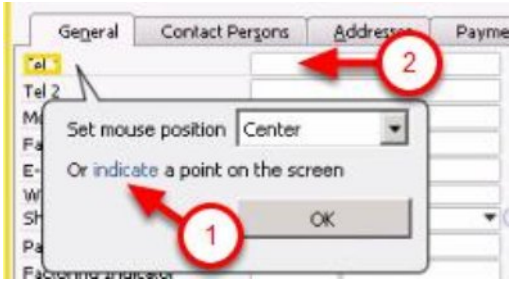
1. Click on **Text->Mouse->Click**.



2. This will pull up the **Screen Scraping** wizard. The target field is next to "Tel 1". The cursor position should be set next to it.

Copy "Tel 1" and put copy it in the **Text to be found** field.

3. Click on **Set mouse position**. "Tel1" will be detected. Click on the **indicate** link, then click on the input field next to it.

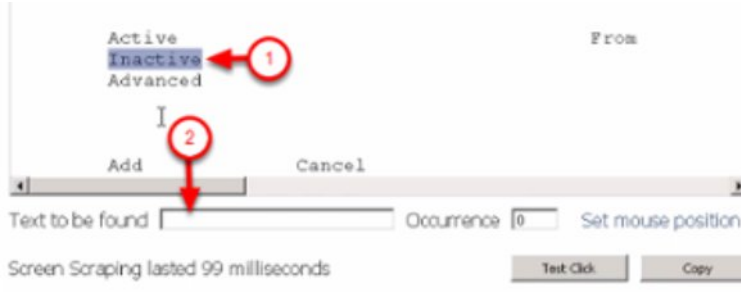


4. Click on the ***Continue*** button . This will position the cursor next to "Tel1". You can use the same technique from step 5 (presented in the previous section) to continue filling out other data.

Radio Buttons

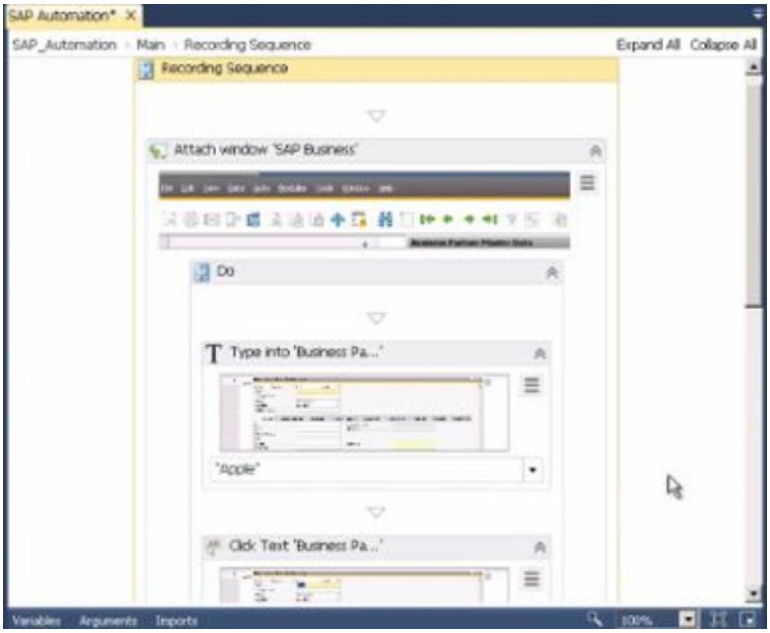
For the radio buttons, the same screen scraping technique can be used.

1. Click on **Text->Mouse->Click** and then copy paste "Inactive" into the **Text to be found field**. There is no need to set the mouse position for this one. The mouse will click in the middle of the element.



2. Use the same technique to click other GUI elements such as buttons

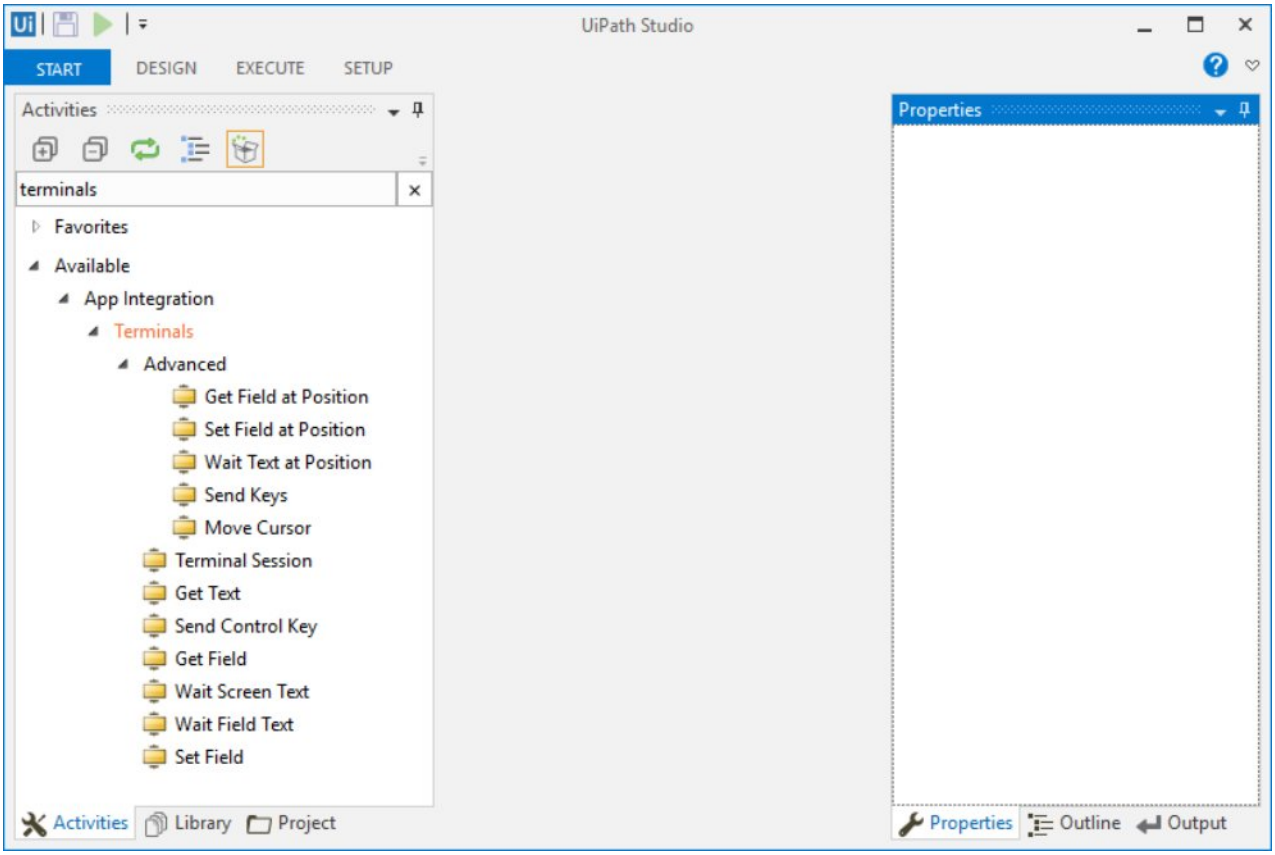
You are now ready to build your SAP automation out of these techniques.



Automating Terminals and Mainframes

1. Introduction

In order to use terminal activities, the Nuget package “UiPath.Terminal.Activities” needs to be installed. Once installed, the activities can be found under “App Integration -> Terminals” as in the following picture:



2. Terminal wizard

UiPath Terminal wizard is designed to help you automate data extraction and/or task execution on various terminals (Mainframe/AS400/VT). It works with TN3270/TN5250/VT terminals.

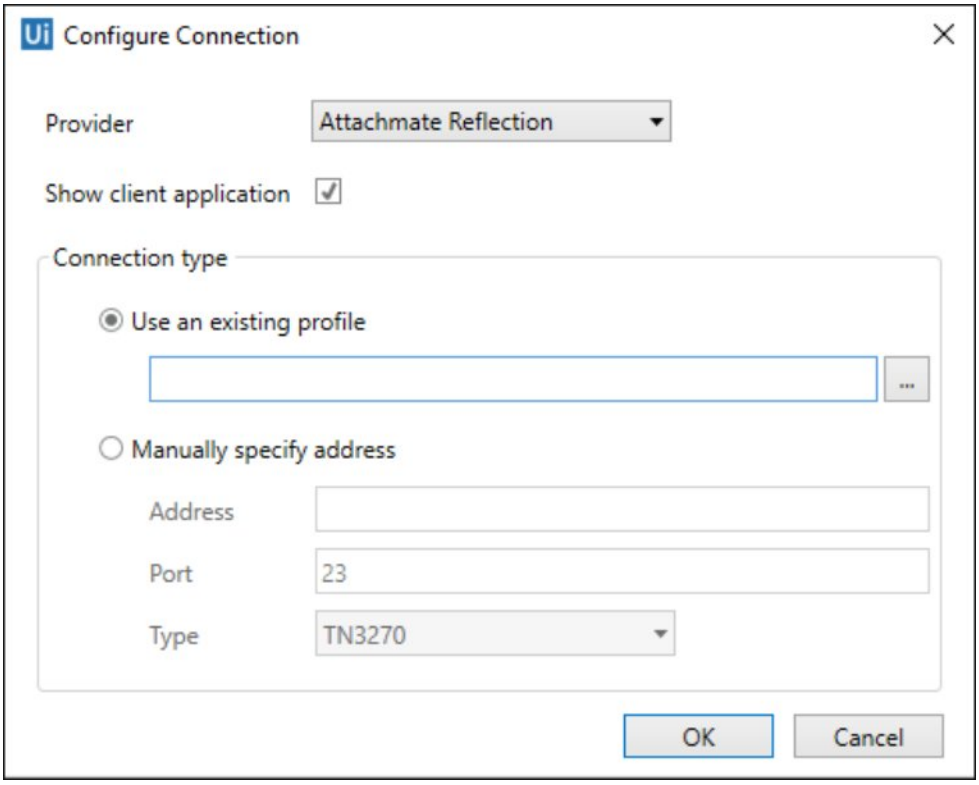
There are several ways to automate the mentioned terminals:

- using the existing/installed terminal application
- using the IBM EHLLL standard
- using the UiPath internal implementation of these protocols

One may choose between those three based on the accuracy and the level of the provided details (like colors, field information, etc).

2.1. Setting up a terminal session

The first step for creating a terminal session is by dragging the “Terminal Session” activity into the workflow. Then the connection configuration dialog is displayed.



The “Provider” combo box specifies which provider to use. Based on this selection, the “Connection type” section changes accordingly, depending on what connection types are available for the specific provider. A more detailed description on each provider can be found in section Supported providers.

“Show client application” flag specifies if the 3rd party provider window is displayed during recording/play.

2.1.1. Use an existing profile

Browse to a profile file containing the connection information, specific to selected provider. For example, for Attachmate Reflection, one may choose a rd5x/rd3x file, corresponding to a TN5250/TN3270 profile file. The same applies to other providers.

2.1.2. Manually specify address

Enter manually the connection parameters:

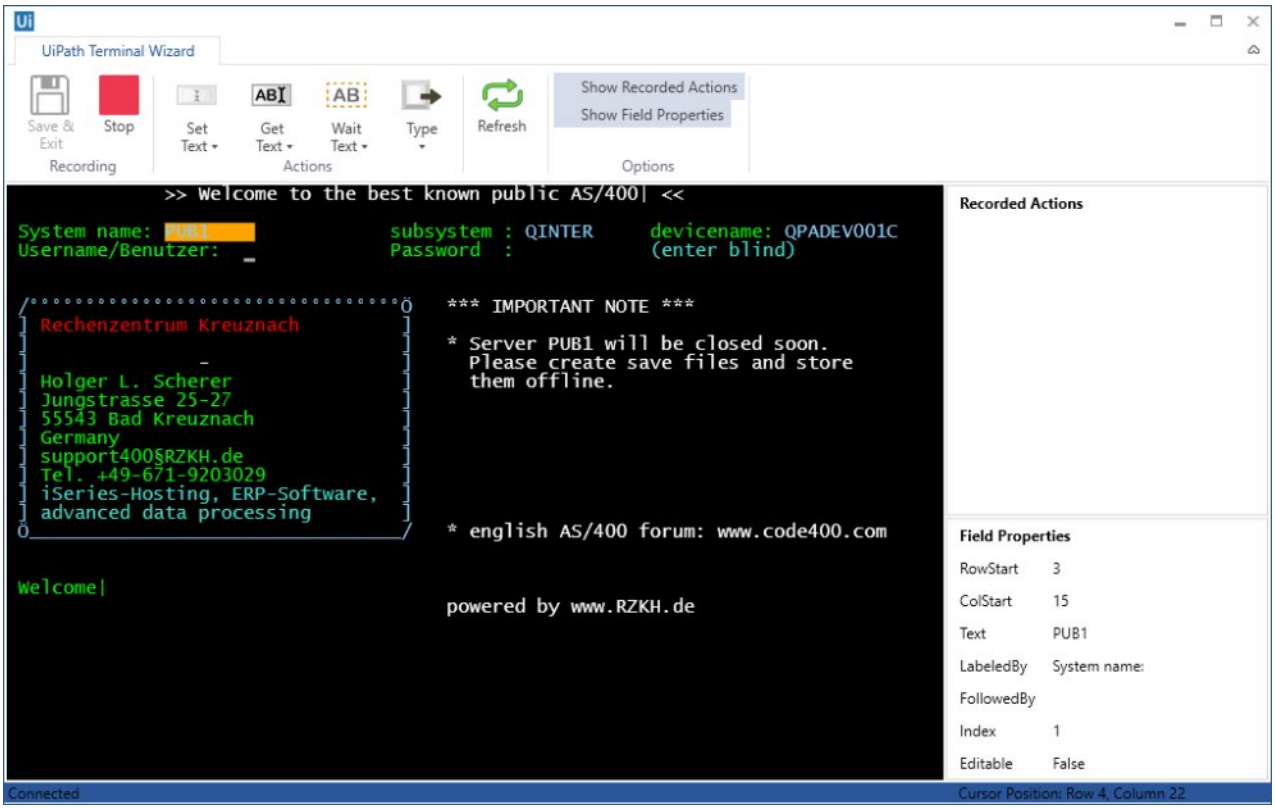
- Address : the server address
- Port: the port to use for connection
- Type: the terminal type: TN3270, TN5250 or VT

2.1.3. Attach to an existing session

This method is available only when using IBM EHLL standard and it is described in EHLL section.

2.2. Recording wizard

After specifying connection parameters the UiPath Terminal Wizard is automatically started.



2.2.1. Screen organization

The terminal screen is organized in fields, highlighted in orange color. The properties of the selected field are displayed the Field Properties pane.

There are two methods by which UiPath identifies a field on the screen: by coordinates or by visual elements.

Field identification by coordinates is straightforward, as it uses the row/column coordinates to located the field. The more reliable way is using LabeledBy/FollowedBy/Index properties. This is useful in case a screen changes a bit and the coordinates are not valid anymore, however, the text before/after a field is usually the same.

In the above picture, the selected field is “PUB1” and it is labeled by “System name:”. Index property is used when there are multiple fields with the same LabeledBy/FollowedBy property, like in a table.

2.2.2. Field Properties pane

The properties of the selected field are displayed the Field Properties pane. It includesthe coordinates (row/column), LabeledBy/FollowedBy/Index properties, the text value and a flag indicating if the field is editable or not.

2.2.3. Recorded Actions pane

This pane containsthe list of recorded actions (auto generated activities).

2.2.4. Available commands

- Save & Exit: stops the terminal connection and saves the recorded actions
- Stop/Start (recording): temporarily stops recording, in case some actions do not need to be recorded

- Actions commands: each of these are commands generates a specific terminal activity; they are described in a Terminal activities section
- Refresh: used to perform a full refresh of the terminal screen (used only for testing/validation)

3. Terminal activities

3.1. Common properties

- DelayMS: represents the time to wait after the activity executed; value is in milliseconds
- TimeoutMS: specifies the time to wait for the activity to execute; value is in milliseconds
- WaitType: allows specifying if the terminal should be in a ready state when executing the activity; recommended value is “READY”

3.2. Terminal Session activity

It is the main terminal activity and represents a connection to a terminal server. It acts as a container for all other terminal activities. By default, after activity execution, the terminal connection is closed.

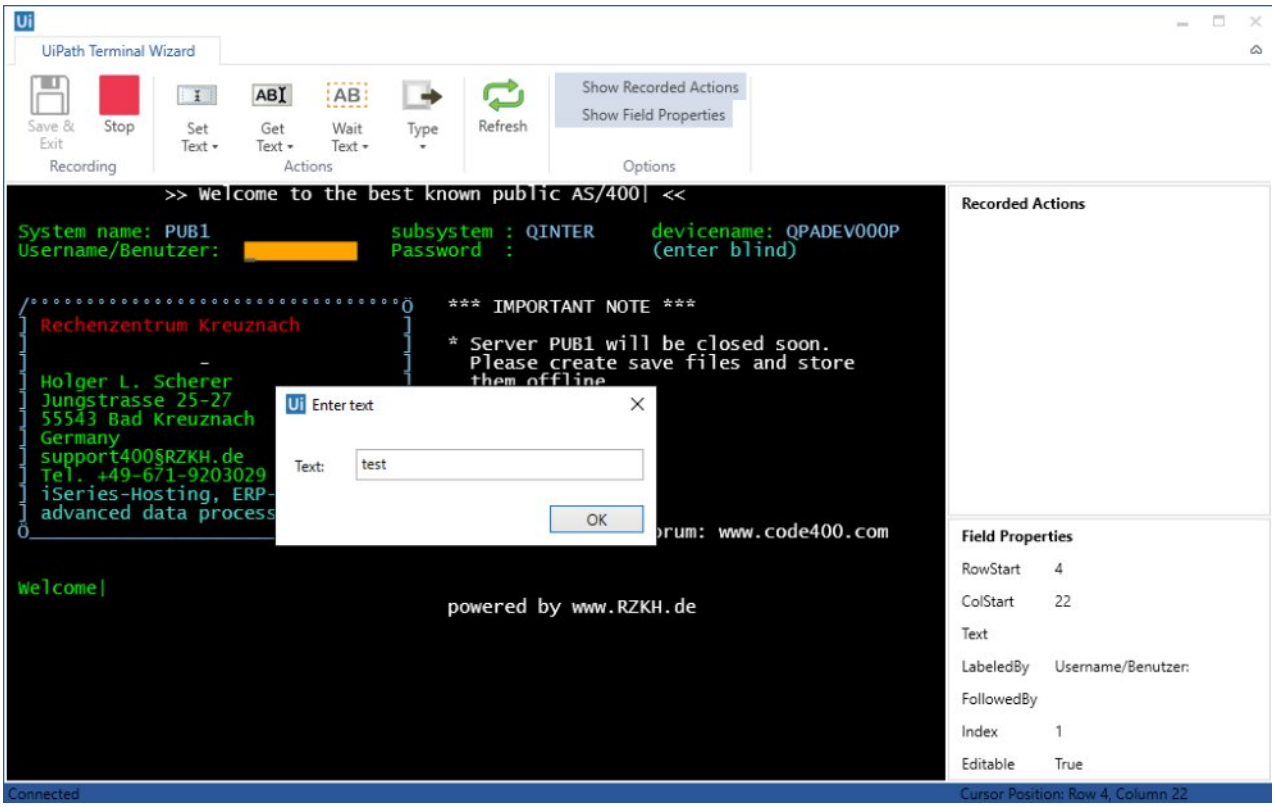
Properties:

- ConnectionString: contains the connection parameters; automatically generated from the connection dialog
- OutputConnection: optional, one may specify an output variable (of type TerminalConnection) in order to be used later in other terminal sessions
- CloseConnection: used with ExistingConnection property; specifies if the connection is closed after executing the Terminal Session activity
- ExistingConnection: a variable of type TerminalConnection that was previously initialized

When using many terminal sessions, it is recommended to reuse the terminal connection by saving it into a variable and use it in the next sessions. This is to avoid connecting and disconnecting multiple times, as this process is more time consuming.

3.3. Set Field activity

Set the text value of the selected field to a given value. The field must be editable, otherwise the activity is disabled.



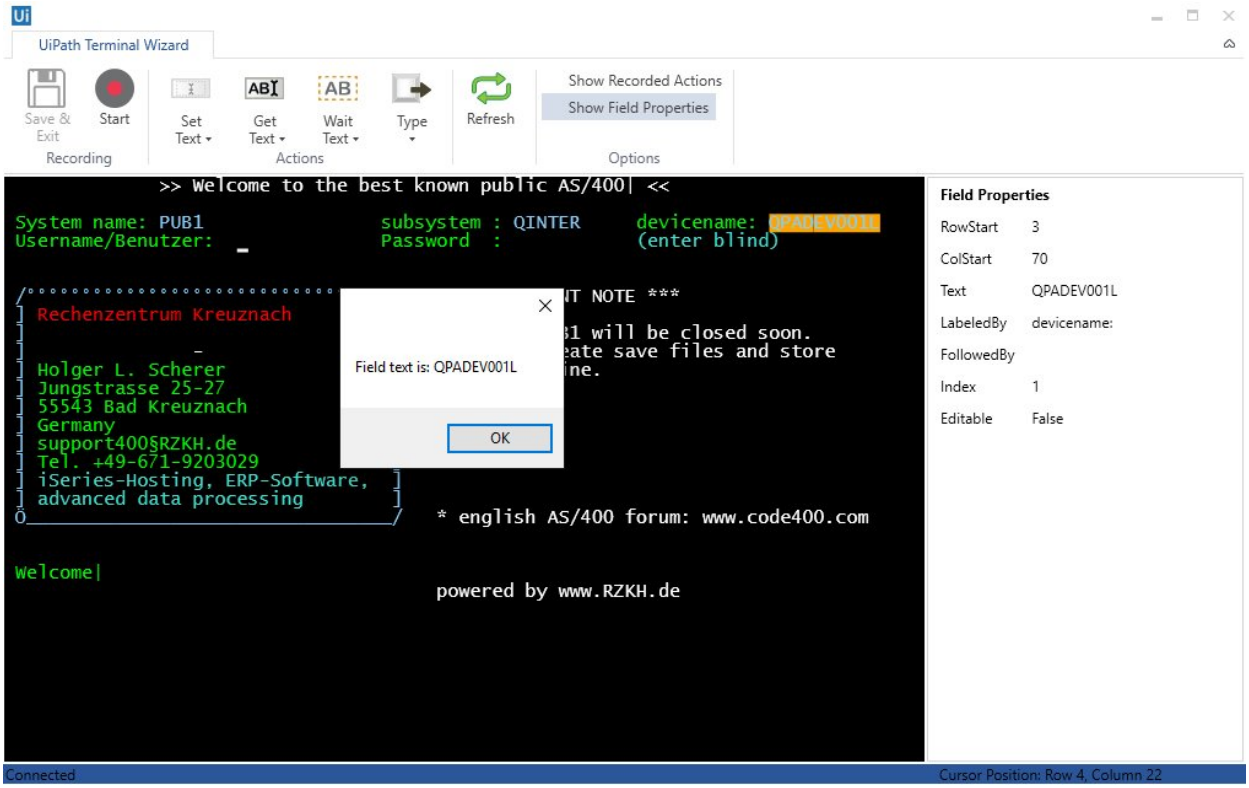
In the sample above, the selected field identified by label “Username/Benutzer” is set to the provided value “test”.

Properties:

- LabeledBy: the label before the selected field
- FollowedBy: the label following the selected field
- Index: 1 or greater, depending if there are multiple fields with same labels
- Text: a string expression used for setting the field value

3.4. Get Field activity

Obtains the text value of the selected field.



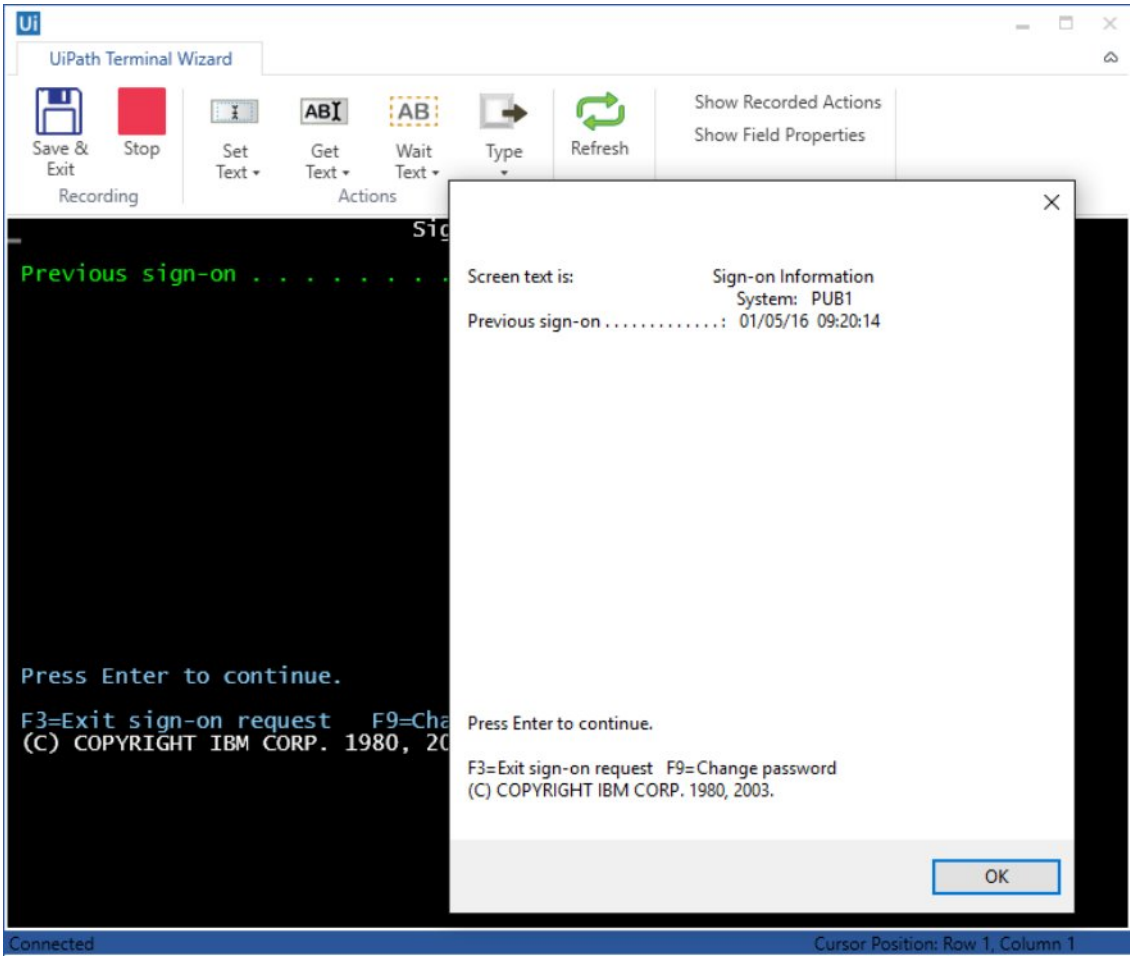
In the sample above, the text from selected field identified by label “devicename:” is returned.

Properties:

- LabeledBy: the label before the selected field
- FollowedBy: the label following the selected field
- Index: 1 or greater, depending if there are multiple fields with same labels
- Text: a string variable where the resulting text is saved

3.5. Get Text activity

Obtains the text value of the entire screen.

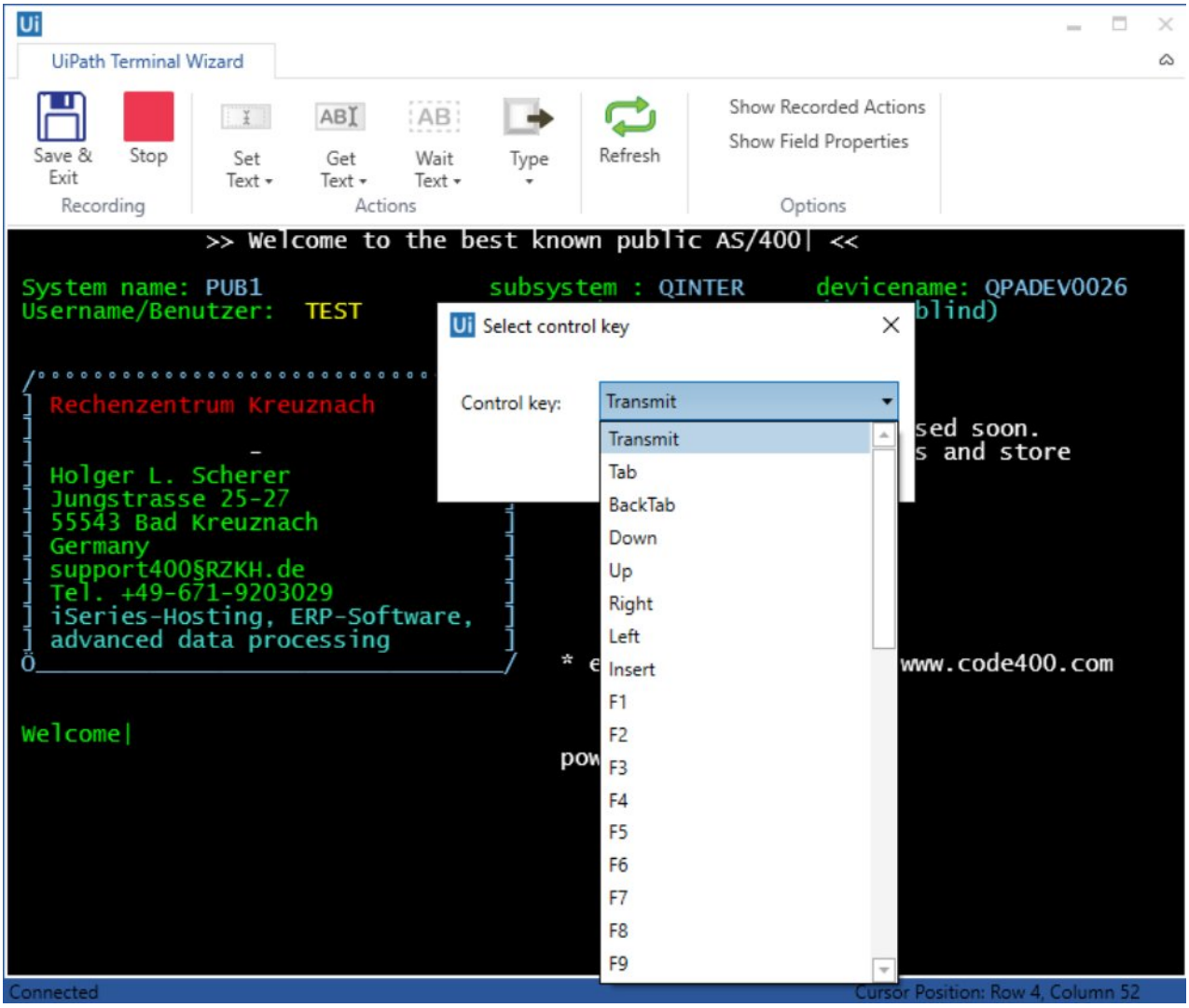


Properties:

- Text: a string variable where the resulting text is saved

3.6. Send Control Key activity

Sends a special key to the terminal, like (Enter), F1-F24 functional keys, etc. Usually, following a control key like , the screen changes. In the sample below it changes to the information screen following the login screen.

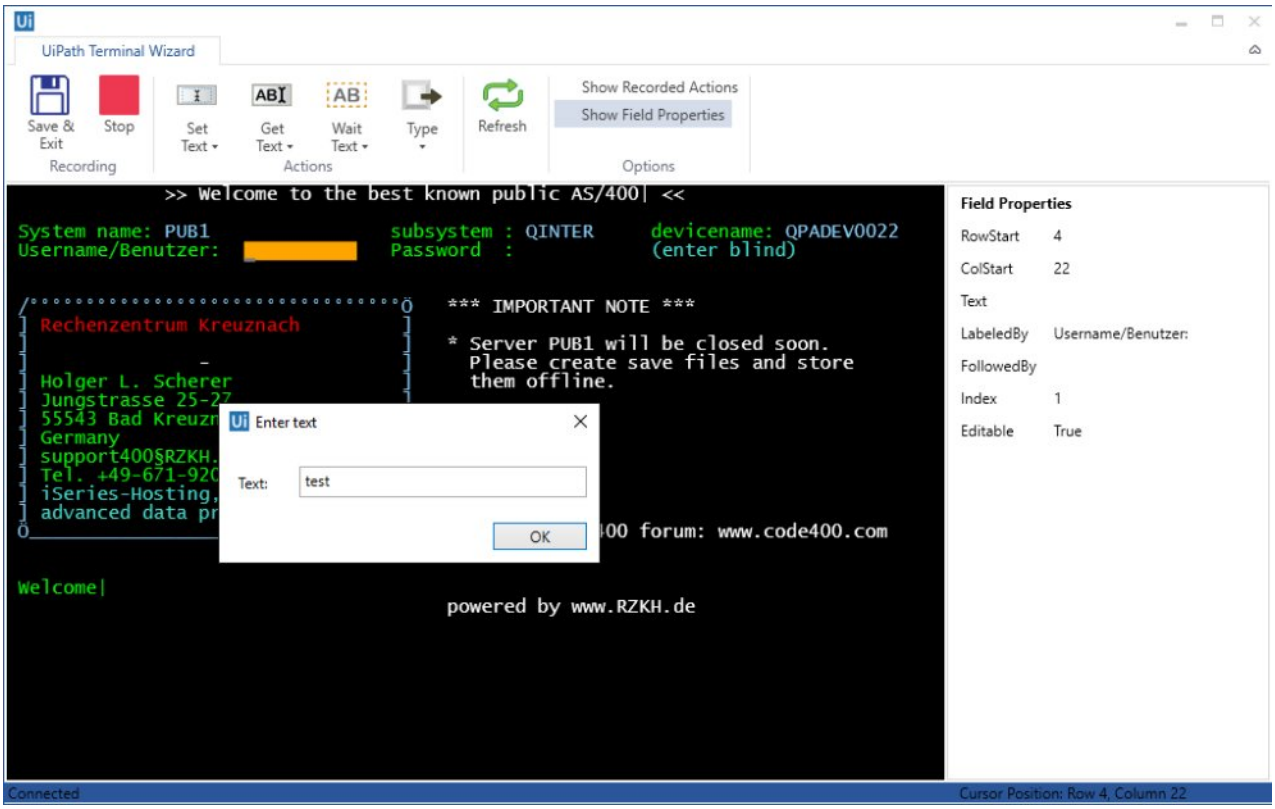


Properties:

- Key: the control key to send to the terminal (selected from the provided combo box)

3.7. Wait Field Text activity

Waits the specified amount of time (TimeoutMS, in milliseconds) until the selected field contains the provided text.



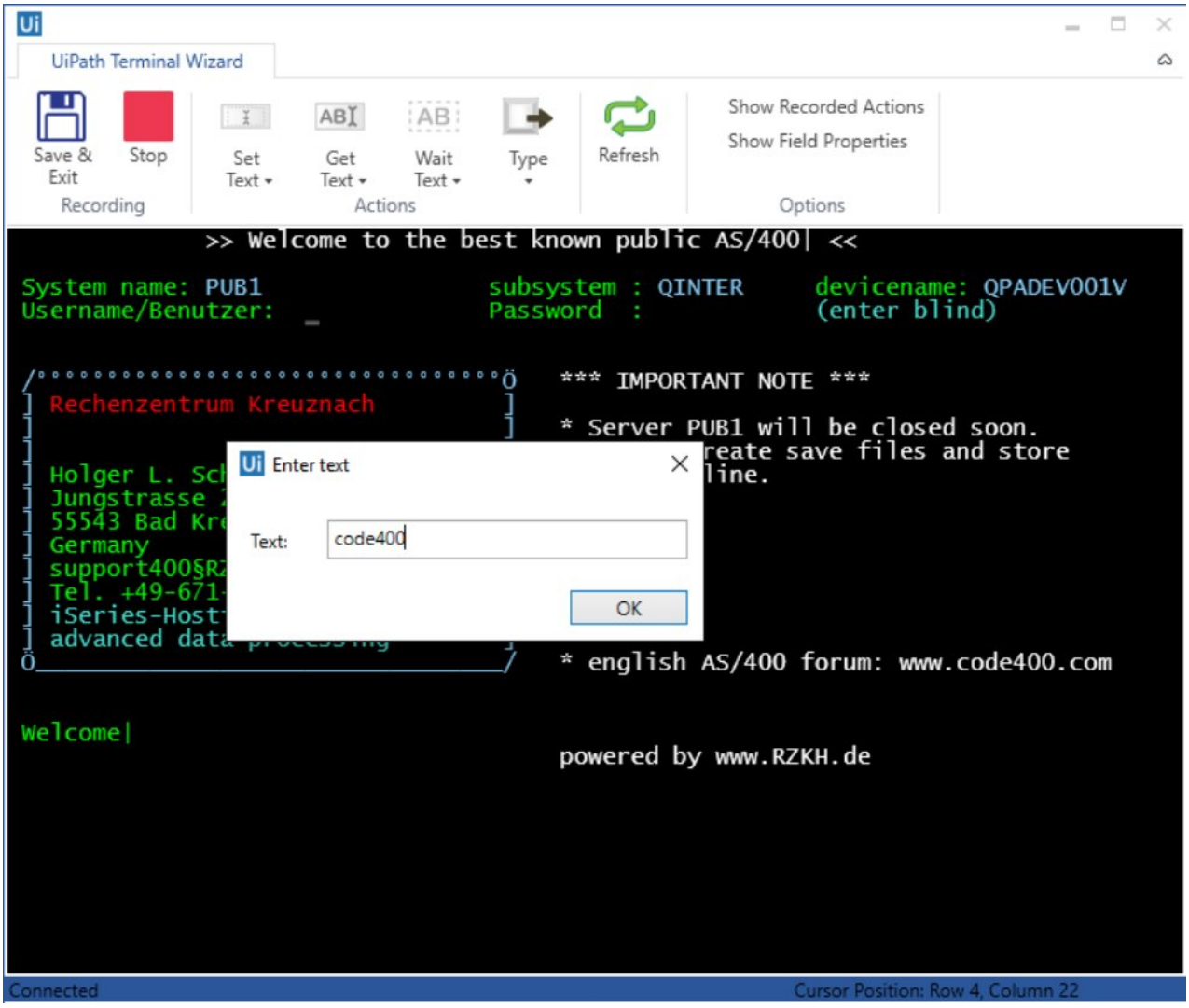
In the sample above, the workflow execution waits until the field identified by label “Username/Benutzer:” contains the text “test”.

Properties:

- LabeledBy: the label before the selected field
- FollowedBy: the label following the selected field
- Index: 1 or greater, depending if there are multiple fields with same labels
- Text: a string expression containing the value to wait for; it supports wildcards
- MatchCase: a flag indicating if the text matching should be case sensitive

3.8. Wait Screen Text activity

Waits the specified amount of time (TimeoutMS, in milliseconds) until the screen contains the provided text. It is very similar to Wait Field Text activity, except it searches the entire screen instead of being limited to a specific field.



In the sample above, the workflow execution waits until the text “code400” is found on the screen.

Properties:

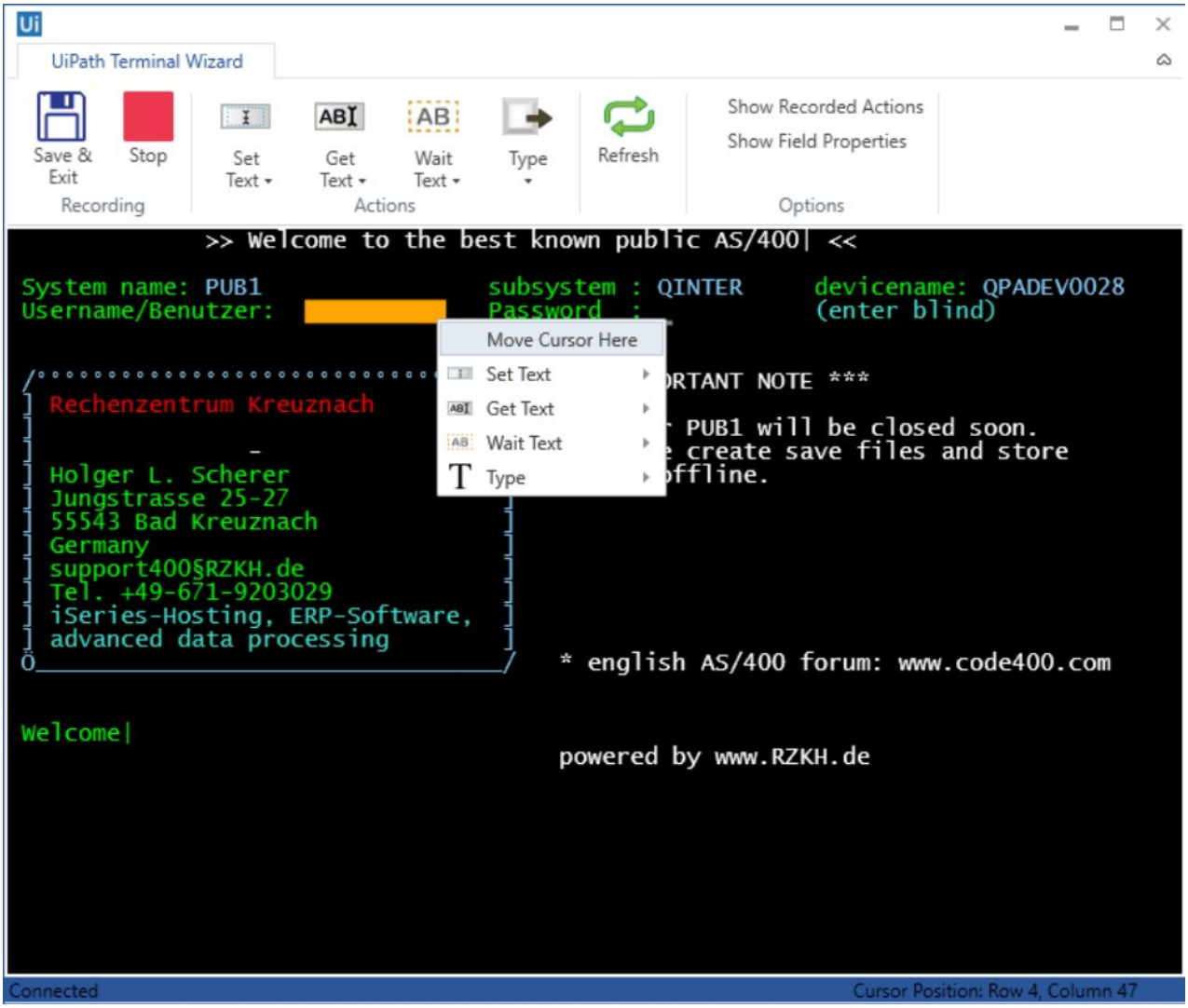
- Text: a string expression containing the value to wait for; it supports wildcards
- MatchCase: a flag indicating if the text matching should be case sensitive

3.9. Advanced activities

Advanced activities are terminal activities that work based on coordinates and cursor location. They should be used only when the field’s positions do not change, in order to ensure a successful workflow run.

3.9.1. Move Cursor activity

Moves the cursor position to the specified location. In the sample below, the cursor will be moved at the beginning of the selected field.

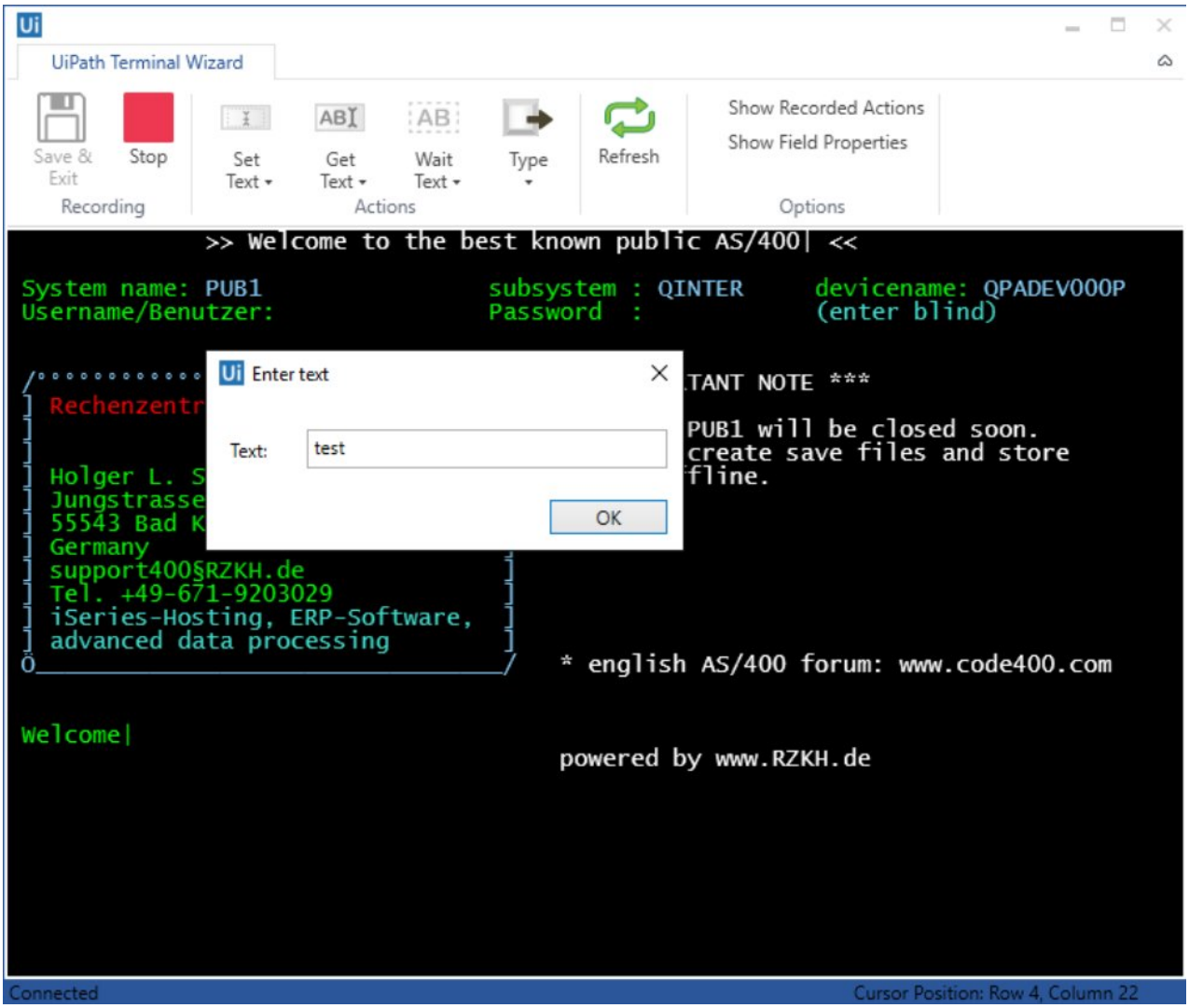


Properties:

- Row: 1-based index of the row where the cursor will be moved
- Column: 1-based index of the column where the cursor will be moved

3.9.2. Send Keys activity

Sends the specified text to the terminal cursor position. One must ensure that the cursor position is inside an editable field by using Move Cursor activity.



Properties:

- Text: a string expression that will be sent to the terminal

3.9.3. Set Field at Position activity

Similar to Set Field activity, uses coordinates to identify the field.

Properties:

- Row: 1-based index of the row where the cursor will be moved
- Column: 1-based index of the column where the cursor will be moved
- Text: a string expression used for setting the field value

3.9.4. Get Field at Position activity

Similar to Get Field activity, uses coordinates to identify the field.

Properties:

- Row: 1-based index of the row where the cursor will be moved
- Column: 1-based index of the column where the cursor will be moved

- Text: a string variable where the resulting text is saved

3.9.5. Get Text at Position activity

Obtains the text of length from the specified position. It is not limited to a single field.

Properties:

- Row: 1-based index of the row where the cursor will be moved
- Column: 1-based index of the column where the cursor will be moved
- Length: the number of characters to return; if is not supplied, the text until the end of the screen is returned
- Text: a string variable where the resulting text is saved

3.9.6. Wait Text at Position activity

Similar to Wait Field Text activity, uses coordinates to identify the field.

Properties:

- Row: 1-based index of the row where the cursor will be moved
- Column: 1-based index of the column where the cursor will be moved
- Text: a string expression containing the value to wait for; it supports wildcards
- MatchCase: a flag indicating if the text matching should be case sensitive

4. Supported providers

4.1. Attachmate Reflection

4.1.1. Prerequisites

Attachmate reflection installed (https://www.attachmate.com/products/reflection/2014/)

4.1.2. Usage

When using profile mode, the profile file must be located in the Attachmate Reflection profile folder. Default is 'C:\Users\\Documents\Attachmate\Reflection'

4.2. Rocket BlueZone

4.2.1. Prerequisites

Rocket BlueZone (5.2+) Terminal Emulation installed (http://www.rocketsoftware.com/products/rocket-bluezone-terminal-emulation)

4.2.2. Usage

No custom requirements

4.3. IBM Personal Communications

4.3.1. Prerequisites

IBM Personal Communications (http://www-03.ibm.com/software/products/en/pcomm)

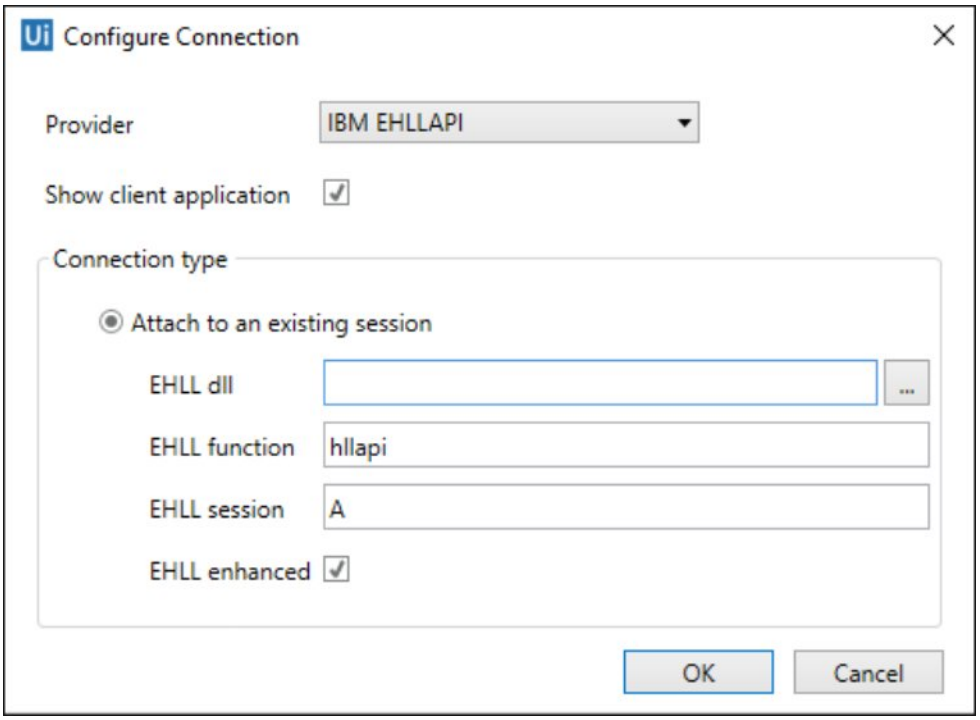
4.3.2. Usage

Only profile mode supported. The profile file must be located in the IBM Personal Communications profile folder. Default is 'C:\Users\\AppData\Roaming\IBM\Personal Communications'

4.4. Using IBM EHLL standard

One may choose to connect to a terminal using IBM EHLL standard. This is an advanced type of connection and specific information regarding EHLL implementation need to be provided. Depending on the EHLL implementation, some features could not be available (like field color).

One can only attach to an existing terminal session using this method.



4.4.1. Prerequisites

An emulator that implements the EHLLAPI standard (http://www-01.ibm.com/support/knowledgecenter/api/content/nl/en-us/SSEQ5Y_5.9.0/com.ibm.pcomm.doc/books/html/emulator_programming07.htm#Header_16)

4.4.2. Usage

The terminal emulator window should be opened before the connection (see Application specifics)

- In connection dialog the path to the DLL implementing the EHLLAPI standard must be specified
- The EHLL function should be changed accordingly (usually is ‘hllapi’)
- The session name should be the session short name of the previously opened
- The Show client application has no effect

4.4.3. Application specifics

4.4.3.1. IBM implementation

The EHLLAPI implementation dll is ‘pcshll32.dll’; default, it is located in ‘C:\Program Files (x86)\IBM\Personal Communications’.

4.4.3.2. Attachmate Extra

The EHLLAPI implementation dll is ‘pcshll32.dll’; default, it is located in ‘C:\Program Files (x86)\Attachmate\EXTRA!’.

Requirements/limitations:

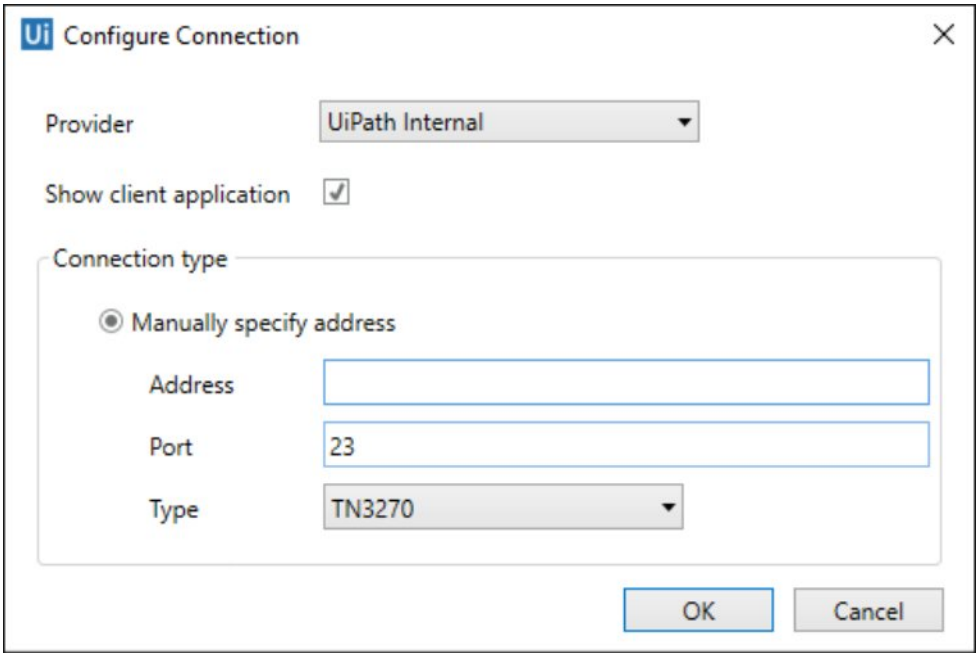
- In Attachmate Extra application, one must associate a session short name letter with a profile file (Options -> Global Preferences -> Advanced -> HLLAPI shortname); this letter will be used in terminal session connection dialog (UiPath Studio)
- The session must NOT be started when connecting from UiPath Studio

4.4.3.3. Micro Focus Rumba

The EHLLAPI implementation dll is ehlapi32.dll’; default, it is located in ‘C:\Program Files (x86)\Micro Focus\RUMBA\System’. The Ehll Enhanced checkbox should be unchecked.

Requirements/limitations:

- In Micro Focus Rumba Desktop application one must associate a session short name letter (Options -> API… -> Identification ->Session Short Name). Also, must check the classic HLLAPI data structure (Options -> API… -> Configuration -> Classic HLLAPI data structure).

4.5. Using UiPath implementation

This is a custom implementation and it requires the address of the server and the terminal type.