

This is documentation for WiX Toolset **v3**, which is no longer actively maintained.

For up-to-date documentation, see the [latest version](#) (v4.0).

Version: v3

Getting Started

There are several options available to get started learning how to use WiX.

How To Guides

This help file includes a set of [How To Guides](#) that explain how to accomplish common Windows Installer tasks using WiX.

Tutorials

- [WiX Tutorial](#)
- [Video on Channel 9](#)

Community

If you prefer to learn by interacting with the community, there is a [WiX users mailing list](#).

Integrated Development Environment

If you prefer to learn by using an integrated development environment, there is an overview of WiX editors at

<http://robmensching.com/blog/posts/2007/11/20/wix-editors>.

Reverse Engineering

If you prefer to learn by working backward from a Windows Installer package you have already created, you can run the [WiX decompiler](#) (Dark) to convert your package into WiX authoring and then recompile it using the [WiX compiler](#) (Candle) and [WiX linker](#) (Light).

Reading Source Code

If you prefer to learn by reading code, WiX is an open source project, and you can look at the source code by reviewing the [How to be a WiX Developer](#) topic.

Fix a Bug, Write a Feature

If you prefer to learn by writing code, you can review the [WiX issue tracker](#).

For WiX development assistance, there is a [WiX developer mailing list](#).

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WiX Toolset v3 Tutorial

The [WiX Toolset](http://wixtoolset.org/) (<http://wixtoolset.org/>) is a set of tools that build Windows installation packages from XML source code. The toolset provides both a command line environment that developers may either integrate into their oldstyle Makefile build processes or use the newer MSBuild technology from inside integrated development

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environments like Microsoft Visual Studio or SharpDevelop to build their MSI and MSM setup packages.

WiX is an open source project, originally developed by Microsoft and maintained by Rob Mensching. You can download the latest binary and source code releases (<http://wixtoolset.org/releases/>). This tutorial covers the stable version 3.x.

The toolset is written in C# and requires the .NET Framework to run. However, this only applies to the toolset itself. The installation packages you create with the toolset do not require any extra framework or software to be installed on the target computer. Similarly, there might be a few additional utilities required for some special applications (merge modules, patches) but only on your build computer, the client will only need the finished and self-contained installer package, nothing else.

There is a friendly community of WiX developers and users all over the Internet. A list of resources is available on the WiX web site. (<https://wixtoolset.org/docs/gethelp/>)

Introduction

Finishing the development of an application is still far from ending it. During the recent years, users have learned to expect a full-fledged, complete setup solution bundled

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with your product---and as the setup is the very first part of the application the end user becomes acquainted with, the importance of its integrity and reliability cannot be overestimated.

Traditional setup tools used a programmatic, script-based approach to describe the various steps involved in the deployment of the application to be installed on the target machine: files to be copied, registry settings to be created, device drivers and services to be started. The technology behind Windows Installer, while it maintains a comparable look and feel for the end user, underwent important philosophical changes. The fundamental change was to move from the imperative description to a declarative one: rather than to describe the individual steps of installation, the declarative form specifies the state the target machine should be left in after various phases of installation and uninstallation. While the imperative description seems to be quite sufficient until some error occurs, the declarative one makes it possible to cope with unexpected conditions, differing target machine environments, aborted installations, shared resources. It is of paramount importance for setup developers to make sure that whatever happens during the process, the target machine should be left in a known, stable state, without introducing any detrimental side effects.

The developers of the widely used setup tools also embraced the new technology and started to offer new

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versions of their tools to create setup programs of this nature. However, as the experience of many developers shows, while these tools are perfectly capable of creating simpler installation packages, they often prove too limiting, inflexible when it comes to more complex requirements.

The toolset we are about to introduce, WiX, uses a different approach. Instead of a tool with a graphical interface that allows the developers to collect the files and other related tasks making up the installation process manually, it is much more like a programming language. Integrating perfectly with the usual process of creating applications, it uses a text file (based on the XML format) to describe all the elements of the installation process. The toolset has a compiler and a linker that will create the setup program just like our usual compiler creates our application from the source files. Therefore, WiX can be made part of any automated application build process very easily, be that based either on the classical technology of makefiles or the similar features of contemporary integrated development environments.

In addition to this integration, providing basically nothing more but developer comfort, WiX offers another level of integration, far more advantageous than the first one: the integration of the setup development process with that of the application. Traditionally, setup programs were only written when the main application had already been finished; often even by different developers. This

approach requires a tedious and error prone process of collecting information about all the resources making up the application. While the files themselves are usually obvious, registry entries, services and most forms of inter-resource dependencies are often hard to reconstruct in a later stage: if solid development documentation is lacking, the setup developers have to collect all pieces of information from the original developers or try to extract it from the source code.

In an integrated application/setup development environment, the original developer should modify the WiX source files in sync with the application development.

As soon as a new module has been started, a new registry entry, service or other dependency has been coded, the appropriate setup modification should be made in parallel. Using this approach, no important information will ever be lost and, as a bonus, the setup program will be practically finished together with the application itself.

As a consequence, WiX is not equally suited to all developers. The relatively steep learning curve (although our primary goal is to help overcome this difficulty with our tutorial) and the unavoidable exposure to the internal details and, sometimes, intricacies of the underlying Windows Installer technology suggest that less experienced developers or those who don't really need the unlimited and unparalleled performance WiX can offer might be better served by a simpler, GUI-based setup

authoring tool, of which there are both commercial and freeware solutions available.

To summarize the features and advantages of the toolset:

- declarative approach
- unrestricted access to Windows Installer functionality
- source code instead of GUI-based assembly of information
- complete integration into application build processes
- possible integration with application development
- support for team development, both in-house and third-party
- free, open source

You might wonder if WiX is already mature enough for the installation of large, complex applications with a large number of files to be deployed. Well, Microsoft itself uses WiX with all its major software packages. Just as an example, the setup of Microsoft Office was developed entirely with WiX.

I'd like to express my thanks to Rob Mensching for creating the toolset in the first place, and to Neil Sleighholm, Vadym Stetsyak, Robert Pickering, Marc Borgers, John DeSoi, Markus Karg, Greg Glass, Stefan Krüger, Nobuo Kihara, Phil Wilson, Peter Tewkesbury, Nicholas Muguirra, David Adams, Mike Green, Chesong Lee and Christophe Michel for the material contributed to the tutorial.

(Ed. note: FireGiant wants to thank Gábor DEÁK JAHN for creating and hosting the WiX Tutorial for so many years.)

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Getting Started

As we have already mentioned in the introduction, the WiX toolset uses XML source files describing the components that make up the installation process of our application as well as additional data about shortcuts, registry or .ini file changes, services and similar. In addition to the files you want to copy to the disk of the user, the installation package can also carry helper files that take part in the installation but will not be actually

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installed (these can include dialogs, icons and bitmaps for the installation UI, license or readme files, or custom DLLs to carry out any programmatic task the Windows Installer doesn't support, including any kind of user registration or key checking logic you might want to implement).

All these will be described in the source files fed to the WiX compiler. The toolset consists of several parts and we will use two of them to compile our installation packages. Assuming we have prepared a `Sample.wxs` file, the command

```
candle.exe Sample.wxs
```

will perform the first phase of the compilation, creating `Sample.wixobj`, a half-digested file (this one is still XML but its internal structure is irrelevant to us; think about it as an object file in usual compiler parlance). The second command

```
light.exe Sample.wixobj
```

will turn this intermediate representation into our final package, a `Sample.msi` file. Much like a compiler and a linker. Actually, even more: the linker, unless we specifically tell it not to do so, also runs a verification step that checks the finished installer database for hundreds of possible issues and problems.

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As is usual with compilers today, you are not limited to the command line any more. Integrated development environments like Microsoft Visual Studio or SharpDevelop also have support for WiX projects: either coming bundled with the IDE itself or as an addin. In the case of Visual Studio, the WiX package installs the VS support automatically. Using this approach, you can create a separate setup solution or even include the setup as a part project of a complete solution. In this case, you don't even have to leave your programming environment in order to build the final setup package.

But, although the analogy of a compiler and linker is very straightforward and might help us understand how WiX actually builds installation packages, you shouldn't consider the WiX source we will start to write in a minute anything like a script or programming language. We won't collect steps or operations required to install our application. The .msi file we want to distribute our application with is not a setup application but an installation database. The programming logic, the knowledge about how to install an application, how to modify registry keys, how to create shortcuts, users and network shares, how to manipulate web directories or services resides in Windows Installer. Our setup file only describes *what* we expect Windows Installer to do and provides the files to be deployed (as well as interface elements used in the process).

This database approach means that our WiX source files

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are not built like regular programs. There is no notion of sequential execution in WiX, the first source line is not supposed to be executed prior to the second one. There will be no declarations that need to precede the references. Various elements might be described in different places and, wherever a link is required between them, one will refer to the other using unique identifiers we need to provide. If you need to think in terms of programming languages, consider WiX as a functional, descriptive language rather than an imperative, prescriptive one.

Also note that WiX is not an installation environment of its own. To put it simply, it is a comfortable, XML-style way to describe your installation requirements that gets translated into Windows Installer .msi databases by its compiler and linker. In this respect, WiX is a relatively thin wrapper around Windows Installer technology, and while it does provide extra features to help the setup developers, its abilities are dictated by the underlying technology and its limitations are not of its own but the limitations of Windows Installer itself.

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The Software Package

Our first WiX sample will install a very simple imaginary application: it consists of an executable, a DLL library and a user manual. We expect these files to be copied to an application specific folder. We will also want two shortcuts to appear in the usual place in the Start Menu, plus we will add an icon shortcut to the user desktop to launch our



application.

As simple as this install package will be, the underlying Windows Installer will offer a great deal of functionality, including automatic inclusion of our program in the Programs and Features Control Panel tool. To make sure that Windows Installer can keep track of our program, we have to provide some means of identification. Although all applications have human readable names, Windows will require a more unique identifier than a mere name: GUIDs (those long, hexadecimal numbers like CE26AD1E-00D5-4E03-8CBE-6DA5C23AA833) to identify every part of our package. GUIDs come for free, you can generate as many as you like any time. They are guaranteed to be unique, no matter who else asks for GUIDs on their computers, they will never collide with yours. There are many utilities to ask for GUIDs, including this very simple C program (`/system/files/samples/UUIDgen.c`) that can be compiled with practically any C/C++ compiler of your choice. If you use a different programming language, you can call the necessary Win32 functions (`CoCreateGuid` and `StringFromGUID2`) there, too. C compilers usually keep them in the `ole32.lib` library file, so if you receive linker errors, remember to link against this library as well. The Windows SDK you get by installing Visual Studio also contains a GUID-generation tool, available, for example, at `%ProgramFiles%\Microsoft SDKs\Windows\v7.1A\Bin\uuidgen.exe` or `%ProgramFiles%\Windows Kits\8.1\bin\x86\uuidgen.exe`.

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Alternatively, many programmers' editors and integrated development environments can insert a freshly generated GUID into the source code on request. If the tool you use generates lowercase hexadecimal letters, convert them to uppercase before you present them to WiX.

All GUIDs in this tutorial, including those in the downloadable samples, are invalid—the first section is always changed to `YOURGUID`. This also means that the samples cannot be built straight away, without providing your own GUIDs first (you get a fatal error `CNDL0027: The 'Id' attribute has an invalid value according to its data type.` if you try). This is a small inconvenience but it is necessary to avoid the remote chance of several people using any of the samples verbatim, forgetting to change the GUIDs, and creating a risk of collision out there in the wild. Also note that you have to replace the complete GUID: never mix parts coming from different GUIDs (in other words, don't replace `YOURGUID` alone, replace the whole number). GUIDs are only guaranteed to be unique if used exactly as they were generated.

To start with, you'll need two GUIDs, one for your product and one for the installation package (actually, for any real world project, you'll also need an `UpgradeCode` GUID; be sure to check out the other lessons before you ship anything). While the other two have to be kept on file because you will probably need to refer to them later, Package GUIDs need to be different with each package

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you create. To make it easier and less likely to forget to issue a new one, we can instruct WiX to autogenerate one by typing an asterisk---but remember, this only applies to package GUIDs: all other GUIDs will need to stay unique and kept recorded for times to come. This with all other textual information about the product will go into the very first part of our `SampleFirst.wxs` file:

```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'>
    <Product Name='Foobar 1.0' Manufacturer='Acme Ltd.' Id='YOURGUID-86C7-4D14-AEC0-86416A69ABDE' UpgradeCode='YOURGUID-7349-453F-94F6-BCB5110BA4FD' Language='1033' Codepage='1252' Version='1.0.0'>
        <Package Id='*' Keywords='Installer' Description="Acme's Foobar 1.0 Installer" Comments='Foobar is a registered trademark of Acme Ltd.' Manufacturer='Acme Ltd.' InstallerVersion='100' Languages='1033' Compressed='yes' SummaryCodepage='1252' />
    </Product>
</Wix>
```

Product names and descriptions depend on you, of course. For the `Version` attribute, use the standard `major.minor.build` format. Windows Installer will ignore an eventual fourth field, `.revision` as it provides other means to differentiate revisions.

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As you know, XML is quite liberal for a format. Use indentation and empty lines as you see fit. Enclose all attribute values in quotes but you can choose from single and double quotes at will. This makes it very easy to write values containing a quote (like `Description` above), just make sure you use the other kind of quote to enclose the string.

You can use both UTF-8 and ANSI to create the XML. If you don't plan to use anything but the usual ASCII characters or those accented letters available in the standard ANSI character set, the `windows-1252` setting depicted in this example is quite satisfactory. If you need a larger or different character set in your user interface, change to UTF-8 and use the appropriate [language](#) ([https://docs.microsoft.com/en-us/previous-versions/windows/embedded/ms912047\(v=winembedded.10\)](https://docs.microsoft.com/en-us/previous-versions/windows/embedded/ms912047(v=winembedded.10))) and code pages (<https://docs.microsoft.com/en-us/windows/win32/intl/code-page-identifiers>) For instance, for Japanese:

```
<?xml version='1.0' encoding='utf-8'?>
<Wix xmlns='http://schemas.microsoft.com/wix/200
6/wi'>
  <Product Language='1041' Codepage='932' ...>
    <Package Languages='1041' SummaryCodepage='932
' ...>
```



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The Files Inside

In the next step, we have to specify the media we want to install from. In the days of CDs and DVDs, we'll hardly need installation files spanning media but the possibility is there (if you need to use it, you can later refer to the individual disks using the media `Id` supplied here).

`DiskPrompt` can contain any textual description of the various units of installation media that makes it possible

for the user to determine which one to insert, Windows Installer will use this description to prompt for it):

```
<Media Id='1' Cabinet='Sample.cab' EmbedCab='yes'  
  ' DiskPrompt='CD-ROM #1' />  
<Property Id='DiskPrompt' Value="Acme's Foobar  
1.0 Installation [1]" />
```

Using the `EmbedCab` attribute, we can decide whether we want the cabinet (archive) of our installation files to become part of the .msi package file itself or to remain separate. Embedding is the usual decision for the final installation package (thus resulting in a single, self-contained file for download or shipment on media). If neither `Cabinet` nor `EmbedCab` is specified, the source files will be left untouched: they can then be copied directly on the distribution media, together with the installer .msi file.

As we have stressed in the introduction, Windows Installer moved from the earlier programmatic approach to a declarative, descriptive one: we describe the hierarchical structure of our source folder structure using hierarchically nested XML structures, and expect the installer to *recreate* this structure during installation on the user machine. Windows Installer requires us to start with an outermost folder, the root destination folder for the whole installation. It has a predefined identifier of `TARGETDIR` and it will be set to our root directory that contains the source cabinet file or the source file tree of

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the installation package, which also have a predefined name: `SourceDir`. This provides the basic link between where to install *from* and where to install *to*:

```
<Directory Id='TARGETDIR' Name='SourceDir'>
```

Inside this root folder, we go on with our actual structure. According to established guidelines, installed files go into predetermined locations. For instance, applications should go under `\Program Files\Company\Product`. Shortcuts, desktop icons, user preferences, and so forth all have their own predefined target locations. For our convenience, the installer environment provides predefined names (<https://msdn.microsoft.com/en-us/library/aa372057.aspx>) for all of them, allowing us to refer to them very easily. This also frees us from localization issues because these folders might very well have different, localized names in non-English Windows versions. In our current example, we'll use three of these names: `ProgramFilesFolder`, `ProgramMenuFolder`, and `DesktopFolder`. Note that these predefined names refer to full paths: even if the Desktop folder is several folders deep in `C:\Users\User\Desktop`, a single `Directory` tag is all it takes to refer to it. With our own nested folders, we have to specify each level separately:

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```
<Directory Id='ProgramFilesFolder' Name='PFiles'>
    <Directory Id='Acme' Name='Acme'>
        <Directory Id='INSTALLDIR' Name='Foobar
1.0'>
```

Note that for each element (and this will be the case throughout the use of WiX) we have to provide an `Id` identifier. Most of the time, these identifiers must be unique because we will cross-reference them all across the WiX source file, so make sure you come up with a naming scheme that makes it easy to follow. In some cases (like `ProgramFilesFolder`) we can use predefined names. In other cases, we use property names (roughly equivalent to a string variable), like `INSTALLDIR`. We will later refer to this property name again.

The notion of *components* and the rules governing their use are probably the most important concepts of the Windows Installer technology and failing to observe these rules is the primary reason for failing setups. Thus, it is very important for us to get a good understanding of components before we can go on with our first sample.

The component is the atomic unit of things to be installed. It consists of resources---files, registry keys, shortcuts, or anything else---that should always be installed as a single unit. Installing a component should never influence other components, removing one should never damage another component or leave any orphaned resource on the target

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machine. As a consequence, components cannot share files: the same file going to the same location must never be included in more than one component.

It's not at the component level that you have to think about what files make up your product. If the product requires an EXE, three DLLs and a couple of data files, this doesn't mean they have to go into a single component, quite the opposite. Later on, we will decide at a higher level of the hierarchy what components belong together to form a standalone part of your product.

Again, a component should only contain items that belong together so strongly that they always need to be installed or removed together. If this means a single file, then your components will contain a single file each. This is not only normal but exactly what you're expected to do. Don't be afraid, Windows Installer can efficiently handle thousands of components or more, if needed.

So, we have a component consisting of three items, a file and two shortcuts pointing to it. A component has to have its own `Id` identifier as well as its own, unique GUID (the WiX compiler and linker will warn you if you happen to reuse any of these two). This is very important--these GUIDs are the only means for Windows Installer to keep track of the various components. Breaking the component rules will have dire consequences: resources can be left orphaned on the machine during removal, a shared resource might be erroneously removed while another

application still needs it, reinstallation of an existing product might fail to restore the functionality, installing the new version of an application can break the previous one.

```
<Component Id='MainExecutable' Guid='YOURGUID-83  
F1-4F22-985B-FDB3C8ABD471'>
```

A file is specified by its name. Apart from the actual names, you can decorate the file with several other attributes. `Vital`, when set to `no`, tells the installer that installing this file is not of vital importance. Normally, if installing any file fails for any reason, the installation will be aborted, the user will not be allowed to ignore the problem. Other attributes include `ReadOnly`, `Hidden`, `System`, all making the file to have the appropriate attribute set when installed.

Each component needs a key path. This is the item Windows Installer can later check to see whether the component is actually installed. Although this doesn't seem very important right now when we only learn to install it in the first place, it is important to specify such a key path for every component we use in order to support the uninstallation and repair functionality of the Installer. Besides, the compiler will complain if we don't specify one...

```
<File Id='FoobarEXE' Name='FoobarAppl10.exe' Dis  
kId='1' Source='FoobarAppl10.exe' KeyPath='yes'>
```

Shortcuts also have names and but also provide other important items like working folder and icon specifications. Note the difference between `Directory` (where the shortcut will be placed such as a Start menu or the desktop) and the `WorkingDirectory` (the place the shortcut points to). The second is optional; if omitted, it will default, as expected, to the folder the parent file will be installed into. The `Icon` attribute will allow us to specify the `Id` of an `Icon` tag specified somewhere else in the source rather than the actual filename (even if the `.exe` extension seems to suggest otherwise, the identifier has to have the same extension as the actual file it will refer to). You can observe that we already reused the `INSTALLDIR` property and, as expected, it will reference to the folder we're installing into, `Program Files\Acme\Foobar 1.0`. Description of other folders might come later in the source code.

Shortcuts can be non-advertised (a simple link pointing to the file in the shortcut's Properties dialog) or advertised (with the link greyed out). This second form lets Windows Installer repair the installation by replacing any missing file the shortcut points to.

```
<Shortcut Id="startmenuFoobar10" Directory="ProgramMenuDir" Name="Foobar 1.0"
          WorkingDirectory='INSTALLDIR' Icon="Foobar10.exe" IconIndex="0" Advertise="yes" />
    <Shortcut Id="desktopFoobar10" Directory="DesktopFolder" Name="Foobar 1.0"
          WorkingDirectory='INSTALLDIR' Icon="Foobar10.exe" IconIndex="0" Advertise="yes" />
</File>
</Component>
```

Here come two other components, with their unique `Id` and `Guid`:

```
<Component Id='HelperLibrary' Guid='YOURGUID-6BE3-460D-A14F-75658D16550B'>
    <File Id='HelperDLL' Name='Helper.dll' DiskId='1' Source='Helper.dll' KeyPath='yes' />
</Component>

<Component Id='Manual' Guid='YOURGUID-574D-4A9A-A266-5B5EC2C022A4'>
    <File Id='Manual' Name='Manual.pdf' DiskId='1' Source='Manual.pdf' KeyPath='yes'>
        <Shortcut Id='startmenuManual' Directory='ProgramMenuDir' Name='Instruction Manual' Advertise='yes' />
    </File>
</Component>
```

As you might expect, for an application with hundreds or even thousands of files, this will mean hundreds or

thousands of components. Yes, this is normal, this is the expected way to do it. Don't be afraid, there will be no performance problems, the Windows Installer is prepared to handle this all right.

Typing all those hundreds or thousands of components into the WiX source file presents another challenge, of course. The toolset has a [small utility \(/docs/wix/v3/tutorial/com-expression-syntax-miscellanea/components-of-a-different-color\)](#) that can help with this (more about it later) but the real solution is a conceptual change. Stop considering the setup program as a separate application that has to be written in a rush when the main application is already finished. As the WiX source files and the toolset itself can be integrated into your development environment easily, you should keep them in sync all the time. As soon as you start working on a new module or add a new registry reference to your program, modify the corresponding WiX source file at the same time. This way, the setup will be finished together with the application itself and there will be no need to extract all the file and other pieces of information required for the installation later. As the WiX project can be modularized (more about this later), this approach works just as well if you have a large team working on the application rather than a single developer.

And now, the closing tags for the directory elements---one less than what we started with because we're not yet finished. Remaining inside the first, TARGETDIR , directory

tag, we specify two more full path folders, using predefined names of the Installer: one for our Start Menu shortcuts and another one for our Desktop icons. Only then will the outermost `Directory` tag be closed.

```
</Directory>
</Directory>
</Directory>
```

As we need to remove the program folder when the product is uninstalled, we need to create a fourth component as well. The `RemoveFolder` tag will describe our intention; the `On` attribute will determine when the folder will be removed (possible values are *install*, *uninstall*, and *both*). As already mentioned, all components must have their own key path. In this case, this will be an extra `RegistryValue` tag. This tag is beyond the scope of this first lesson, we will return to it later. Putting the `KeyPath` attribute on the component or the folder might work, too, but that would result in a linker warning. So, please, accept this solution for now as something temporarily unexplained for the sake of avoiding any messages from the compiler and linker.

```
<Directory Id="ProgramMenuFolder" Name="Programs">
    <Directory Id="ProgramMenuDir" Name="Foobar 1.0">
        <Component Id="ProgramMenuDir" Guid="YOURGUID-7E98-44CE-B049-C477CC0A2B00">
            <RemoveFolder Id='ProgramMenuDir' On='uninstall' />
            <RegistryValue Root='HKCU' Key='Software\[Manufacturer]\[ProductName]' Type='string' Value='' KeyPath='yes' />
        </Component>
    </Directory>
</Directory>

    <Directory Id="DesktopFolder" Name="Desktop" />
</Directory>
```

Note the `Id` identifiers we used to identify these two folders, these are the names we used in our shortcut's `Directory` attribute earlier to make the connection between the location of the shortcut and the actual folder. Last but not least, we tell the installer which *features* we would like to install. Features are separated parts of the application that we offer the user to decide whether to install or not. The details will of course depend on your particular software package but a usual scheme might look like this:

- the basic executables necessary for the functioning of the program

- documentation, help files
- tutorials, sample files
- related utilities

In our first sample, we won't have such features. First, because we could hardly divide the three files we plan to install into various features. Second, to do so, we would also need a user interface that the user can use to turn these features on or off. We'll return to that in the next lesson but for now, we will have one feature (because we have to have at least one). We refer back to the components we would like to install with this feature using their `Id` identifiers:

```
<Feature Id='Complete' Level='1'>
    <ComponentRef Id='MainExecutable' />
    <ComponentRef Id='HelperLibrary' />
    <ComponentRef Id='Manual' />
    <ComponentRef Id='ProgramMenuDir' />
</Feature>
```

We also have to include the icon we want to use in the shortcuts. Note that the `Id` identifier has to carry the same extension as the target file, in this case, `.exe`:

```
<Icon Id="Foobar10.exe" SourceFile="FoobarAppl1
0.exe" />
```

This will store the source file separately in the final installation package (so, if you refer to your main

executable, you will end up with two copies). If the size of the file is large enough to cause concern, create a small .exe or .ico file containing nothing but the icons.

```
<Shortcut Id="desktopFoobar10" Directory="Deskt  
pFolder" Name="Foobar 1.0" WorkingDirectory='INS  
TALLDIR' Icon="Foobar10.ico" IconIndex="0" />  
...  
<Icon Id="Foobar10.ico" SourceFile="FoobarAppl1  
0.ico" />
```

All there's left to do is to provide the closing tags for the two tags we still have open:

```
</Product>  
</Wix>
```

To summarize: first, we provided the description of our application, both the human readable texts and the required GUIDs. Second, we specified the media we want to install from. Next, we specified the folder structure of our files to be installed. These files, together with their accompanying resources, all went into the appropriate components. And finally, we described the features we would like to install, referring back to the individual components.

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System Folder Properties

Article 09/13/2007

The following list provides links to more information about system folders that the installer sets at setup.

Property	Description
AdminToolsFolder	The full path to the directory that contains administrative tools.
AppDataFolder	The full path to the Roaming folder for the current user.
CommonAppDataFolder	The full path to application data for all users.
CommonFiles64Folder	The full path to the predefined 64-bit Common Files folder.
CommonFilesFolder	The full path to the Common Files folder for the current user.
DesktopFolder	The full path to the Desktop folder.
FavoritesFolder	The full path to the Favorites folder for the current user.
FontsFolder	The full path to the Fonts folder.
LocalAppDataFolder	The full path to the folder that contains local (nonroaming) applications.
MyPicturesFolder	The full path to the Pictures folder.
PersonalFolder	The full path to the Documents folder for the current user.
ProgramFiles64Folder	The full path to the predefined 64-bit Program Files folder.
ProgramFilesFolder	The full path to the predefined 32-bit Program Files folder.
ProgramMenuFolder	The full path to the Program Menu folder.

Property	Description
SendToFolder	The full path to the SendTo folder for the current user.
StartMenuFolder	The full path to the Start menu folder.
StartupFolder	The full path to the Startup folder.
System16Folder	The full path to folder for 16-bit system DLLs.
System64Folder	The full path to the predefined System64 folder.
SystemFolder	The full path to the System folder for the current user.
TempFolder	The full path to the Temp folder.
TemplateFolder	The full path to the Template folder for the current user.
WindowsFolder	The full path to the Windows folder.
WindowsVolume	The volume of the Windows folder.

See Also

[About Properties](#)

[Property Reference](#)

[Using Properties](#)

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Build date: 9/10/2007

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Putting it to Use

If you copy all these fragments together (or, to spare some elbow grease, download the [SampleFirst archive \(/system/files/samples/SampleFirst.zip\)](#)), you can build the installer package with the commands:

```
candle.exe SampleFirst.wxs  
light.exe SampleFirst.wixobj
```

You should get no error message from either tool, and you should find a `SampleFirst.msi` file in your folder upon completion. If not, check for typos everywhere. Please, also note that the required syntax of the `.wxs` files might undergo some minor changes as the WiX toolset develops.

This tutorial always assumes the most current version of the WiX toolset and the samples should all compile without any error message straight out of the box (provided you correct the invalid GUIDs as described earlier). If you do receive compiler errors or warnings, please, compare your toolset version to the current one available for download.

To test your first installer, simply click on it. It will not greet you or offer any options, just show a progress dialog for a few seconds. But as soon as it finishes without errors, you should be able to find your three files in `Program Files\Acme\Foobar 1.0` all right. Note that the actual files deployed are 1-byte placeholder files, so the installed "application" will, naturally, refuse to run.

To remove this huge application again, go to the Programs and Features Control Panel tool, find `Foobar 1.0` in the list, click `Remove`. (`Change` will accomplish nothing at this stage.) Both the three files and the `Acme\Foobar 1.0` folders will be removed.

If you experience any problems---or just for fun---start the

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installer with logging turned on:

```
msiexec /i SampleFirst.msi /l* SampleFirst.log
```

or even

```
msiexec /i SampleFirst.msi /l*v SampleFirst.log
```

The log will be rather verbose (especially in the second case) but it will pinpoint the error that might cause the installation to fail.

During testing, you might find it more convenient to remove the package without having to open the Programs and Features Control Panel tool. Just enter the command instead:

```
msiexec /x SampleFirst.msi
```

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Useful Extras

Needless to say, we can do much more than to simply copy a couple of files around. To start with, we can have launch conditions: we check for some global settings and stop the installation if our conditions are not met. Just add this line to our previous sample somewhere not within a feature (for instance, between the `Package` and `Media` tags) and it will refuse to run if you're not an administrator

on your machine:

```
<Condition Message="You need to be an administrator to install this product.">
    Privileged
</Condition>
```

On Vista, use:

```
<Condition Message="You need to be an administrator to install this product.">
    AdminUser
</Condition>
```

Note that the messages will appear and the installation will be aborted if the condition between the starting and closing tags evaluates to *false*. In other words, don't specify the error condition, specify the case you want to proceed with the installation in:

```
<Condition Message='This application only runs on Windows 95/98/ME.'>
    Version9X
</Condition>
```

There are quite a few standard properties you can use in similar conditions but the most important ones would be those specifying the version of Windows the setup is running on. **Version9X** is true on Windows 95, 98 and ME. **VersionNT** is true on NT 4.0 and later. **VersionNT64**

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Now you can install with confidence. FireGiant arms you with accurate support from the creators of WiX.

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signals a 64-bit operating system.

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```
<Condition Message='Windows 95'>Version9X = 400
</Condition>
<Condition Message='Windows 95 OSR2.5'>Version9X
= 400 AND WindowsBuild = 1111</Condition>
<Condition Message='Windows 98'>Version9X = 410
</Condition>
<Condition Message='Windows 98 SE'>Version9X = 4
10 AND WindowsBuild = 2222</Condition>
<Condition Message='Windows ME'>Version9X = 490
</Condition>
<Condition Message='Windows NT4'>VersionNT = 400
</Condition>
<Condition Message='Windows NT4 SPn'>VersionNT =
400 AND ServicePackLevel = n</Condition>
<Condition Message='Windows 2000'>VersionNT = 50
0</Condition>
<Condition Message='Windows 2000 SPn'>VersionNT
= 500 AND ServicePackLevel = n</Condition>
<Condition Message='Windows XP'>VersionNT = 501
</Condition>
<Condition Message='Windows XP SPn'>VersionNT =
501 AND ServicePackLevel = n</Condition>
<Condition Message='Windows XP Home SPn'>Version
NT = 501 AND MsINTSuitePersonal AND ServicePackL
evel = n</Condition>
<Condition Message='Windows Server 2003'>Version
NT = 502</Condition>
<Condition Message='Windows Vista'>VersionNT = 6
00</Condition>
<Condition Message='Windows Vista SP1'>VersionNT
= 600 AND ServicePackLevel = 1</Condition>
<Condition Message='Windows Server 2008'>Version
NT = 600 AND MsINTProductType = 3</Condition>
<Condition Message='Windows 7'>VersionNT = 601</
Condition>
```

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There are many more properties like these ([http://msdn.microsoft.com/en-us/library/aa370905\(VS.85\).aspx#operating_system_properties](http://msdn.microsoft.com/en-us/library/aa370905(VS.85).aspx#operating_system_properties)) to choose from. For instance, `MsiNTProductType` allows you to differentiate between Workstation, Domain Controller and Server. Be sure to check out the other `MsiNT` properties as well.

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Property Reference

Article • 08/19/2021

This section lists the properties defined by Windows Installer:

- [Component Location Properties](#)
- [Configuration Properties](#)
- [Date, Time Properties](#)
- [Feature Installation Options Properties](#)
- [Hardware Properties](#)
- [Installation Status Properties](#)
- [Operating System Properties](#)
- [Product Information Properties](#)
- [Summary Information Update Properties](#)
- [System Folder Properties](#)
- [User Information Properties](#)

Additional properties can be specified by authored data or custom actions. Properties with names containing no lowercase letters are public properties and can be specified on the command line.

For information about values of the **Uninstall** registry key that are provided by installer properties, see [Uninstall Registry Key](#).

Component Location Properties

The following list provides links to more information about the component location properties.

Property	Description
OriginalDatabase	The installer sets this property to the launched-from database, the database on the source, or the cached database.
ParentOriginalDatabase	The installer sets this property for installations run by a Concurrent Installation action.
SourceDir	Root directory that contains the source files.
TARGETDIR	Specifies the root destination directory for the installation. During an administrative installation this property is the location to copy the installation package.

Configuration Properties

The following list provides links to more information about other configurable properties.

Property	Description
ACTION	Initial action called after the installer is initialized.
ALLUSERS	Determines where configuration information is stored.
ARPAUTHORIZEDCDFPREFIX	URL of the update channel for an application.
ARPCOMMENTS	Provides Comments for the Add or Remove Programs in Control Panel .
ARPCONTACT	Provides Contact for the Add or Remove Programs in Control Panel .
ARPINSTALLLOCATION	Fully qualified path to the primary folder of an application.
ARPNOMODIFY	Disables functionality that modifies a product.

Property	Description
ARPNOREMOVE	Disables functionality that removes a product.
ARPNOREPAIR	Disables the Repair button in the Programs wizard.
ARPPRODUCTICON	Specifies the primary icon for the installation package.
ARPREADME	Provides a ReadMe for the Add or Remove Programs in Control Panel.
ARPSIZE	Estimated size of an application in kilobytes.
ARPSYSTEMCOMPONENT	Prevents display of an application in the Add or Remove Programs list.
ARPURLINFOABOUT	URL for the home page of an application.
ARPURLUPDATEINFO	URL for application update information.
AVAILABLEFREEREG	Registry space (in kilobytes) that an application requires. Used by AllocateRegistrySpace action.
CCP_DRIVE	The root path for qualifying products for CCP.
DefaultUIFont	Default font style used for controls.
DISABLEADVTSHORTCUTS	Set to disable the generation the specific shortcuts that support installation-on-demand .
DISABLEMEDIA	Prevents the installer from registering media sources, such as a CD-ROMs, as valid sources for the product.
DISABLEROLLBACK	Disables rollback for the current configuration.
EXECUTEACTION	Top-level action that ExecuteAction initiates.
EXECUTEMODE	Mode of execution that the installer performs.
FASTOEM	Improves installation performance under specific OEM scenarios.

Property	Description
INSTALLLEVEL	Initial level where features are installed.
LIMITUI	UI level capped as Basic.
LOGACTION	List of action names to be logged.
MEDIAPACKAGEPATH	This property must be set to the relative path if the installation package is not located at the root of the CD-ROM.
MSIARPSETTINGSIDENTIFIER	This optional property contains a semi-colon delimited list of the registry locations where the application stores a user's settings and preferences. Available with Windows Installer 4.0.
MSIDISABLEEUI	Disable the embedded user interface for the installation.
	Windows Installer 4.0 and earlier : Not supported.
MSIFASTINSTALL	Reduce the time required to install a large Windows Installer package.
	Windows Installer 4.5 and earlier : Not supported.
MSIINSTALLPERUSER	Requests that the Windows Installer install the package only for the current user.
	Windows Installer 4.5 and earlier : Not supported.
MSINODISABLEMEDIA	Set this property to prevent the installer from setting the DISABLEMEDIA property.
MSIENFORCEUPGRADECOMPONENTRULES	Set this property to 1 (one) on the command line or in the Property Table to apply the upgrade component rules during small updates and minor upgrades of a specific product. Available beginning with Windows Installer 3.0.
MSIUNINSTALLSUPERSEDEDCOMPONENTS	When this property has been set to 1, the installer can unregister and uninstall redundant components to prevent leaving behind orphan components on the computer.
	Windows Installer 4.0 and earlier : Not supported.
PRIMARYFOLDER	Allows the author to designate a primary folder for an installation. Used to determine the values for the PrimaryVolumePath , PrimaryVolumeSpaceAvailable ,

Property	Description
	PrimaryVolumeSpaceRequired , and PrimaryVolumeSpaceRemaining properties.
Privileged	Runs an installation with elevated privileges.
PROMPTROLLBACKCOST	Action if there is insufficient disk space for the installation.
REBOOT	Forces or suppresses a restart.
REBOOTPROMPT	Suppresses the display of prompts for restarts to the user. Any restarts that are needed happen automatically.
ROOTDRIVE	Default drive for an installation.
SEQUENCE	A table that has the sequence table schema.
SHORTFILENAMES	Causes short file names to be used.
TRANSFORMS	List of transforms to be applied to a database.
TRANSFORMSATSOURCE	Informs the installer that the transforms for a product reside at the source.
TRANSFORMSSECURE	Setting the TRANSFORMSECURE property to 1 (one) informs the installer that transforms are to be cached locally on the user computer in a location where the user does not have write access.
MsiLogFileLocation	The installer sets the value of this property to the full path of the log file, when logging has been enabled. This property is available starting with Windows Installer 4.0.
MsiLogging	Sets the default logging mode for the Windows Installer package. This property is available starting with Windows Installer 4.0.
MSIUSERALADMINDETECTION	Set this property to 1 to request that the installer use actual user information when setting the AdminUser property. This property is available starting with Windows Installer 4.0.

Date, Time Properties

The **Date** and **Time** properties are live properties that the installer sets when data is extracted.

Property	Description
Date	The current date.
Time	The current time.

Feature Installation Options Properties

The following list provides links to more information about the feature installation options properties.

Property	Description
ADDDEFAULT	List of features to be installed in the default configuration.
ADDLOCAL	List of features to be installed locally.
ADDSOURCE	List of features to be run from source.
ADVERTISE	List of features to be advertised.
COMPADDDEFAULT	List of components to be installed in the default configuration.
COMPADDLOCAL	List of component IDs to be installed locally.

Property	Description
COMPADDSOURCE	List of component IDs to run from source media.
FILEADDDEFAULT	List of file keys for files to be installed in the default configuration.
FILEADDLOCAL	List of file keys for files to be run locally.
FILEADDSOURCE	List of file keys to be run from the source media.
MSIDISABLELUAPATCHING	Setting this property prevents Least Privileged User (LUA) patching of an application.
MsiPatchRemovalList	List of patches to be removed during the installation.
MSIRESTARTMANAGERCONTROL	Specifies whether the package uses the Restart Manager or FilesInUse functionality.
MSIDISABLERMRESTART	Specifies how applications or services that are currently using files affected by an update should be shutdown and restarted to enable the installation of the update.
MSIRMSHUTDOWN	Specifies how applications or services that are currently using files affected by an update should be shutdown to enable the installation of the update.
MSIPATCHREMOVE	Setting this property removes patches.
PATCH	Setting this property applies a patch.
REINSTALL	List of features to be reinstalled.
REINSTALLMODE	A string that contains letters that specify the type of reinstall to perform.
REMOVE	List of features to be removed.

Hardware Properties

The following list identifies the hardware properties that the Windows Installer sets at startup.

Property	Description
Alpha	The numeric processor level when running on an Alpha processor. Note: This property is obsolete, the Alpha platform is not supported by Windows Installer.
BorderSide	The width of the window borders, in pixels.
BorderTop	The height of the window borders, in pixels.
CaptionHeight	The height of normal caption area, in pixels.
ColorBits	The number of adjacent color bits for each pixel.
Intel	The numeric processor level when running on an Intel processor.
Intel64	The numeric processor level when running on an Itanium processor.
Msix64	The numeric processor level when running on an x64 processor.
PhysicalMemory	The size of the installed RAM, in megabytes.
ScreenX	The width of the screen, in pixels.
ScreenY	The height of the screen, in pixels.
TextHeight	The height of characters, in logical units.
VirtualMemory	The amount of available page file space, in megabytes.

Installation Status Properties

The following list provides links to more information about status properties that are updated by the installer during installation.

Property	Description
AFTERREBOOT	Indicates current installation follows a reboot that the ForceReboot action invokes.
CostingComplete	Indicates whether disk space costing is complete.
Installed	Indicates that a product is already installed.
MSICHECKCRCs	The Installer does a CRC on files only if the MSICHECKCRCs property is set.
MsiRestartManagerSessionKey	The Installer sets this property to the session key for the Restart Manager session.
MsiRunningElevated	The Installer sets the value of this property to 1 when the installer is running with elevated privileges.
MsiSystemRebootPending	The Installer sets this property to 1 if a restart of the operating system is currently pending.
MsiUIHideCancel	The Installer sets MsiUIHideCancel to 1 when the internal install level includes INSTALLUILEVEL_HIDECANCEL .
MsiUIProgressOnly	The Installer sets MsiUIProgressOnly to 1 when the internal install level includes INSTALLUILEVEL_PROGRESSONLY .
MsiUISourceResOnly	MsiUISourceResOnly to 1 (one) when the internal install level includes INSTALLUILEVEL_SOURCERESONLY .
NOCOMPANYNAME	Suppresses the automatic setting of the COMPANYNAME property.
NOUSERNAME	Suppresses the automatic setting of the USERNAME property.
OutOfDiskSpace	Insufficient disk space to accommodate the installation.

Property	Description
OutOfNoRbDiskSpace	Insufficient disk space with rollback turned off.
Preselected	Features are already selected.
PrimaryVolumePath	The Installer sets the value of this property to the path of the volume that the PRIMARYFOLDER property designates.
PrimaryVolumeSpaceAvailable	The Installer sets the value of this property to a string that represents the total number of bytes available on the volume that the PrimaryVolumePath property references.
PrimaryVolumeSpaceRemaining	The Installer sets the value of this property to a string that represents the total number of bytes remaining on the volume that the PrimaryVolumePath property references if all the currently selected features are installed.
PrimaryVolumeSpaceRequired	The Installer sets the value of this property to a string that represents the total number of bytes required by all currently selected features on the volume that the PrimaryVolumePath property references.
ProductLanguage	Numeric language identifier (LANGID) for the database. (REQUIRED)
ReplacedInUseFiles	Set if the installer installs over a file that is being held in use.
RESUME	Resumed installation.
RollbackDisabled	The installer sets this property when rollback is disabled.
UILevel	Indicates the user interface level.
UpdateStarted	Set when changes to the system have begun for this installation.
UPGRADINGPRODUCTCODE	Set by the installer when an upgrade removes an application.
VersionMsi	The installer sets this property to the version of Windows Installer that is run during the installation.

Operating System Properties

The following list provides links to more information about operating system properties that the Installer sets at startup.

Property Name	Brief Description
AdminUser	Set on Windows 2000 if the user has administrator privileges.
ComputerName	Computer name of the current system.
MsiNetAssemblySupport	On systems that support common language runtime assemblies, the Installer sets the value of this property to the file version of fusion.dll. The Installer does not set this property if the operating system does not support common language runtime assemblies.
MsiNTProductType	Indicates the Windows product type.
MsiNTSuiteBackOffice	On Windows 2000 and later operating systems, the Installer sets this property to 1 (one) only if Microsoft BackOffice components are installed.
MsiNTSuiteDataCenter	On Windows 2000 and later operating systems, the Installer sets this property to 1 (one) only if Windows 2000 Datacenter Server is installed.
MsiNTSuiteEnterprise	On Windows 2000 and later operating systems, the Installer sets this property to 1 (one) only if Windows 2000 Advanced Server is installed.
MsiNTSuitePersonal	On Windows XP and later operating systems, the Installer sets this property to 1 (one) only if the operating system is Home (not Professional).
MsiNTSuiteSmallBusiness	On Windows 2000 and later operating systems, the Installer sets this property to 1 (one) only if Microsoft Small Business Server is installed.

Property Name	Brief Description
MsiNTSuiteSmallBusinessRestricted	On Windows 2000 and later operating systems, the Installer sets this property to 1 (one) only if Microsoft Small Business Server is installed with the restrictive client license.
MsiNTSuiteWebServer	On Windows 2000 and later operating systems, the Installer sets the MsiNTSuiteWebServer property to 1 (one) if the web edition of the Windows Server 2003 is installed. Only available with the Windows Server 2003 release of the Windows Installer.
MsiTabletPC	The installer sets this property to a nonzero value if the current operating system is Windows XP Tablet PC Edition.
MsiWin32AssemblySupport	On systems that support Win32 assemblies, the Installer sets the value of this property to the file version of sxs.dll. The Installer does not set this property if the operating system does not support Win32 assemblies.
OLEAdvtSupport	Set if OLE supports the Windows Installer.
RedirectedDllSupport	The Installer sets the RedirectedDllSupport property if the system performing the installation supports Isolated Components .
RemoteAdminTS	The Installer sets the RemoteAdminTS property when the system is a remote administration server running the Terminal Server role service.
ServicePackLevel	The version number of the operating system service pack.
ServicePackLevelMinor	The minor version number of the operating system service pack.
SharedWindows	Set when the system is operating as Shared Windows.
ShellAdvtSupport	Set if the shell supports feature advertising.
SystemLanguageID	Default language identifier for the system.
TerminalServer	Set when the system is a server running the Terminal Server role service.

Property Name	Brief Description
TTCsupport	Indicates if the operating system supports using .ttc (true type font collections) files.
Version9X	Version number for the Windows operating system.
VersionDatabase	Numeric database version of the current installation.
VersionNT	Version number for the operating system.
VersionNT64	Version number for the operating system if the system is running on a 64-bit computer.
Windows build	Build number of the operating system.

Product Information Properties

The following list provides links to more information about product-specific properties specified in the [Property Table](#).

Property Name	Brief Description
ARPHELPLINK	Internet address or URL for technical support.
ARPHELPTELEPHONE	Technical support phone numbers.
DiskPrompt	String displayed by a message box that prompts for a disk.
IsAdminPackage	Set to 1 (one) if the current installation is running from a package created through an administrative installation.
LeftUnit	Places units to the left of the number.
Manufacturer	Name of the application manufacturer. (Required)

Property Name	Brief Description
MediaSourceDir	The installer sets this property to 1 (one) when the installation uses a media source, such as a CD-ROM.
MSIINSTANCEGUID	The presence of this property indicates that a product code changing transform is registered to the product.
MSINEWINSTANCE	This property indicates the installation of a new instance of a product with instance transforms.
ParentProductCode	The installer sets this property for installations that a Concurrent Installation action runs.
PIDTemplate	String used as a template for the PIDKEY property.
ProductCode	A unique identifier for a specific product release. (Required)
ProductName	Human readable name of an application. (Required)
ProductState	Set to the installed state of a product.
ProductVersion	String format of the product version as a numeric value. (Required)
UpgradeCode	A GUID that represents a related set of products.

Summary Information Update Properties

The following properties are only set by transforms in .msp files that are used to update the summary information stream of an administrative image.

Property	Description
PATCHNEWPACKAGECODE	The value of this property is written to the Revision Number Summary Property.

Property	Description
PATCHNEWSUMMARYCOMMENTS	The value of this property is written to the Comments Summary Property.
PATCHNEWSUMMARYSUBJECT	The value of this property is written to the Subject Summary Property.

System Folder Properties

The following list provides links to more information about system folders that the installer sets at setup.

Property	Description
AdminToolsFolder	The full path to the directory that contains administrative tools.
AppDataFolder	The full path to the Roaming folder for the current user.
CommonAppDataFolder	The full path to application data for all users.
CommonFiles64Folder	The full path to the predefined 64-bit Common Files folder.
CommonFilesFolder	The full path to the Common Files folder for the current user.
DesktopFolder	The full path to the Desktop folder.
FavoritesFolder	The full path to the Favorites folder for the current user.
FontsFolder	The full path to the Fonts folder.
LocalAppDataFolder	The full path to the folder that contains local (nonroaming) applications.
MyPicturesFolder	The full path to the Pictures folder.

Property	Description
NetHoodFolder	The full path to the NetHood folder.
PersonalFolder	The full path to the Documents folder for the current user.
PrintHoodFolder	The full path to the PrintHood folder.
ProgramFiles64Folder	The full path to the predefined 64-bit Program Files folder.
ProgramFilesFolder	The full path to the predefined 32-bit Program Files folder.
ProgramMenuFolder	The full path to the Program Menu folder.
RecentFolder	The full path to the Recent folder.
SendToFolder	The full path to the SendTo folder for the current user.
StartMenuFolder	The full path to the Start menu folder.
StartupFolder	The full path to the Startup folder.
System16Folder	The full path to folder for 16-bit system DLLs.
System64Folder	The full path to the predefined System64 folder.
SystemFolder	The full path to the System folder for the current user.
TempFolder	The full path to the Temp folder.
TemplateFolder	The full path to the Template folder for the current user.
WindowsFolder	The full path to the Windows folder.
WindowsVolume	The volume of the Windows folder.

User Information Properties

The following list provides links to more information about user-supplied information.

Property	Description
AdminProperties	List of properties that are set during an administration installation.
COMPANYNAME	Organization name of the user who is performing the installation.
LogonUser	User name for the user who is currently logged on.
MsiHiddenProperties	List of properties that are prevented from being written into the log.
PIDKEY	Part of the Product ID that the user enters.
ProductID	Full Product ID after a successful validation.
UserLanguageID	Default language identifier of the current user.
USERNAME	User who is performing the installation.
UserID property	Set by the installer according to the security identifier (SID) of the user.

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Where to Install?

Standalone applications will be installed into their own folders under **Program Files** ---we've already seen how to accomplish this. But plugins, add-ons or similar additional products, not meant for standalone use but to accompany other programs already installed on the system (either your own or some third party) has to learn when and where to install themselves first. Asking the

user to provide this information would be both inelegant and possibly dangerous in many cases, thus we need means of querying the registry, to consult .ini files already on the system or to look for actual folders and files to determine what to do.

When we look for any of those items, the result will be stored in a property (a string variable). So, we start by specifying the property (note that the `Id` we use is the same name we've already used in our first sample, denoting the target folder we install to). Inside the `Property` tag, we launch a registry search. The attributes speak for themselves:

```
<Property Id="INSTALLDIR">
  <RegistrySearch Id='AcmeFoobarRegistry' Type
  ='raw' Root='HKLM' Key='Software\Acme\Foobar 1.0'
  ' Name='InstallDir' />
</Property>
```

If the registry search was successful (that is, the registry entry specified does exist), its value will be assigned to our `INSTALLDIR` property, ready to be used for our purposes. To check this out, add this line after the `Media` tag in our previous sample and save it to `SampleRegistry.wxs` (or, just [download it](#) (`/system/files/samples/SampleRegistry.zip`) again). Compile it but before you start the installation, go into the registry and create the `HKEY_LOCAL_MACHINE\SOFTWARE\Acme\Foobar 1.0` key. Create a new string value named `InstallDir` and set it

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to an empty folder you've just created anywhere on your system. Run the installer with logging enabled.

If you did everything right, our three sample files will appear in this new folder. Also note the shortcuts (in the Start Menu and on the Desktop) to point to this new location now.

Similar information can come from other sources as well. Let's assume a `\Windows\SampleRegistry.ini` file (you can only read these files if they are located in the system folder):

```
[Sample]
InstallDir=C:\InstallHere
```

Replace the previous section with this new one:

```
<Property Id="INSTALLDIR">
  <IniFileSearch Id='AcmeFoobarIniFile' Type='
  directory' Name='SampleRegistry.ini' Section='Sa
  mple' Key='InstallDir' />
</Property>
```

There might be cases when simply knowing the folder is not enough: you have to look into the folder and make sure a given file exists there. `Depth=n` can be used to instruct the installer to look *n* levels deeper than the specified `Path`. Zero or a missing `Depth` attribute means only to look in the specified folder, not below it. We use

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square brackets in `Path` to tell the installer to use the value of the `INSTALLDIR` property--bracketed names will be looked up and if found, replaced with their actual value. If not found, the string will remain unchanged.

```
<Property Id="FILEEXISTS">
    <DirectorySearch Id="CheckFileDir" Path="[INSTALLDIR]" Depth="0">
        <FileSearch Id="CheckFile" Name="Lookfor.txt" />
    </DirectorySearch>
</Property>
```

If the file has been found, its full path will be assigned to the `FILEEXISTS` property, otherwise it will be left unassigned. You can check this if you build this sample (you need both the previous `RegistrySearch` and this fragment) and then run it with logging enabled. Observe that if you first put the file `Lookfor.txt` into the folder specified in the registry, the log will contain a reference to `FILEEXISTS`, with the full path of the file as its value.

Although we don't yet have a user interface, it's already worth noting that properties meant to receive their value from any interaction with the user, passing that value to the installation logic (eg. destination folders or features selected by the user) need to be *public* properties. To ensure their public status, their name has to be in all uppercase letters.

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It is also worth noting that Windows Installer has better ways of upgrading your product than to look for specific registry entries of the previous installation. You should use these features whenever you can---but you need some patience until we reach them during our discussion.

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Conditional Installation

We've already covered launch conditions. Using them will abort the whole installation if the specified condition is false. There are finer uses of conditions, too, when they don't disable the whole process, only help us determine what to do. To make room for that, we divide the previous single feature into two separate ones---then we can use

our conditions to decide which one to install.

```
<Feature Id='Complete' Level='1'>
    <Feature Id='MainProgram' Level='1'>
        <ComponentRef Id='MainExecutable' />
    </Feature>

    <Feature Id='Documentation' Level='1'>
        <ComponentRef Id='Manual' />
    </Feature>
</Feature>
```

Building this sample as it is now wouldn't result in anything interesting, the MainProgram feature would install the EXE and the DLL, plus the associated shortcuts while the Documentation feature would do the rest, the PDF and its associated shortcut. So, in the end, the same files are installed. But if you note the `Level` attribute we haven't discussed so far, a non-zero value means *install* while a zero value means that the parent feature of the condition (the `Feature` tag directly enclosing the condition) will *not* be installed:

```
<Feature Id='Documentation' Level='0'>
    <ComponentRef Id='Manual' />
    <Condition Level="1">FILEEXISTS</Condition>
</Feature>
```

The PDF and its shortcut will only be installed if the file `Lookfor.txt` can be found in the folder referenced by our

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registry entry. To try this out on your computer, download SampleCondition (/system/files/samples/SampleCondition.zip). You can use all the conditions we have already seen as well, for instance, to disable the feature for a non-administrator user:

```
<Feature Id='Documentation' Level='0'>
    <ComponentRef Id='Manual' />
    <Condition Level="1">Privileged</Condition>
</Feature>
```

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Beyond Files

In the real life out there, you'll probably need more to do than to copy files into their final repository. To create a registry keys, include them inside a `RegistryKey` in the component:

```
<RegistryKey Root='HKLM' Key='Software\Acme\Foobar 1.0'>
    <RegistryValue Type='string' Name='InstallDir' Value='[INSTALLDIR]' />
    <RegistryValue Type='integer' Name='Flag' Value='0' />
</RegistryKey>
```

Type can be *string*, *integer*, *binary*, *expandable*, or *multiString*. If the Name attribute is omitted, the default key will be created.

In the case of a *multiString*, use one or more MultiStringValue children to specify the individual strings. You can also include the Root and Key attributes directly on the RegistryValue element:

```
<RegistryValue Root='HKLM' Key='Software\Acme\Foobar 1.0' Type='multiString' Name='InstallDir'>
    <MultiStringValue>[TARGETDIR]</MultiStringValue>
    <MultiStringValue>[INSTALLDIR]</MultiStringValue>
    <MultiStringValue>[ProgramFilesFolder]</MultiStringValue>
</RegistryValue>
```

If your application handles its own file data type, you will need to register a file association for it. Put a ProgId inside your component. FileId should refer to the Id attribute of the File element describing the file meant to

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handle the files of this extension:

```
<ProgId Id='AcmeFoobar.xyzfile' Description='Acme Foobar data file'>
    <Extension Id='xyz' ContentType='application/xyz'>
        <Verb Id='open' Command='Open' TargetFile='FileDialog' Argument='"%1"' />
    </Extension>
</ProgId>
```

To assign an icon to this file type, you have to specify where the icon should come from:

```
<ProgId Id='AcmeFoobar.xyzfile' Description='Acme Foobar data file' Icon='Foobar.ico'>
```

or, if the icon comes from an executable or resource file containing several icons, you can specify which one:

```
<ProgId Id='AcmeFoobar.xyzfile' Description='Acme Foobar data file' Icon='Foobar.exe' IconIndex='1'>
```

And finally, if you want to write an .ini file---although the registry is more in vogue these days---this is what you need in your component:

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```
<IniFile Id="WriteIntoIniFile" Directory="INSTAL  
LDIR" Name="Foobar.ini" Action="addLine" Key="In  
stallDir" Section="Paths" Value="[INSTALLDIR]" /  
>
```

In the next lesson we'll see how to implement a user interface so that the user can get a chance to decide what and where to install.

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Orphaned on Removal

The application might create files during its functioning that were not present in the installation package originally (user data file, user settings, log files, etc). You might need to remove them when the product is uninstalled. To remove individual files, use `RemoveFile`:

```
<Component>
  ...
  <RemoveFile Id='LogFile' On='uninstall' Name
='Foobar10User.log' />
</Component>
```

The `On` attribute will determine when the file will be removed (possible values are *install*, *uninstall* and *both*). The `Name` can contain wildcard characters, too. The file or files should be located in the same folder as the component itself. To override this folder, you can use either the `Directory` or the `Property` attribute. The second will allow us to remove files from a folder we don't yet know at the time of creating the installation package.

We have already seen how to signal the removal of folders during uninstallation. For folders created by the application rather than the installer, we will need to specify them separately:

```
<Component>
  ...
  <RemoveFolder Id='LogFolder' On='uninstall'
/>
</Component>
```

Again, `Directory` or `Property` can be used to specify the folder if it is not the one of the component itself.

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User Interface

In the previous lesson we have learned how to describe the files we want to be installed. Although we saw some simple implementations of automated installer logic to determine whether a given product has already been installed previously, everything went without the customary user interface giving the user a chance to say anything about the installation. So this is the topic we will be treating in this installment.

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The Windows Installer doesn't have its built-in user interface (except for a simple progress dialog we've already seen and a few message boxes popping up to inform the user about various errors). Installer packages have to define their own user interface, compile it and carry it around inside their own .msi file. This makes this file somewhat larger (an .msi file with a typical user interface will start just below 300KB, although this will also depend on the size of the icons and other graphical elements inside) but, in return to this size, will be perfectly customizable to every possible need.

It wouldn't be too much fun to start to develop a complete user interface for ourselves. Fortunately, there is no need to do that. The WiX toolset comes with a standard user interface library, WixUI. This user interface is based on the prefabricated interface in the [MSI SDK](#) (<https://docs.microsoft.com/en-us/windows/win32/msi/platform-sdk-components-for-windows-installer-developers>). The WixUI library provides the complete user interface of a standard installer package, including all standard wizard pages: license agreement, customer information, typical/custom/complete setup types, customization of install target folder, calculation of disk usage requirements, modify/repair/remove and rollback. The only difference is that---for sake of individuality---its dominant color is reddish instead of bluish. However, it only takes to modify a couple of bitmaps and icons if you want to customize that.

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First Steps

We will expand our previous sample with a nice user interface. But before we delve into details, download [SampleWixUI \(/system/files/samples/SampleWixUI.zip\)](/system/files/samples/SampleWixUI.zip). Compile and run it to get a feeling about what it can do. Build it with the following commands (we will discuss the new linker command line argument later):

```
candle.exe SampleWixUI.wxs  
light.exe -ext WixUIExtension SampleWixUI.wixobj
```

Try the Custom installation and try to change the target folder you install to. When done, start the installation package again, this time it will allow you to modify or remove the program (the same as you can do in the Programs and Features Control Panel tool by clicking on Change).

Let's see how we could achieve all this functionality. The first part remains the same---after all, we want to install the same product, the same files, same components, same features:

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```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'>

    <Product Name='Foobar 1.0' Id='YOURGUID-86C7-4D14-AEC0-86416A69ABDE'
        UpgradeCode='YOURGUID-7349-453F-94F6-BCB5110BA4FD'
        Language='1033' Codepage='1252' Version='1.0.0' Manufacturer='Acme Ltd.'>

        <Package Id='*' Keywords='Installer' Description="Acme's Foobar 1.0 Installer"
            Comments='Foobar is a registered trademark of Acme Ltd.' Manufacturer='Acme Ltd.'
            InstallerVersion='100' Languages='1033'
            Compressed='yes' SummaryCodepage='1252' />

        ...

        <Directory Id="DesktopFolder" Name="Desktop" />
    </Directory>
```

No surprise so far. The structure of the following segment will also look familiar but we have a couple of new attributes:

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```
<Feature Id='Complete' Title='Foobar 1.0' Description='The complete package.'  
    Display='expand' Level='1' ConfigurableDirectory='INSTALLDIR'>  
    <Feature Id='MainProgram' Title='Program' Description='The main executable.' Level='1'>  
        <ComponentRef Id='MainExecutable' />  
        <ComponentRef Id='HelperLibrary' />  
        <ComponentRef Id='ProgramMenuDir' />  
    </Feature>  
  
    <Feature Id='Documentation' Title='Description' Description='The instruction manual.' Level='1000'>  
        <ComponentRef Id='Manual' />  
    </Feature>  
</Feature>
```

We will have a user interface now, so we need to display something to the user, to inform them about the choice of features they have. Hence the need for some human readable descriptions. Start the compiled installer package again and navigate to the custom setup so that you can see where and how the various UI texts appear.

The contents of the `Title` attributes are used to populate the treeview on the left of the dialog. The `Description` texts will appear on the right side inside the rectangle when you click on an item in the tree. The `Display` attribute (possible values are `collapse`, `expand`, and `hidden`) determines whether the specified tree part will be displayed collapsed or expanded initially, or will not be

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displayed at all.

`Level` allows us to decide which features will be installed. The usual scenario is to offer three choices to the user: *Typical*, *Complete*, and *Custom*. The last two are simple (*Complete* includes everything and *Custom* will allow the user to specify everything in finer details) but we have to specify what belongs to *Typical*. Or, if necessary, we can have more choices. When the installer runs, there will be a prefabricated property called `INSTALLLEVEL` that can have any value between 1 and 32,767. A feature will be installed if its level is non-zero and not higher than the current value of `INSTALLLEVEL`.

In our user interface, we will set this `INSTALLLEVEL` to 3 for a Typical installation and to 1,000 for a Complete one (this second number is rather arbitrary, we could use any other available number). Consequently, we have to mark those features we don't want to include in a Typical with this level. As `INSTALLLEVEL` will be 3 during such an installation, only those features having a level of 1 to 3 will be installed, anything above that---including our `Level=1000` features---will be left alone.

And finally, the most important part:

`ConfigurableDirectory`. By including this attribute and making it refer to `INSTALLDIR`, thus creating the link to the intended target directory as specified in the innermost `Directory` tag a few lines earlier, we allow the user to change our originally intended target. If we don't use this

attribute, the user can enable and disable the various features the same way but won't be able to modify the installation directory.

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Custom Settings

In this treeview, each entry will have an associated context menu, allowing the user to decide which features should be installed and how. The menu defaults to the following entries:

- This feature will be installed on local hard drive.
- This feature, and all subfeatures, will be installed on local

hard drive.

- This feature will be installed to run from network.*
- This feature, and all subfeatures, will be installed to run from network.*
- This feature will be installed when required.
- This feature will not be available.

* There seems to be a bug in Windows Installer. With features having no files inside, this entry will appear in the context menu even if you use the attributes outlined above to remove it. In this case, add an empty component (with no files inside) to the feature.

Using various attributes of `Feature`, some of these items can be removed or modified, leaving only those that make sense for the feature in question. Basically, there are five possibilities: to install the feature on the local hard drive, to let it run from the installation media, to run it from the network, to install on demand (the feature will be installed when the user tries to activate it for the first time; this is only supported on more recent operating systems) and to not install it at all.

- **AllowAdvertise='no'**: This feature will be installed when required will be removed from the context menu. The user is not allowed to install this feature on demand.
- **AllowAdvertise='yes'**: This feature will be installed when required will appear in the context menu. The user is allowed to install this feature on demand.

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- **AllowAdvertise='system'**: This feature will be installed when required will only appear in the context menu, allowing the user to install the feature on demand, if the operating system supports this.
- **InstallDefault='local'**: This feature, [and all subfeatures,] will be installed on local hard drive will appear in the context menu.
- **InstallDefault='source'**: This feature, [and all subfeatures,] will be installed to run from CD will appear in the context menu instead of the original entry ...installed on local hard drive .
- **InstallDefault='followParent'**: The actual state (either *local* or *source*) will follow the one set in the parent feature.
- **Absent='allow'**: This feature will not be available will appear in the context menu. The user can decide whether to install this feature or not.
- **Absent='disallow'**: This feature will not be available will be removed from the context menu. The feature is always required, the user is not allowed to turn its installation off.

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UI Wizardry

And here comes the real magic. WixUI has five different flavors, depending on how sophisticated you want your user interface to be:

- *WixUI_Mondo* offers the complete interface, welcome page, license agreement, setup type (typical, custom and complete), allows for feature customization, browsing for

the target directory and offers disk costing. Maintenance mode dialogs are also included. You should use this flavor when some of your product's features shouldn't be installed by default (in other words, there is a significant and meaningful difference between typical and complete installs).

- *WixUI_FeatureTree* is similar to the full set but it doesn't allow the user to chose between setup types. It always assumes Custom and goes directly to the feature customization dialog after the user has accepted the license agreement.
- *WixUI_InstallDir* allows the user to select a destination directory but without presenting the usual customized features page. After having selected the directory, the installation will proceed automatically*.
- *WixUI_Minimal* features a simplistic user interface with a single dialog combining the welcome and license agreement pages. After that, the installation goes on automatically without allowing the user to customize anything. Use it when your application has no optional features to install.
- *WixUI_Advanced* is rather similar to *WixUI_Minimal* as it offers a simple, one-click install but it also allows selecting features and folders if the user chooses to do so.

*Note that if you use the *WixUI_InstallDir* dialog set, you'll have to provide an extra property somewhere in your source:

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```
<Property Id="WIXUI_INSTALLDIR" Value="INSTALLDIR" />
```

In order to get a full user interface, all we have to do is to add two lines to include the WixUI interface library into our project:

```
<UIRef Id="WixUI_Mondo" />
<UIRef Id="WixUI_ErrorProgressText" />
```

The first reference includes the appropriate user interface library but it doesn't automatically use the localized (or modified, in case of English) error and action texts in the language files. Without the second reference, the installer package will be slightly smaller and will use the stock messages inside Windows Installer.

And, finally, we finish it just like in our earlier samples:

```
<Icon Id="Foobar10.exe" SourceFile="FoobarAp
pl10.exe" />
</Product>
</Wix>
```

All the user interface variants come in a common precompiled library. We simply link against this extension library using the command line switch we have already mentioned. When working inside an integrated development environment, we have to add a reference to

First Steps (/docs/wix/v3/tutorial/user-interface/first-steps/)

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this library to achieve the same effect.

```
candle.exe SampleWixUI.wxs  
light.exe -ext WixUIExtension SampleWixUI.wixobj
```

You can customize some visual aspects of the user interface by simply providing replacement files. The default ones reside inside the toolset but you're allowed to create your own replacement bitmaps, icons and license text there. You can also replace selected files, not all of them. Their paths are stored in variables that you can specify either on the command line or directly in the source code:

```
<WixVariable Id="WixUILicenseRtf" Value="path\License.rtf" />  
<WixVariable Id="WixUIBannerBmp" Value="path\banner.bmp" />  
<WixVariable Id="WixUIDialogBmp" Value="path\dialog.bmp" />  
<WixVariable Id="WixUIExclamationIco" Value="path\exclamation.ico" />  
<WixVariable Id="WixUIInfoIco" Value="path\information.ico" />  
<WixVariable Id="WixUINewIco" Value="path\new.ico" />  
<WixVariable Id="WixUIUpIco" Value="path\up.ico" />
```

Their meaning and details are:

[syntax-miscellanea/](#)

▶ [SQL \(/docs/wix/v3/tutorial/sql/\)](#)

▶ [User Interface Revisited \(/docs/wix/v3/tutorial/user-interface-revisited/\)](#)

▶ [Transforms \(/docs/wix/v3/tutorial/transforms/\)](#)

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▶ [Localization \(/docs/wix/v3/tutorial/localization/\)](#)

- WixUIBannerBmp 493 by 58 pixels, this bitmap will appear at the top of all but the first page of the installer.
- WixUIDialogBmp 493 by 312 pixels, this bitmap will appear on the first page of the installer.
- WixUIExclamationIco 32 by 32 pixels, exclamation mark icon.
- WixUIInfoIco 32 by 32 pixels, information sign icon.
- WixUINewIco 16 by 16 pixels, new folder icon.
- WixUIUpIco 16 by 16 pixels, parent folder icon.
- WixUILicenseRtf Preferably, use a simple editor like Wordpad to create it, or if you insist on overly complex applications like Word, consider resaving the final version from Wordpad, anyway. The RTF will be less complicated and smaller.

< Custom Settings (/docs/wix/v3/tutorial/user-interface/custom-settings/)

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Do You Speak English?

The languages below are currently supported by WiX:

- ar-SA
- bg-BG
- ca-ES

- cs-CZ
- da-DK
- de-DE
- el-GR
- en-US
- es-ES
- et-EE
- fi-FI
- fr-FR
- he-IL
- hi-IN
- hr-HR
- hu-HU
- it-IT
- ja-JP
- kk-KZ
- ko-KR
- lt-LT
- lv-LV
- nb-NO
- nl-NL
- pl-PL
- pt-BR
- pt-PT
- ro-RO
- ru-RU
- sk-SK

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- sl-SI
- sr-LA
- sv-SE
- th-TH
- tr-TR
- uk-UA
- zh-CN
- zh-HK
- zh-TW

◀ [UI Wizardry](/docs/wix/v3/tutorial/user-interface/ui-wizardry/) (/docs/wix/v3/tutorial/user-interface/ui-wizardry/)
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/ New Link in the Chain

New Link in the Chain

Although the WixUI interface libraries can handle most usual setup scenarios, modifications or additions are sometimes required. To handle these cases, the [WiX source code \(https://github.com/wixtoolset/wix3/archive/refs/heads/master.zip\)](https://github.com/wixtoolset/wix3/archive/refs/heads/master.zip) has to be downloaded, too, because we will need to take a peek at some source files.

In our sample (</system/files/samples> </SampleWixUIAddDlg.zip>), we will modify the *WixUI_Mondo* library, adding a new dialog to collect registration information (name, organization, serial number) from the user. The new dialog will appear between the License Agreement and Setup Type dialogs.

To achieve this, we have to provide a new *UserRegistrationDlg.wxs* file describing this new dialog. You can start with an existing dialog, modifying it, or writing your dialog from scratch. A later lesson (</docs/wix/v3/tutorial/user-interface-revisited>) describes how to create dialogs and use various interface elements in WiX. Here we only mention a few remarks:

```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns="http://schemas.microsoft.com/wix/2006/wi">
```

We have to author the new dialog as a separate fragment:

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```
<Fragment>
  <UI>
    <Dialog Id="UserRegistrationDlg" Width="370" Height="270" Title="[ProductName] Setup" NoMinimize="yes">
      <Control Id="NameLabel" Type="Text" X="45" Y="73" Width="100" Height="15" TabSkip="no" Text="&User Name:" />
      <Control Id="NameEdit" Type="Edit" X="45" Y="85" Width="220" Height="18" Property="USERNAME" Text="{80}" />
      <Control Id="OrganizationLabel" Type="Text" X="45" Y="110" Width="100" Height="15" TabSkip="no" Text="&Organization:" />
      <Control Id="OrganizationEdit" Type="Edit" X="45" Y="122" Width="220" Height="18" Property="COMPANYNAME" Text="{80}" />
      <Control Id="CDKeyLabel" Type="Text" X="45" Y="147" Width="50" Height="10" TabSkip="no">
        <Text>CD & Key:</Text>
      </Control>
      <Control Id="CDKeyEdit" Type="MaskedEdit" X="45" Y="159" Width="250" Height="16" Property="PIDKEY" Text="[PIDTemplate]" />
    </Dialog>
  </UI>
</Fragment>
```

The dialog will be inserted into the original chain of dialogs. We have to specify which dialogs it will step forward or backward to in this chain: License Agreement and Setup Type. We can learn the actual identifiers of these dialogs if we look into the source file of *WixUI_Mondo*: `src\ext\UIExtension\wixlib\WixUI_Mondo.wxs` in the download source package. The

- ▶ [First Steps \(/docs/wix/v3/tutorial/user-interface/first-steps/\)](#)
- ▶ [Custom Settings \(/docs/wix/v3/tutorial/user-interface/custom-settings/\)](#)
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names are *LicenseAgreementDlg* and *SetupTypeDlg*, so this is how we refer to them from this new dialog:

[syntax-miscellanea/](#)

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```
<Control Id="Back" Type="PushButton" X="180" Y="243" Width="56" Height="17" Text="&#xA;Back">
    <Publish Event="NewDialog" Value="LicenseAgreementDlg">1</Publish>
    </Control>
    <Control Id="Next" Type="PushButton" X="236" Y="243" Width="56" Height="17" Default="yes" Text="&#xA;Next">
        <Publish Event="ValidateProductID" Value="0">1</Publish>
        <Publish Event="SpawnWaitDialog" Value="WaitForCostingDlg">CostingComplete = 1</Publish>
        <Publish Event="NewDialog" Value="SetupTypeDlg">ProductID</Publish>
        </Control>
        <Control Id="Cancel" Type="PushButton" X="304" Y="243" Width="56" Height="17" Cancel="yes" Text="Cancel">
            <Publish Event="SpawnDialog" Value="CancelDlg">1</Publish>
            </Control>
            <Control Id="BannerBitmap" Type="Bitmap" X="0" Y="0" Width="370" Height="44" TabSkip="no" Text="WixUI_Bmp_Banner" />
            <Control Id="Description" Type="Text" X="25" Y="23" Width="280" Height="15" Transparent="yes" NoPrefix="yes">
                <Text>Please enter your customer information</Text>
            </Control>
            <Control Id="BottomLine" Type="Line" X="0" Y="234" Width="370" Height="0" />
            <Control Id="Title" Type="Text"
```

```
X="15" Y="6" Width="200" Height="15" Transparent  
="yes" NoPrefix="yes">  
    <Text>{\WixUI_Font_Title}Cus  
tomer Information</Text>  
    </Control>  
    <Control Id="BannerLine" Type="L  
ine" X="0" Y="44" Width="370" Height="0" />  
  </Dialog>  
  </UI>  
</Fragment>  
</Wix>
```

It is rather easy to incorporate the dialog into the original user interface. Instead of simply referencing *WixUI_Mondo* as we did earlier, we build our own interface with the `UI` tag. However, we still want to use the bulk of *WixUI_Mondo*, so we start by calling it with `UIRef` and only add our modifications: first, we refer to our new *UserRegistrationDlg* dialog.

Then we have to specify the remaining two links. The License Agreement dialog used to point to the Setup Type dialog as its successor and vice versa. Now that our own dialog is inserted between them, we have to modify their *Next* and *Back* links correspondingly. The easy way is to copy the relevant `Publish` tags from *WixUI_Mondo.wxs* and modify the `Value` attribute to point to our new dialog, without changing anything else:

```
<UI Id="MyWixUI_Mondo">
  <UIRef Id="WixUI_Mondo" />
  <UIRef Id="WixUI_ErrorProgressText" />

  <DialogRef Id="UserRegistrationDlg" />

  <Publish Dialog="LicenseAgreementDlg" Control
  ="Next" Event="NewDialog" Value="UserRegistrationDlg" Order="3">LicenseAccepted = "1"</Publish>
  <Publish Dialog="SetupTypeDlg" Control="Back"
  Event="NewDialog" Value="UserRegistrationDlg">1
  </Publish>
</UI>
```

The main file will need to define the property we referred to. MaskedEdit controls use various characters

(<https://msdn.microsoft.com/en-us/library/aa369797.aspx>)

to determine what and how will appear in the control, what kind of input the control will accept and how the final data assigned to the receiving property will be formed.

```
<Property Id="PIDTemplate"><![CDATA[12345<### ##
#>@####]]></Property>
```

And this is all there is to it. Now we can build our modified installer with the following commands:

```
candle.exe SampleWixUIAddDlg.wxs UserRegistrationDlg.wxs  
light.exe -ext WixUIExtension -out SampleWixUIAddDlg.msi SampleWixUIAddDlg.wixobj UserRegistrationDlg.wixobj
```

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Think Localized

If we add our own dialogs to WixUI, we might want them to be localized as well. That doesn't require too much extra work. The main source file stays the same, we only have to modify our new dialog in `UserRegistrationDlg.wxs`. Instead of hardwired texts we will use localizable string references:

```
<Fragment>
...
<Dialog Id="UserRegistrationDlg" Width="370"
Height="270" Title="!(loc.UserRegistrationDlg_Ti-
tle)" NoMinimize="yes">
    <Control Id="NameLabel" Type="Text" X="4
5" Y="73" Width="100" Height="15" TabSkip="no" T
ext="!(loc.UserRegistrationDlg_UserName)" />
    <Control Id="OrganizationLabel" Type="Te
xt" X="45" Y="110" Width="100" Height="15" TabSk
ip="no" Text="!(loc.UserRegistrationDlg_Organiza
tion)" />
...
</Fragment>
```

Next, create localization files listing these strings in the appropriate culture. Let's call our file `UserRegistrationDlg.fr-fr.wxl` (the name is up to you, the extension is fixed). In the `WixLocalization` tag you have to specify the culture and its codepage. Create parallel copies for other languages you want to localize to.

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```
<?xml version="1.0" encoding="utf-8"?>
<WixLocalization Culture="fr-fr" Codepage="1252"
  xmlns="http://schemas.microsoft.com/wix/2006/localization">
  <String Id="UserRegistrationDlg_Title" Overridable="yes">???</String>
  <String Id="UserRegistrationDlg_UserName" Overridable="yes">???</String>
  <String Id="UserRegistrationDlg_Organization" Overridable="yes">???</String>
  ...
</WixLocalization>
```

To build the installer from the source ([/system/files](#) [/samples/SampleWixUIAddDlgLoc.zip](#)), we also need to reference the localization file. In the integrated environment, just include the file in your project and it will be used automatically.

```
candle.exe SampleWixUIAddDlgLoc.wxs UserRegistrationDlg.wxs
light.exe -ext WixUIExtension -cultures:fr-fr -loc UserRegistrationDlg.fr-fr.wxl -out SampleWixUIAddDlgLoc.msi SampleWixUIAddDlgLoc.wixobj UserRegistrationDlg.wixobj
```

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Events and Actions

In the previous lesson we learned how to create a fully customizable, rich installer package with the usual look and feel, bitmaps, icons, license agreement---everything we have seen in other people's installer packages. The vast majority of installation tasks can be solved with our accumulated knowledge. Still, there are times when we need a little bit more, something not found in the standard package.

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Queueing Up

There are many steps, so-called actions the Windows Installer carries out during an installation. The basic ones and those additional items required by the specific installer (this depends on the features you use, registry searches, user interface, etc) are automatically scheduled, in other words, their sequence is predetermined by the toolset when it creates the installer database. For a

common .msi file, this might look like:

- AppSearch
- LaunchConditions
- ValidateProductID
- CostInitialize
- FileCost
- CostFinalize
- InstallValidate
- InstallInitialize
- ProcessComponents
- UnpublishFeatures
- RemoveShortcuts
- RemoveFiles
- InstallFiles
- CreateShortcuts
- RegisterUser
- RegisterProduct
- PublishFeatures
- PublishProduct
- InstallFinalize
- RemoveExistingProducts

You can check out the actual action sequence in an installer using Orca, an MSI editor from the Windows Installer SDK (<https://learn.microsoft.com/en-us/windows/win32/msi/platform-sdk-components-for-windows-installer-developers>).

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Reordering these events can be done using the appropriate tags. Actually, we have as many as four of them:

- AdminUISequence
- InstallUISequence
- AdminExecuteSequence
- InstallExecuteSequence

The ones starting with `Admin` refer to administrative installs (launched using `msiexec /a`). These type of installations create a source image of the application onto the network so that users in the workgroup can later install from this source image instead of the original media. This functionality comes for free, we've never bothered with it so far, yet our previous samples can all be installed this way (try it!).

So, for the moment, this only leaves two tags.

`InstallExecuteSequence` is always consulted by the installer to determine the actions, `InstallUISequence` is only considered when the installer runs in full or reduced UI mode (yet another functionality to experiment with, try `msiexec`'s `/qn`, `/qb` and `/qr` switches). Because we need to schedule our registry search before the launch condition in all UI cases, insert that line into both tags. Compile and run, it should work now, keep renaming the registry key to check.

You can see the sequence order numbers in Orca.

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Although you can use these numbers as well, it is much easier not to bother with them, just tell WiX the relative sequence of your actions: simply specify which sequence your action should come `Before` or `After`. To remove an action from the chain of execution, use the `Suppress=yes` attribute.

```
<InstallExecuteSequence>
    <LaunchConditions After='AppSearch' />
    <RemoveExistingProducts After='InstallFinalize' />
</InstallExecuteSequence>
```

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Extra Actions

There are many other standard actions

([http://msdn.microsoft.com/en-us/library/windows/desktop/aa372023\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/desktop/aa372023(v=vs.85).aspx)) available but not scheduled by default. `ScheduleReboot`, for instance, will instruct the user to reboot after the installation:

```
<InstallExecuteSequence>
    <ScheduleReboot After='InstallFinalize' />
</InstallExecuteSequence>
```

If the need to reboot depends on a condition (for instance, the operating system the installer is running on), use a condition:

```
<InstallExecuteSequence>
    <ScheduleReboot After='InstallFinalize'>Version9X</ScheduleReboot>
</InstallExecuteSequence>
```

It's not only these so-called standard actions that you can schedule and re-schedule. There are a couple of custom actions as well (*custom* here means that they don't appear in the standard course of events but you can use them wherever and whenever you like). A very common need is to launch the application you've just installed.

Custom actions need to be mentioned in two places in the source file. First as a child of the `Product` tag (for instance, between the closing `Feature` and the `UI` tag). This `CustomAction` tag will specify what to do. To launch an executable we've just installed, refer to it using the `Id` identifier of the `File` tag specifying the file. You also have to provide a command line, although it can be left empty if not needed:

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```
<CustomAction Id='LaunchFile' FileKey='FoobarEXE'  
' ExeCommand=' ' Return='asyncNoWait' />
```

Second, we have to schedule the action the usual way. The link between the action and the scheduling entry is provided by the matching `Id` / `Action` attribute pair. If the execution of the custom action is conditional, we can specify the condition inside the `Custom` tag. We need the condition here so that we only launch the executable when we make an installation but not when we remove the product:

```
<InstallExecuteSequence>  
  ...  
  <Custom Action='LaunchFile' After='InstallFinalize'>NOT Installed</Custom>  
</InstallExecuteSequence>
```

In some cases, we want to start a helper utility we carry along in the installation package but we don't install on the user's machine (for instance, a readme file viewer or a special configuration utility). Instead of the `File`, we refer to the identifier in a `Binary` tag. The scheduling is the same:

```
<CustomAction Id='LaunchFile' BinaryKey='FoobarEXE'  
' ExeCommand=' ' Return='asyncNoWait' />
```

We can also launch any other executable on the user's

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machine if we provide its name in a property:

```
<Property Id='NOTEPAD'>Notepad.exe</Property>
<CustomAction Id='LaunchFile' Property='NOTEPAD'
ExeCommand='[SourceDir]Readme.txt' Return='async
NoWait' />
```

Custom actions can also specify how their return will be handled, using a `Return` attribute. Possible values are: `check` will wait for the custom action to finish and check its return value, `ignore` will wait for the action but the return value will be ignored, `asyncWait` will run asynchronously but the installer will wait for the return value at the end of the scheduling sequence and `asyncNoWait` will simply launch the action and then leave it alone, the action might still be running after the installer finishes. This last value is the one we use when we want to launch an application or a readme file after the installation.

If we encounter an error the normal machinery can't report, we can display an error message and terminate the installation. The `Error` attribute can contain either the actual message text or the `Id` identifier of an `Error` tag:

```
<CustomAction Id='AbortError' Error='Cannot solve this riddle. Giving up.' />
```

There is no direct way to assign the value of a property to

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another one but a custom action can bridge this gap. The `Value` attribute can be a formatted string, thus we can perform some string manipulation, too (note that path references always have their trailing backslash automatically, there is no need to add an extra one):

```
<CustomAction Id='PropertyAssign' Property='Path  
Property' Value='[INSTALLDIR][FilenamePropert  
y].[ExtensionProperty]' />
```

A directory can also be set to a similarly formatted string representing a path:

```
<CustomAction Id='PropertyAssign' Directory='INS  
TALLDIR' Value='[TARGETDIR]\Program Files\Acme\F  
oobar 1.0\bin' />
```

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What's Not in the Book

For very specialized actions that the Windows Installer provides no solution for (eg. checking the validity and integrity of the registration key entered by the user), we can use yet another type of custom action: a DLL we write. For our example, we use a simplistic approach: we will accept the user key if its first digit is '1'.

The following source can be directly compiled with Visual C++ but minimal modifications, if any, will be required to compile it with a different compiler. The `msi.h` and `msiquery.h` header files can be acquired from the MSI SDK. You also have to link against `msi.lib`.

```
#include <windows.h>
#include <msi.h>
#include <msiquery.h>

#pragma comment(linker, "/EXPORT:CheckPID=Check
PID@4")

extern "C" UINT __stdcall CheckPID (MSIHANDLE hI
nstall)
{
    char Pid[MAX_PATH];
    DWORD PidLen = MAX_PATH;

    MsiGetProperty(hInstall, "PIDKEY", Pid, &Pid
Len);
    MsiSetProperty(hInstall, "PIDACCEPTED", Pid
[0] == '1' ? "1" : "0");
    return ERROR_SUCCESS;
}
```

To use this DLL, add the following lines to the appropriate places (now, nearing the end of the third lesson, you might be able to do this yourself but if you want to cheat, download [SampleCA](#). (/system/files/samples/SampleCA.zip)

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```
<Condition Message='This installation can only run in full UI mode.'>
  <![CDATA[UILevel = 5]]>
</Condition>

<CustomAction Id='CheckingPID' BinaryKey='CheckPID' DllEntry='CheckPID' />
<CustomAction Id='RefusePID' Error='Invalid key. Installation aborted.' />

<InstallExecuteSequence>
  <Custom Action='CheckingPID' After='CostFinalize' />
  <Custom Action='RefusePID' After='CheckingPID'>PIDACCEPTED = "0" AND NOT Installed</Custom>
</InstallExecuteSequence>

<Binary Id='CheckPID' SourceFile='CheckPID.dll' />
```

To summarize: first, we won't allow the installer to run with reduced or no UI because the user can't enter a registration key in those cases. The reason for the ugly CDATA wrapper is that XML attributes special meaning to some characters, most notably `<` and `>`. Wherever they appear in a different context, meaning *less-than* or *greater-than*, we have to escape them by wrapping the whole expression into a CDATA. Although this actual case could get away without it because it only checks for equality, it is a good habit to learn to wrap all similar conditional values just in case we need to modify them later, introducing such XML conflicts.

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Then, we have a custom action named *CheckingPID* running after *CostFinalize*, when we instruct the installer to start the actual installation after having specified which features we need and where we want to install. This action will call the *CheckPID* function in our *CheckPID.dll*, bundled with the installer. The DLL sets the `PIDACCEPTED` property to either 1 or 0, according to its decision on the validity of the user key entered and stored into the `PIDKEY` property by the control involved. Note that using properties (with all uppercase names, otherwise Windows Installer will not treat them as public properties) is the only way to pass arguments to and from the custom action.

We have a second custom action named *RefusePID*, scheduled to run after the previous action. This is a conditional custom action, only run if the returned `PIDACCEPTED` property is found to be zero. In this case, the custom action will display an error message and abort the installation. But we will only be interested in this value during the installation, not while we're uninstalling the product.

To get an understanding of how these actions are called and how they relate to each other, we might run the installer with verbose logging. As it will be verbose, using a text editor and searching for our property and custom action names ("PID" will do just fine) might help locate what's really happening.

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```
msiexec /i SampleCA.msi /l*v SampleCA.log
```

If the DLL we need to call has been installed rather than just included in the package, we can use:

```
<CustomAction Id='CheckingPID' FileKey='HelperDL  
L' DllEntry='CheckPID' />
```

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Control Your Controls

Granted, what we've just done was not elegant. We should check right when the user enters the key, display a warning and give the user a chance to re-enter the key instead of aborting the installation in a later phase. Let's see how we can accomplish this.

We can link custom actions to two kinds of user interface controls, push buttons and check boxes. We can use the `Publish` tag we already know to accomplish this. The `Value` attribute carries the name of the custom action:

```
<Control Id="..." Type="PushButton" ...>
    <Publish Event="DoAction" Value="CheckingPID">1</Publish>
</Control>
```

This will cause the custom action to call our DLL when the user presses the Next button of the User Information page. The custom action will be linked to this UI event, thus we no longer need to schedule it in the `InstallExecuteSequence` tag. However, the custom action definition remains in the source:

```
<CustomAction Id='CheckingPID' BinaryKey='CheckPID' DllEntry='CheckPID' />
```

To warn the user, we need a message box. This is just another dialog, similar to our previously created User Information page. We can put it into a separate source file as a fragment and refer to it using a `DialogRef` tag, as earlier. Just to illustrate that there is another solution as well, we now specify it directly in our main source file, right inside the `UI` section.

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```
<Dialog Id="InvalidPidDlg" Width="260" Height="85" Title="[ProductName] Setup" NoMinimize="yes">
    <Control Id="Icon" Type="Icon" X="15" Y="15" Width="24" Height="24" ToolTip="Information icon" FixedSize="yes" IconSize="32" Text="Exclam.ic o" />
    <Control Id="Return" Type="PushButton" X="100" Y="57" Width="56" Height="17" Default="yes" Cancel="yes" Text="&Return">
        <Publish Event="EndDialog" Value="Return" />
    </Control>
    <Control Id="Text" Type="Text" X="48" Y="15" Width="194" Height="30" TabSkip="no">
        <Text>
            The user key you entered is invalid.
            Please, enter the key printed on the label
            of the jewel case of the installation CD.
        </Text>
    </Control>
</Dialog>
```

We also have to update the User Information page because we have to call our custom action and the new message box from this dialog:

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```
<Control Id="Next" Type="PushButton" X="236" Y="243" Width="56" Height="17" Default="yes" Text=""[ButtonText_Next]">
    <Publish Event="DoAction" Value="CheckingPID">1</Publish>
    <Publish Event="SpawnDialog" Value="InvalidPIDDlg">PIDACCEPTED = "0"</Publish>
    <Publish Event="NewDialog" Value="SetupTypeDlg">PIDACCEPTED = "1"</Publish>
</Control>
```

Now, when the user presses the Next button, the function in the DLL is called (every time because the `1` condition evaluates to *true*). The function in our DLL will check the `PIDKEY` property and set `PIDACCEPTED` to signal whether the key was accepted. If it was, we go on to `SetupTypeDlg`. If it wasn't, we display our error message.

There is only one small item left, as we mentioned an icon in the message box, we also have to provide it in the installer:

```
<Binary Id="Exclam.ico" SourceFile="Exclam.ico"
/>
```

The full source can be downloaded as [SampleAskKey](#) ([/system/files/samples/SampleAskKey.zip](#)).

By the way, it's not necessarily a nice and safe thing to have the user key appear in the log file. To avoid this, use

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the `Hidden` attribute:

```
<Property Id="PIDKEY" Hidden='yes' />
```

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How to Manage?

A common question is whether custom actions can be written in managed code, C#, VB.NET or something similar. After all, these runtime environments offer a much richer set of features, besides, there might be some programmers working with these languages who are less familiar with other programming languages.

Earlier, in the WiX version 2 era, writing custom actions in

managed code was only possible with hacks and was considered very bad and dangerous practice. Version 3 brought changes with the introduction of its Deployment Tools Foundation (DTF), a set of .NET class libraries and related resources. If you can accept the obvious dependency limitations (you have to make sure .NET is present on the installation machine, possibly using a bootstrap installer first, and you can have problems during uninstallation as well, if the user removes the .NET Framework before uninstalling your application), here is our previous sample custom action ported to C#:

```
namespace WiXTutorial.Samples
{
    using System;
    using System.Collections.Generic;
    using System.IO;
    using Microsoft.Deployment.WindowsInstaller;

    public class SampleCheckPID
    {
        [CustomAction]
        public static ActionResult CheckPID(Session session)
        {
            string Pid = session["PIDKEY"];
            session["PIDACCEPTED"] = Pid.StartsWith("1") ? "1" : "0";
            return ActionResult.Success;
        }
    }
}
```

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There is one tiny bit we have to modify in our source code of `SampleAskKeyNET`. (`/system/files/samples/SampleAskKeyNET.zip`) The name of the DLL will be different because the straight managed DLL has to be wrapped into a special package bridging the gap between Windows Installer and the managed world:

```
<Binary Id="CheckPID" SourceFile="CheckPIDPackage.dll" />
```

Also prepare a small `CustomAction.config` file. It will describe the runtime your managed custom action is dependent upon.

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <startup>
    <supportedRuntime version="v2.0.50727"/>
  </startup>
</configuration>
```

There is a price to pay for the relative simplicity of working with a .NET language: the build process is more complicated. If you use an IDE, it might be simpler, you can find a sample project file under the DTF branch of the WiX source package. Here we only can show you the command line way. Look for `Microsoft.Deployment.WindowsInstaller.dll`, `MakeSfxCA.exe`, and `sfxca.dll` in your installed WiX toolset, you will find them there. Where we indicated a

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path, you have to supply an absolute full path or else MakeSfxCA will give an error message and the resulting DLL will not be usable.

```
csc.exe /target:library /reference:path\Microsoft.Deployment.WindowsInstaller.dll /out:CheckPID.dll CheckPID.cs  
MakeSfxCA.exe path\CheckPIDPackage.dll path\sfxca.dll path\CheckPID.dll path\CustomAction.config  
path\Microsoft.Deployment.WindowsInstaller.dll  
candle.exe SampleAskKeyNET.wxs UserRegistrationDlg.wxs  
light.exe -ext WixUIExtension -out SampleAskKeyNET.msi SampleAskKeyNET.wixobj UserRegistrationDlg.wixobj
```

DTF has its own documentation in the toolset, thus we won't discuss it further in our tutorial. Just use the documentation and the sample code there.

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At a Later Stage

Many custom actions that set properties, feature or component states, target directories or schedule system operations by inserting rows into sequence tables, can in many cases use immediate execution safely. Other custom actions that require to change the system directly or to call another system service must be deferred to such time when the installation script is executed. The

Windows Installer writes these *deferred* custom actions into the installation script for later execution.

Deferred custom actions are defined in the following way:

```
<CustomAction Id="MyAction" Return="check" Execute="deferred" BinaryKey="CustomActionsLibrary" DllEntry="MyAction" HideTarget="yes"/>
```

The `Execute` attribute will specify the deferred status of our custom action. We need to refer to the DLL function we need to call using the `DllEntry` attribute (don't forget the decoration for C++-style names like `_MyAction@4` if your compiling environment requires this). And finally, `HideTarget` will allow us to disable logging the parameters passed to this custom action if security considerations so dictate.

Because the installation script will be executed outside of the normal installation session, this session may no longer exist during the execution of the deferred action; neither the original session handle nor any property data set during the installation sequence will be available to the deferred action. The very limited amount of information the custom action can obtain consists of three properties:

- `CustomActionData` Value at time custom action is processed in sequence table. This property is only available to deferred execution custom actions, immediate ones do not have access to it.

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- ProductCode The unique GUID code for the product.
- UserID The user's security identifier (SID), set by the installer.

If we need to pass any other property data to the deferred action, we can use a secondary custom action to set this value beforehand. The simplest solution is a property assignment custom action. Set it up in a way that the name of the property set will be the same as the `Id` attribute of the deferred custom action:

```
<Property Id="SOME_PUBLIC_PROPERTY">Hello, from  
deferred CA</Property>  
<CustomAction Id="MyAction SetProperty" Return="check"  
Property="MyAction" Value="[SOME_PUBLIC_P  
ROPERTY]" />
```

Scheduling the property assignment *before* the deferred action is important, too:

```
<InstallExecuteSequence>  
    <Custom Action="MyAction SetProperty" After  
="ValidateProductID" />  
    <Custom Action="MyAction" After="MyAction.Se  
tProperty" />  
</InstallExecuteSequence>
```

The data we wanted to pass will appear in the `CustomActionData` property. Should we need to pass more than one piece of information, we have to devise a

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way to incorporate them into this single property, for instance, to use a semicolon separated list of Name=Value pairs.

```
#include <windows.h>
#include <msi.h>
#include <msiquery.h>
#include <tchar.h>

#pragma comment(linker, "/EXPORT:MyAction=_MyAction@4")

extern "C" UINT __stdcall MyAction (MSIHANDLE hInstall)
{
    TCHAR szActionData[MAX_PATH] = {0};
    DWORD dActionDataLen = MAX_PATH;

    MsiGetProperty(hInstall, "CustomActionData",
    szActionData, &dActionDataLen);
    MessageBox(NULL, szActionData, _T("Deferred
    Custom Action"), MB_OK | MB_ICONINFORMATION);
    return ERROR_SUCCESS;
}
```

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Upgrades and Modularization

At the end of the previous lesson, we have already learned how to do everything that can be thought of when it comes to installation packages, right? After all, even if Windows Installer doesn't provide an immediate solution, we just fire up our trusty old compiler and write it for ourselves, right?

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In a way, yes. And in a way, no. We know how to assemble our original installation package but what shall we do when it comes to shipping an upgrade? Or a patch? Shall we ask the user to uninstall the previous version and reinstall the new one? And what happens to the settings our user has made during the use of the software? Shall they start everything from scratch again?

Of course not. So, let's see how Windows Installer can help solve such problems. It divides product changes into three categories:

- *Small updates* mean small changes to one or a few files where the change doesn't warrant changing the product version (major.minor.build) or product ID GUID.

Note that you always have to change the Package GUID when you create a new .msi file that is different from the previous ones in any respect. The Installer keeps track of your installed programs and finds them when the user wants to change or remove the installation using these GUIDs. Using the same GUID for different packages will confuse the Installer.

- *Minor upgrades* denote changes where the product version will already change. Modify the `Version` attribute of the `Product` tag. The product will remain the same, so you don't need to change the

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Product GUID but, of course, get a new Package GUID.

- *Major upgrades* denote significant changes like going from one full version to another. Change everything: Version attribute, Product and Package GUIDs.

There are cases when the Windows Installer forces you to use a major upgrade (in other words, to change the Product GUID). You have to when you expect the old and new versions to coexist on the user's computer. You have to when you change the name of the .msi file for any reason. You have to when you need to change any Component GUID in the package. You have to when a component has been removed. You have to when there are any changes in the feature hierarchy (child feature moving out of a parent, or a parent feature getting a new child).

So, major upgrades are a clear cut but the line between small updates and minor upgrades can be blurred. Think about it this way: if you'll ever need to differentiate between the current and the new versions in your future products, vote for the minor upgrade. In most of the usual cases, however, unless the product is rather large and downloading and deploying it again would be out of question, major upgrades are the safest because they provide the smoothest solution without the risks of the other two variants.

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When you change GUIDs, keep track of the old ones. You will need them to use the sophisticated upgrade features of Windows Installer.

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Checking for Oldies

The first task when doing any kind of update or upgrade is to make sure we have the previous version we want to change.

Windows Installer relies on the `UpgradeCode` attribute of the `Product` tag to do that. Therefore, it is very important to always include an `UpgradeCode`, even if you don't plan your current program to be upgraded later. You never

know and once it's out there, you can't provide it any more.

Keep the same `UpgradeCode` GUID as long as you want the products to be upgraded by the same upgrade version. In the usual case, this would mean one code for all 1.x versions, another one for the 2.x versions, etc:

```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'>
    <Product Name='Foobar 1.0' Id='PUT-GUID-1-HERE'
        UpgradeCode='PUT-GUID-2-HERE'
        Language='1033' Codepage='1252' Version='1.0.0'
        Manufacturer='Acme Ltd.'>
        <Package Description="Acme's Foobar 1.0
Installer" Compressed='yes' />
        ...
    </Product>
</Wix>
```

Our current [SampleUpgrade](#) ([/system/files/samples/SampleUpgrade.zip](#)) now consists of two installation packages. Both are based on the simple UI installer, `SampleWixUI`.

The second version of `SampleUpgrade` is meant to replace one of the deployed files with a newer version. As we will now consider this a *minor upgrade*, we change the `Version`. Cosmetic changes to the human readable `Name`

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and `Description` are obvious:

```
<Product Name='Foobar 1.0.1' Id='PUT-GUID-1-HERE'
  UpgradeCode='PUT-GUID-2-HERE'
  Version='1.0.1' Manufacturer='Acme Ltd.' Lan-
  guage='1033' Codepage='1252' >
<Package Id='*' Keywords='Installer' Description
  ='Acme's Foobar 1.0.1 Updater" ... >
```

We also need a description of what product versions we plan to replace with this upgrade. The `Id` attribute of the `Upgrade` tag refers back to the `UpgradeCode` GUID of the original installation package (the older `SampleUpgrade` in our case). The internal `UpgradeVersion` tag describes the details of the versions to be updated. `OnlyDetect` tells the installer not to remove the previous product (remember, we're doing a minor upgrade, we keep the old version of the product in place but replace one file. If we were doing a major upgrade, we would probably *remove* 1.0.0 and *install* 1.1.0 instead).

`Minimum` and `Maximum` specify the range of versions we are supposed to update with this upgrade.

`IncludeMaximum` and `IncludeMinimum` specify whether the bound value is actually included in the range or not (`IncludeMaximum=yes` meaning to find versions *less than or equal to* the version specified in `Maximum` while `IncludeMaximum=no` only finds those *less than* the `Maximum`). Although these attributes have their default values, we don't rely on those here and always include

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them---it's better to spell them out for the sake of clarity and self-documentation.

```
<Upgrade Id='PUT-GUID-2-HERE'>
    <UpgradeVersion OnlyDetect='yes' Property='SELFFOUND'
        Minimum='1.0.1' IncludeMinimum='yes'
        Maximum='1.0.1' IncludeMaximum='yes' />
    <UpgradeVersion OnlyDetect='yes' Property='NEWERFOUND'
        Minimum='1.0.1' IncludeMinimum='no' />
</Upgrade>
```

Using an `Upgrade` tag in our source file triggers the inclusion of a new standard action,

`FindRelatedProducts`. It is scheduled to run before `AppSearch`, if any. If necessary, we can re-schedule it inside the `InstallExecuteSequence` tag.

`FindRelatedProducts` works its way through our `Upgrade` tag and checks for each version listed there. If one is found, its `Product` GUID will be appended to the property specified in the `UpgradeVersion` `Property` attribute (`SELFFOUND` and `NEWERFOUND` in our example). Needless to say, the Installer can only find products that have been installed using an .msi package with `UpgradeCode` specified---so now you know why it's so important to always specify one.

If you develop localized software packages, you can also specify a `Language` attribute in both `UpgradeVersion` and

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Product tags. Use the usual Windows decimal language identifier to specify the language. If specified, `FindRelatedProducts` will only locate products with matching languages.

After the check has run, we can take the appropriate actions based on the existence and value of the properties involved:

```
<CustomAction Id='AlreadyUpdated' Error='Foobar  
1.0 has already been updated to 1.0.1 or newer.'  
/>  
<CustomAction Id='NoDowngrade' Error='A later ve  
rsion of [ProductName] is already installed.' />  
  
<InstallExecuteSequence>  
    <Custom Action='AlreadyUpdated' After='FindR  
elatedProducts'>SELFFOUND</Custom>  
    <Custom Action='NoDowngrade' After='FindRela  
tedProducts'>NEWERFOUND</Custom>  
</InstallExecuteSequence>
```

For some strange reason, small updates and minor upgrades cannot be run simply by clicking on the .msi file. They give the error: Another version of this product is already installed.

We know, stupid. Anyway, you have to start it with the command:

```
msiexec /i SampleUpgrade.msi REINSTALL=ALL REINS  
TALLMODE=vomus
```

Don't ask me how this would fare with the average user. You'd better start it from an Autorun.inf file or devise an outer Setup.exe shell to launch it.

As you can see, this upgrade version will behave properly in both directions. It will replace the earlier package but it will also handle the case where the program might be upgraded even further in the future (eg, 1.0.2 and later). It will not downgrade a possible later version back to 1.0.1. To be absolutely correct and foolproof, we have to plan that early. Even the very first installer we ship should already have this safety lock built in:

```
<Upgrade Id='PUT-GUID-2-HERE'>  
    <UpgradeVersion OnlyDetect='yes' Property='N  
EWERFOUND' Minimum='1.0.0' IncludeMinimum='no' /  
    >  
    </Upgrade>  
  
<CustomAction Id='NoDowngrade' Error='A later ve  
rsion of [ProductName] is already installed.' />  
  
<InstallExecuteSequence>  
    <Custom Action='NoDowngrade' After='FindRela  
tedProducts'>NEWERFOUND</Custom>  
</InstallExecuteSequence>
```

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Replacing Ourselves

If our intention is a major upgrade, that is, complete and automatic removal of the previous version when a new one arrives, we just need to set `OnlyDetect=no` and to set the version numbers accordingly. `Minimum` will then specify the first version we allow to replace with the current one (and we include this minimum version in the range) while `Maximum` can be set to the current version

number (but *not* included in the range). Then, any version between the first and the previous one before the current version will be removed automatically during the installation of the current version. Also note that this same installer works as a first time installer as well: if it finds a previous version, it will remove the previous version and install the current one. If it is run on a clean system, it will simply install the current application; there is no need to create separate upgrade and full installers.

```
<Upgrade Id='YOURGUID-7349-453F-94F6-BCB5110BA4FD'>
  <UpgradeVersion OnlyDetect='no' Property='PREVIOUSFOUND'
    Minimum='1.0.0' IncludeMinimum='yes'
    Maximum='3.0.0' IncludeMaximum='no' />
</Upgrade>
```

The removal of the previous version is completely automatic. If, for any reason, we need to perform any action when this previous version is removed, we can author a custom action whose condition is the UPGRADINGPRODUCTCODE property. The Windows Installer only sets this property when the automatic removal is in progress, not when the application is manually uninstalled using the Programs and Features Control Panel tool.

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```
<InstallExecuteSequence>
    <Custom Action=' ... ' After=' ... '>UPGRADI
NGPRODUCTCODE</Custom>
    <RemoveExistingProducts Before="InstallIniti
alize" />
</InstallExecuteSequence>
```

Note that both `Upgrade` and `UpgradeVersion` only work if you are doing a major upgrade.

```
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Patchwork

It wouldn't be terribly effective to create an upgrade installation package with megabytes of files in it just because one or two small files inside have to be renewed.

In cases like this, patching has always been a better solution. Patches basically contain the difference between the old and the new versions and can automagically turn the old file on the user's computer into the new one. Patch

packages can also contain new files to be deployed.

The WiX toolset can also create patch installation packages (.msp files). These are created from two normal installation packages: the original one with the old, erroneous files and a new one with the fixed files. In the downloadable [SamplePatch \(/system/files/samples/SamplePatch.zip\)](#) we have two very simple installation packages, without user interface. Both install a single file that will change between the original and patched versions. The details of the source files must be completely familiar by now. Our Error.wxs and Fixed.wxs source files will only differ in their `Source` file references:

```
<File Id='FoobarEXE' Name='FoobarAppl10.exe' DiskId='1' Source='Error\FoobarAppl10.exe' KeyPath='yes' />
```

versus

```
<File Id='FoobarEXE' Name='FoobarAppl10.exe' DiskId='1' Source='Fixed\FoobarAppl10.exe' KeyPath='yes' />
```

The patch will be created from a third source file. It is, just like the earlier ones, an XML file but the contents are different from the files we've created so far:

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```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'>
  <Patch AllowRemoval='yes' Manufacturer='Acme LTD.' MoreInfoURL='www.acmefoobar.com'
    DisplayName='Foobar 1.0.1 Patch' Description='Small Update Patch' Classification='Update'>

    <Media Id='5000' Cabinet='Sample.cab'>
      <PatchBaseline Id='Sample' />
    </Media>

    <PatchFamily Id='SamplePatchFamily' Version='1.0.0.0' Supersede='yes'>
      <ComponentRef Id='MainExecutable' />
    </PatchFamily>

  </Patch>
</Wix>
```

The `Classification` attribute can be *Hotfix*, *Security Rollup*, *Critical Update*, *Update*, *Service Pack*, or *Update Rollup*. `AllowRemoval` controls whether the user can later uninstall the patch or not. A `PatchFamily` tag encompasses the items to be patched. `Supersede` controls whether this actual patch supersedes all previous patches in this same family.

Building will be a little bit more complicated than our previous projects. First, we build the two base packages the usual way. Each goes into its own folder:

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```
candle.exe Error.wxs  
light.exe -out Error\Product.msi Error.wixobj
```

```
candle.exe Fixed.wxs  
light.exe -out Fixed\Product.msi Fixed.wixobj
```

Then we use another WiX tool, Torch, to create a transform between the two installation packages. The command line arguments instruct the program to use WiX's own formats, .wixpdb and .wixmst rather than those of Windows Installer (.msi and .mst).

```
torch.exe -p -xi Error\Product.wixpdb Fixed\Product.wixpdb -out Patch.wixmst
```

We also have to build our patch package using the usual WiX compiler and linker but this time, the output format will be different from the usual one, .wixmsp. There is no need to tell the linker to produce this kind of file, it will determine it automatically based on the contents of the source file.

```
candle.exe Patch.wxs  
light.exe Patch.wixobj
```

And finally, we build the actual Windows Installer patch package from the result of the previous step and the transform we created a while ago. Pyro, the WiX tool responsible for patch creation, needs not only the name

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of the transform file but the corresponding PatchBaseline/@Id attribute as well on the command line:

```
pyro.exe Patch.wixmsp -out Patch.msp -t Sample Patch.wixmst
```

The Patch.msp will be the patch installer actually distributed. To test it, first install the original package (Error/Product.msi), then apply the patch:

```
msiexec /p Patch.msp
```

... and check that the file has indeed been changed to the new version. Then, go into the Programs and Features Control Panel tool, choose *Show Updates*, and remove first the patch (the changed file will revert back to the original one) and then the program itself.

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Fragments

Fragments offer a way to break up large installation projects. Basically, a fragment is a wrapper put around a WiX source unit, be it as simple or as complicated as we like. Similarly to object files or libraries we use in program development, a fragment can be linked into other product installation packages. If you consider the two WiX tools we have, Candle and Light like compiler and linker,

fragments, just like source code modules, can be compiled independently into object code (.wixobj files). Rebuilding of a large installation package can be sped up dramatically by using the usual makefile approach, only recompiling .wxs source files that have been changed since the last compilation and linking the .wixobj files, fresh and old, together to form the final package.

As we can't have such large and complex projects as samples in a tutorial, our SampleFragment (/system/files /samples/SampleFragment.zip) will be necessarily somewhat constructed. We reuse our first installer but we outsource some parts to separate fragments in order to illustrate our point. We removed the component that installs the user manual file, thus, the following reference will point to nowhere:

```
<Feature Id='Complete' Title='Foobar 1.0' Description='The complete package.' ...>
    <Feature Id='Documentation' Title='Description' Description='The instruction manual.' Level='1'>
        <ComponentRef Id='Manual' />
    </Feature>
</Feature>
```

We place the removed component into a file of its own, inside a `Fragment` tag. Here we only *refer to* the `Directory` we have already declared in our main source file because we can't declare the same thing in two

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places. Anything that can be delegated into a fragment has its variant tag: to refer to a feature defined elsewhere, we use `FeatureRef`, to refer to a property, we use `PropertyRef`.

```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/200
6/wi'>
    <Fragment Id='FragmentManual'>
        <DirectoryRef Id='INSTALLDIR'>
            <Component Id='Manual' Guid='YOURGUI
D-574D-4A9A-A266-5B5EC2C022A4'>
                <File Id='Manual' Name='Manual.p
df' DiskId='1' Source='Manual.pdf' KeyPath='yes'
>
                    <Shortcut Id="startmenuManua
l" Directory="ProgramMenuDir" Name="Instruction
Manual" Advertise="yes" />
                </File>
            </Component>
        </DirectoryRef>
    </Fragment>
</Wix>
```

We could already compile and link these two files into an installation package. Note that we didn't need to add a single line to the source to make the two compilation units link together. The fact that we referenced a component from one file that was defined in the other one is enough for the linking to happen as we expect it. Referencing one element from a fragment opens up the whole fragment and makes all its elements immediately available. This

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behavior is different from what we are used to with the usual programming languages: fragment linking not only makes it possible to use elements defined elsewhere, using at least one of them will always switch on *everything* from the fragment referenced.

To build the sample, use the commands:

```
candle.exe SampleFragment.wxs Manual.wxs  
light.exe -out SampleFragment.msi SampleFragmen  
t.wixobj Manual.wixobj
```

Fragments have many uses not only inside a single setup project but to share common items between different projects as well. For instance, if you have several related applications that share one or more common files (eg. device drivers or other functionality in DLLs), you might need to ensure that removing one application will not remove the common file that is still needed by the other one.

In this case, put your common file into a fragment of its own and refer to this fragment from all of your separate application setups. As the component (and, therefore, the component GUID) is the same, Windows Installer will be able to keep track of all the application requiring the common files, including properly enforcing versioning rules so that a newer version will never be overwritten by an older one.

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Mergers

Fragments help divide a large package into manageable chunks of source code and make developer co-operation and code reuse possible. Therefore, it is best suited to in-house development where WiX source code can and will be shared. But there is another mechanism capable of providing complete installation packages for other parties to use: merge modules. If, say, your product A depends on

product B of another vendor, you can use their merge module meant to install their product and make it a part of your own so that both will be installed at the same time.

Setting up a merge module is very similar to the standalone source files we've used so far. However, instead of a `Product`, we specify a `Module` tag. Unlike with earlier packages, here we have to provide a unique GUID ourselves:

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```
<?xml version="1.0" encoding="windows-1252"?>
<Wix xmlns="http://schemas.microsoft.com/wix/2006/wi">
    <Module Id="File1" Language="0" Version="1.2.3">
        <Package Id="YOURGUID-8DEE-4410-990A-1802896C4209" InstallerVersion="100" Languages="1033" Manufacturer="dev" SummaryCodepage="1252" AdminImage="no" />

        <Directory Id='TARGETDIR' Name='SourceDir'>
            <Directory Id='ProgramFilesFolder' Name='PFiles'>
                <Directory Id='Acme' Name='Acme'>
                    <Directory Id='INSTALLDIR' Name='Foobar 1.0'>
                        <Component Id="File1" Guid="YOURGUID-CF0E-40AB-ACC5-0E9A5F112628">
                            <File Id="File1.txt" Name="File1.txt" Source="File1.txt" KeyPath='yes' />
                        </Component>
                    </Directory>
                </Directory>
            </Directory>
        </Directory>
    </Module>
</Wix>
```

In our sample, we use a second merge module as well. Its source file almost identical to the previous one, with the following differences: we refer to a different file to deploy

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and we include a `Dependency` tag to indicate that the second module is dependent on the first one. For the dependency, we use the `Module/@Id` identifier with the module's Package GUID appended---but we have to replace the original dashes by underscore characters:

```
<Module Id="File2" Language="0" Version="1.2.3">
    ...
    <File Id="File2.txt" Name="File2.txt" Source
        ="File2.txt" KeyPath='yes' />
    ...
    <Dependency RequiredId="File1.YOURGUID_8DEE_
        4410_990A_1802896C4209"
        RequiredLanguage="0" RequiredVersion="1.
        2.3" />
</Module>
```

To create a unified installation package, we write a usual standalone WiX source file:

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```
<?xml version="1.0" encoding="windows-1252"?>
<Wix xmlns="http://schemas.microsoft.com/wix/2006/wi">
  <Product Name='Foobar 1.0' Id='YOURGUID-86C7-4D14-AEC0-86416A69ABDE' UpgradeCode='YOURGUID-7349-453F-94F6-BCB5110BA4FD' Language='1033' Codepage='1252' Version='1.0.0' Manufacturer='Acme Ltd.'>

    <Package Id='*' Keywords='Installer' Description="Acme's Foobar 1.0 Installer" Comments='Foobar is a registered trademark of Acme Ltd.' Manufacturer='Acme Ltd.' InstallerVersion='100' Languages='1033' Compressed='yes' SummaryCodepage='1252' />

    <Media Id="1" Cabinet="product.cab" EmbedCab="yes" />

    <Directory Id='TARGETDIR' Name='SourceDir'>
      <Directory Id='ProgramFilesFolder' Name='PFiles'>
        <Directory Id='Acme' Name='Acme'>
          <Directory Id='INSTALLDIR' Name='Foobar 1.0'>
```

Instead of the usual components, we refer to the merge modules. The SourceFile mentions the .msm files:

```
<Merge Id="file1" Language="1033" So
urceFile="Module1.msm" DiskId="1" />
    <Merge Id="file2" Language="1033" So
urceFile="Module2.msm" DiskId="1" />

    </Directory>
    </Directory>
</Directory>
</Directory>

<Feature Id="Msm" Title="Msm" Level="1">
    <MergeRef Id="file1" />
    <MergeRef Id="file2" />
</Feature>

</Product>
</Wix>
```

You can download the complete [SampleMergeModule](#) (/system/files/samples/SampleMergeModule.zip). You need to build the merge modules separately:

```
candle.exe Module1.wxs
light.exe Module1.wixobj

candle.exe Module2.wxs
light.exe Module2.wixobj

candle.exe SampleMerge.wxs
light.exe SampleMerge.wixobj
```

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Net and .NET

When you plan to distribute programs based on the .NET Framework, you have to make sure the user has the framework installed. Microsoft allows you to redistribute their framework but only in its original form (see their description (<http://msdn.microsoft.com/library/default.asp?url=/library/en-us/cpguide/html/cpconDistributingCommonLanguageRuntime.asp>)).

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This also means that you can't build the framework into your own .msi package. There is no merge module or similar available. You have to provide a separate bootstrap installer, Setup.exe, that looks for the installed framework and starts your .NET Framework redistributable (or, alternatively, downloads and installs it from the Net). When finished, it will call your own installation package.

However, you don't have to write such a bootstrap installer yourself. Starting with WiX v3.6, you can use the Burn chainer to install .NET Framework (http://wixtoolset.org/documentation/manual/v3/howtos/redistributables_and_install_checks/install_dotnet.html).

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Framed by .NET

If you need to determine the presence of the .NET Framework on the user's computer, you can use the WixNetFxExtension extension module that comes with WiX. This extension sets a large number of properties (the complete list can be found in the WiX help file) for every version of the framework. The most important ones for us will be:

- **NETFRAMEWORKxx**: Set if the specified version of the framework is installed.
- **NETFRAMEWORKxx_SP_LEVEL**: Set to the Service Pack level of the framework.
- **NETFRAMEWORKxxINSTALLROOTDIR**: Set to the installation folder of the framework.

All you have to do to read the value of any of these properties is to reference them using a `PropertyRef` tag:

```
<PropertyRef Id="NETFRAMEWORK10"/>
<Condition Message='This setup requires the .NET
Framework 1.0 installed.'>
  <![CDATA[Installed OR NETFRAMEWORK10]]>
</Condition>
```

If you need to check for a Service Pack, you don't even have to check for the framework version itself, the SP property will only be set if the base framework is also present. However, you first need to check whether the property is set at all, then go on checking which value it actually has:

```
<PropertyRef Id="NETFRAMEWORK20_SP_LEVEL"/>
<Condition Message='This setup requires the .NET
Framework 2.0 with Service Pack 1 installed.'>
  <![CDATA[Installed OR (NETFRAMEWORK20_SP_LEVEL
AND NETFRAMEWORK20_SP_LEVEL = "#1")]]>
</Condition>
```

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With later framework versions, extra properties are also available:

```
<PropertyRef Id="NETFRAMEWORK35_CLIENT"/>
<Condition Message='This setup requires the .NET Framework 3.5 client profile installed.'>
    <![CDATA[Installed OR NETFRAMEWORK35_CLIENT]]>
</Condition>
```

When you link the installer, don't forget to link against the *WixNetFxExtension* module:

```
candle.exe SampleDotNET.wxs
light.exe -ext WixNetFxExtension SampleDotNET.wi
xobj
```

You can download the complete SampleDotNET. ([/system/files/samples/SampleDotNET.zip](#))

```
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Bootstrapping

We've already seen how to detect external packages like the .NET Framework but users expect more than a mere warning when prerequisites and dependencies are not yet present on their machine. Creating complex installers that not only warn about these situations but install the required dependent packages themselves were not at all easy to author. But now, thanks to Burn built into WiX, it's

a breeze.

A Burn project, called a bundle, is just as easy to author. Note that this is a separate WiX project: you author your own MSIs exactly as before. The bundle will assemble the already finished MSIs and other packages we want to install together, and will create a separate bootstrapper installer that consists of an executable the user can start, plus all the separate MSIs and EXEs needed for the various packages (either external or bundled inside the main executable).

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```
<Wix xmlns="http://schemas.microsoft.com/wix/2006/wi">
  <Bundle Name="..." Version="..." Manufacturer="..." UpgradeCode="..." Copyright="..." IconSourceFile="..." AboutUrl="...">
    <BootstrapperApplicationRef Id="WixStandardBootstrapperApplication.RtfLicense" />

    <Chain>
      <ExePackage Id="Dependency1" SourceFile="Dependency_package_1.exe" />
      <ExePackage Id="Dependency2" SourceFile="Dependency_package_2.exe" />

    <RollbackBoundary />

    <MsiPackage Id="MainPackage" SourceFile="Main_package.msi" Vital="yes" />
  </Chain>
</Bundle>
</Wix>
```

Building this project is just as easy as any other project we've seen so far, only that it creates an .exe, not an .msi (SampleBurn.exe, to be exact):

```
candle.exe SampleBurn.wxs
light.exe -ext WixBalExtension SampleBurn.wixobj
```

Unlike a regular project, this has a `Bundle` at its root, not a `Product`. This `Bundle` uses most of the same attributes to describe its name, version, copyright and

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usual UI details. For the main part, it has a `Chain` child that lists all the packages that have to be installed, in sequence. A `RollbackBoundary` tag can be used to mark what should be rolled back and what not if the user decides to roll back our installation.

`Chain` typically has two kinds of children: `ExePackage` and `MsiPackage` elements. Both can have either `SourceFile` or `DownloadUrl` attributes. In the first case, the setup package itself will be bundled and distributed directly with out installer (although, of course, any installer provided can be a web installer, a small executable that downloads the bulk of the material to be deployed from the Net). In the second case, the installer will be fetched from the URL supplied and then executed.

In the simple example above, both dependency packages are installed unconditionally. In real life scenarios, we usually have to check first whether we already have those packaged installed and skip their installation if they can be found on the target machine. To do so, we use conditions we are already familiar with:

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```
<Wix xmlns="http://schemas.microsoft.com/wix/2006/wi"
      xmlns:bal="http://schemas.microsoft.com/wix/BalExtension"
      xmlns:util="http://schemas.microsoft.com/wix/UtilExtension">
  <Bundle Name="..." Version="..." Manufacturer="..."
          UpgradeCode="..." Copyright="..." IconSourceFile="..." AboutUrl="...">
    <BootstrapperApplicationRef Id="WixStandardBootstrapperApplication.RtfLicense" />

    <util:RegistrySearch Root="HKLM" Key="SOFTWARE\Microsoft\Net Framework Setup\NDP\v4\Full" Value="Version" Variable="Net4FullVersion" />
    <util:RegistrySearch Root="HKLM" Key="SOFTWARE\Microsoft\Net Framework Setup\NDP\v4\Full" Value="Version" Variable="Net4x64FullVersion" Win64="yes" />

    <Chain>
      <ExePackage Id="Net45" Name="Microsoft .NET Framework 4.5.1 Setup" Cache="no" Compressed="yes" PerMachine="yes" Permanent="yes" Vital="yes" InstallCommand="/q"
                  SourceFile="NDP451-KB2859818-Web.exe"
                  DetectCondition="(Net4FullVersion = "4.5.50938") AND (NOT VersionNT64 OR (Net4x64FullVersion = "4.5.50938"))"
                  InstallCondition="(VersionNT >= v6.0 OR VersionNT64 >= v6.0) AND (NOT (Net4FullVersion = "4.5.50938" OR Net4x64FullVersion = "4.5.50938"))"/>

      <ExePackage Id="Net4Full" Name="Microsoft
```

```
.NET Framework 4.0 Setup" Cache="no" Compressed  
="yes" PerMachine="yes" Permanent="yes" Vital="y  
es" InstallCommand="/q"  
    SourceFile="dotNetFx40_Full_setup.exe"  
    DetectCondition="Net4FullVersion AND (NO  
T VersionNT64 OR Net4x64FullVersion)"  
    InstallCondition="(VersionNT < v6.0 O  
R VersionNT64 < v6.0) AND (NOT (Net4FullVersi  
on OR Net4x64FullVersion))"/> />  
  
    <RollbackBoundary />  
  
    <MsiPackage Id="MainPackage" SourceFile="M  
ain_package.msi" DisplayInternalUI="yes" Compres  
sed="yes" Vital="yes" />  
    </Chain>  
    </Bundle>  
</Wix>
```

And this is already more than an example; this is a fully working copy of a .NET Framework-aware installer. When compiling it, we will also need to reference some extensions:

```
candle.exe -ext WixNetFxExtension -ext WixBalExt  
ension -ext WixUtilExtension SampleBurn.wxs  
light.exe -ext WixNetFxExtension -ext WixBalExte  
nsion -ext WixUtilExtension SampleBurn.wixobj
```

Let's see how it works and what it does.

We have two `RegistrySearch` items from the utility extension to help us determine the current version of the

Framework installed. Both `ExePackage` items have conditions that determine when to install the Framework with the provided installer. The first installs 4.5.1 on Vista and later systems if not yet present. The second installs 4.0 on XP systems if not yet present. Finally, the chain setup installs our own .msi, also specifying that it should run with its original full UI. If we don't specify this, our package will be already installed in silent mode.

The two .exe installers and our .msi will all be bundled into the single resulting SampleBurn.exe executable.

We can customize the appearance of the setup:

```
<BootstrapperApplicationRef Id="WixStandardBoots  
trapperApplication.RtfLicense">  
    <bal:WixStandardBootstrapperApplication Licens  
eFile="License.rtf" LogoFile="Logo.png" />  
</BootstrapperApplicationRef>
```

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Launch the Internet

There are cases when you want to launch something in a browser, either locally or online. To do this, you can create an URL link on the user's disk. These files are actually formatted as .ini files, thus we can use `IniFile` to create them:

```
<Component>
  ...
  <IniFile Id='Launch' Action='addLine' Name='Launch.url' Directory='INSTALLDIR'
    Section='InternetShortcut' Key='URL' Value='http://www.acmefoobar.com' />
  ...
</Component>
```

To launch the default browser directly, first we have to query it, then use this path in the usual way to launch a custom action after we have finished the installation (but only when we install, not when we uninstall). Please, make sure you use this solution to make sure that the user's preferred browser will start: *never hardwire any specific browser.*

```
<Property Id="BROWSER">
  <RegistrySearch Id='DefaultBrowser' Type='raw'
    Root='HKCR' Key='http\shell\open\command' />
</Property>

<CustomAction Id='LaunchBrowser' Property='BROWSER'
  ExeCommand='www.something.com' Return='async
  NoWait' />

<InstallExecuteSequence>
  ...
  <Custom Action='LaunchBrowser' After='InstallFinalize'>NOT Installed</Custom>
</InstallExecuteSequence>
```

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You can download the complete SampleBrowser (</system/files/samples/SampleBrowser.zip>).

To add a shortcut to the desktop or the Start menu that launches the default browser and jumps to a specific web site is even simpler. The only thing we have to look out for is to use a property for the URL: writing the URL directly into the `Target` attribute of the Shortcut would fail because the compiler would think it is the name of a local file to be deployed:

```
<Property Id="URL" Value="http://www.something.com" />
...
<Shortcut Id="WebShortcut" Name="Web URL" Description="Jump to our website" Target="[URL]" />
```

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Web Directory

The WiX toolset has additional libraries that allow the installer to perform additional tasks like creating a web directory in IIS. To use these extensions, all you have to do is to link against the appropriate WiX library. The linker will include the necessary helper DLLs into the installation package automatically.

First, we have to create the web site with the files

belonging to it:

```
<Directory Id='TARGETDIR' Name='SourceDir'>
    <Directory Id='ProgramFilesFolder' Name='PFiles'>
        <Directory Id='InstallDir' Name='Acme'>
            <Component Id='default.phpComponent' Guid='YOURGUID-5314-4689-83CA-9DB5C04D5742'>
                <File Id='default.htmFile' Name='default.htm' Source='default.htm' DiskId='1' KeyPath='yes' />
            </Component>
        </Directory>
    </Directory>
</Directory>
```

The next step is to create the virtual directory:

```
<Component Id='TestWebVirtualDirComponent' Guid='YOURGUID-6304-410E-A808-E3585379EADB'>
    <WebVirtualDir Id='TestWebVirtualDir' Alias='Test' Directory='InstallDir' WebSite='DefaultWebSite'>
        <WebApplication Id='TestWebApplication' Name='Test' />
    </WebVirtualDir>
</Component>
```

Finally, create an entry to reference the web site:

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```
<WebSite Id='DefaultWebSite' Description='Default Web Site'>
  <WebAddress Id='AllUnassigned' Port='80' />
</WebSite>
```

When you link the installation package, you have to link it against the appropriate WiX library. As you pass more than one WiX object file to the linker, you also have to specify the name of the output file:

```
light.exe -out SampleWebDir.msi SampleWebDir.wix
obj path\sca.wixlib
```

You can download the complete [SampleWebDir \(/system/files/samples/SampleWebDir.zip\)](#).

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Services Rendered

Services can be installed and started automatically.

```
<Component Id='ServiceExeComponent' Guid='YOURGUID-  
D752-4C4F-942A-657B02AE8325'  
    SharedDllRefCount='no' KeyPath='no' NeverOverwrite='no'  
    Permanent='no' Transitive='no'  
    Win64='no' Location='either'>  
  
    <File Id='ServiceExeFile' Name='ServiceExe.exe'  
        Source='ServiceExe.exe'  
        ReadOnly='no' Compressed='yes' KeyPath='yes'  
        Vital='yes' Hidden='no' System='no'  
        Checksum='no' PatchAdded='no' />  
  
    <ServiceInstall Id='MyServiceInstall' DisplayName='My Test Service' Name='MyServiceExeName'  
        ErrorControl='normal' Start='auto' Type='ownProcess' Vital='yes' />  
  
    <ServiceControl Id='MyServiceControl' Name='MyServiceExeName'  
        Start='install' Stop='uninstall' Remove='uninstall' />  
  
</Component>
```

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Components of a Different Color

Heat harvests data from various sources (folders, files, DLLs, ActiveX controls, performance counters) where the number of entries might be too large to author the corresponding WiX source file manually. Its primary intention is to be run once, to collect the data to be used

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later in the usual maintenance of the source files, not to be part of a build environment where it is run on a changing set of input data over and over again. If you still want to use it in this second way, you have to be very careful to make sure that changes in the input don't introduce unwelcome effects (mostly breaking the component rules). Heat does have features that help you achieve this goal but be careful when using them.

The first mode of Heat will help us author the necessary WiX source for one or more folders full of files:

```
heat dir folder -cg SampleGroup -out SampleGroup.wxs
```

will harvest the folder specified recursively, creating a Fragment consisting of a ComponentGroup with the name specified with the -cg switch. The group will contain as many components as there are files, each component having a single file inside, as the rules dictate, and will assign uniquely generated component, directory and file identifiers that remain the same when regenerated on the same input set. GUIDs will not be generated (only a placeholder text) unless explicitly instructed to do so by the -gg switch.

In addition to the component group, Heat also generates fragments containing directory references (`DirectoryRef` tags) for each folder traversed recursively. The root directory harvested will have the identifier `TARGETDIR`,

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unless you specify your own name:

```
heat dir path -dr MyDirName -cg SampleGroup -out  
SampleGroup.wxs
```

Note that the automatically generated identifiers use this name as a seed. Changing the name will change all identifiers, with possible dire component-rule violation consequences if changed at an inappropriate time.

Yet another switch, `-srd` will suppress the identifier generation for the root folder specified. File components in the root folder will refer to their `Directory` as either `TARGETDIR` or the name specified in the `-dr` switch and there will be no separate `DirectoryRef` fragment for the root folder:

```
heat dir path -srd -dr MyDirName -cg SampleGroup  
-out SampleGroup.wxs
```

The second mode of the tool deals with a single file. If there are registry, COM and similar items to be collected from the file, they will all be extracted by Heat (the subject here was the Interop assembly for the `Shell32.dll` system library):

```
heat file file -cg SampleGroup -out SampleGroup.  
wxs
```

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This results in a similar source file, with all details duly extracted:

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```
<?xml version="1.0" encoding="utf-8"?>
<Wix xmlns="http://schemas.microsoft.com/wix/200
6/wi">
    <Fragment>
        <ComponentGroup Id="SampleGroup">
            <Component Id="cmpA8B0842041500B0ACE61F7EF
D0FBD893" Directory="dir0F6F75DF46D1BACE2233EC57
3E6D4AA9" Guid="PUT-GUID-HERE">
                <File Id="filDDAAB2C11E1E5AE4668D99216C3
B5523" KeyPath="yes" Source="SourceDir\SampleHea
t\Interop.Shell32.dll" />
                <RegistryValue Root="HKCR" Key="CLSID\{0
A89A860-D7B1-11CE-8350-444553540000}\InprocServe
r32\1.0.0.0" Name="Class" Value="Shell32.ShellDi
spatchInprocClass" Type="string" Action="write"
/>
                <RegistryValue Root="HKCR" Key="CLSID\{0
A89A860-D7B1-11CE-8350-444553540000}\InprocServe
r32\1.0.0.0" Name="Assembly" Value="Interop.Shel
l32, Version=1.0.0.0, Culture=neutral, PublicKey
Token=null" Type="string" Action="write" />
                <RegistryValue Root="HKCR" Key="CLSID\{0
A89A860-D7B1-11CE-8350-444553540000}\InprocServe
r32\1.0.0.0" Name="RuntimeVersion" Value="v2.0.5
0727" Type="string" Action="write" />
                <RegistryValue Root="HKCR" Key="CLSID\{0
A89A860-D7B1-11CE-8350-444553540000}\InprocServe
r32\1.0.0.0" Name="CodeBase" Value="file:///[#fi
1DDAAB2C11E1E5AE4668D99216C3B5523]" Type="strin
g" Action="write" />
                <RegistryValue Root="HKCR" Key="CLSID\{0
A89A860-D7B1-11CE-8350-444553540000}\InprocServe
r32" Name="Class" Value="Shell32.ShellDispatchIn
procClass" Type="string" Action="write" />
                <RegistryValue Root="HKCR" Key="CLSID\{0
```

```
A89A860-D7B1-11CE-8350-444553540000}\InprocServer32" Name="Assembly" Value="Interop.Shell32, Version=1.0.0.0, Culture=neutral, PublicKeyToken=null" Type="string" Action="write" />
    <RegistryValue Root="HKCR" Key="CLSID\{0A89A860-D7B1-11CE-8350-444553540000}\InprocServer32" Name="RuntimeVersion" Value="v2.0.50727" Type="string" Action="write" />
    <RegistryValue Root="HKCR" Key="CLSID\{0A89A860-D7B1-11CE-8350-444553540000}\InprocServer32" Name="CodeBase" Value="file:///[#filDDAAB2C11E1E5AE4668D99216C3B5523]" Type="string" Action="write" />
    ...
</Component>
</ComponentGroup>
</Fragment>

<Fragment>
<DirectoryRef Id="TARGETDIR">
    <Directory Id="dir0F6F75DF46D1BACE2233EC573E6D4AA9" Name="SampleHeat" />
</DirectoryRef>
</Fragment>

<Fragment>
<DirectoryRef Id="dir0F6F75DF46D1BACE2233EC573E6D4AA9" />
</Fragment>
</Wix>
```

A few additional words have to be added here. People often wonder whether they should author all their registry and other changes into their installation package or let

their installed components (DLLs, for instance) register themselves by adding the registry entries or carrying out other setup tasks when they are first run. The answer is clear: *never use self registration*. The Windows installer needs to be able to keep track of all registration and file changes of your product in order to be able to track versions, updates and to remove the product completely and reliably. Moving important data out of the jurisdiction of the Installer mechanism will jeopardize this and only cause problems to your users. Using self registration is very strongly discouraged by Microsoft

(<https://msdn.microsoft.com/en-us/library/aa371608%28v=vs.85%29.aspx>) and should be avoided at all costs.

The third mode works through a Visual Studio or a compatible project file and creates references to all files of the specified type: *Binaries, Symbols, Documents, Satellites, Sources or Content*. For instance, with *Binaries* the tools collects all binary files to be built and deployed by the project, all put into their respective components and directories, ready to be included in your final WiX source with a simple reference:

```
heat project projectfile -pog:Binaries -cg SampleGroup -out SampleGroup.wxs
```

In our previous examples, we used Heat to generate a fragment for later inclusion into a complete setup

package. We can also tell it to create a module or a standalone product instead. For smaller packages, the tool might actually author the bulk of the WiX source files and only some items (GUIDs, textual descriptions) have to be added manually.

```
heat ... -template:module -cg SampleGroup -out SampleGroup.wxs  
heat ... -template:product -cg SampleGroup -out SampleGroup.wxs
```

Typelibs are supported directly in WiX, there is no need to use Heat or any other tool to gather all their internal information:

```
<File Id="file.dll" Name="file.dll" KeyPath="yes">  
  <TypeLib Id="YOURGUID-0BFE-4B1A-9205-9AB900C7D0DA" Language="0" />  
</File>
```

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Expression Syntax

We've already used conditional expressions, among others, in `Condition` and `Publish` tags. We are already aware of logical operators like `NOT` , `AND` , `OR` or comparisons like `<` , `>` , `=` . To have them all described, here they are in order of precedence:

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Logical operators

- NOT Prefix unary operator; inverts state of following term.
- AND Logical AND
- OR logical OR
- XOR exclusive OR
- EQV equivalence
- IMP implication

Comparative operators

- = equal
- \neq not equal
- $>$ greater than
- \geq greater than or equal
- $<$ less than
- \leq less than or equal
- $\sim=$ equal, case insensitive
- $\sim\neq$ not equal, case insensitive
- $\sim>$ greater than, case insensitive
- $\sim\geq$ greater than or equal, case insensitive
- $\sim<$ less than, case insensitive
- $\sim\leq$ less than or equal, case insensitive

Substring operators, only between strings

- $>< \text{left}$ contains _right
- $<< \text{left}$ starts with _right

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- >> *left* ends with *_right*

Bitwise operators, only between integers

- >< bitwise AND
- << high 16-bits of *left* equal to *_right*
- >> low 16-bits of *left* equal to *_right*

Note that---as usual in XML---you have to be cautious when you use angle brackets that can be mistaken for an opening or closing character of an XML tag. To avoid confusion, you should use XML's character data mechanism (<https://www.w3.org/TR/REC-xml/#sec-cdata-sect>) to escape these conditions: Wrap conditional expressions with `<![CDATA[` and `]]>`:

```
<![CDATA[ IAgree <> "Yes"]]>
```

The safest approach would be to wrap everything (this is what the WiX decompiler, Dark, does) but---at least in my humble opinion---this makes the source far too illegible. Or, you have to take care of which expressions are misleading and which are not (the compiler will give an error message if it doesn't understand something) and only use the wrapper where really necessary. It's your choice.

Properties in expressions

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In these expressions, you can use property names (remember that they are case sensitive). Non-existent property names will be treated as empty strings. The logical value of a property reflects whether it has been set---meaning that you *cannot* check for a logical value by simply using the property:

- PROPERTY This will evaluate to *true* if the property has been set and has *any* value, even if this value is false or 0.
- NOT PROPERTY This will evaluate to *true* if the property has not been set at all.

Prefixes

Prepending some special characters to the names will give them extra meaning:

- % environment variable (name is case insensitive)
- \$ action state of component
- ? installed state of component
- & action state of feature
- ! installed state of feature

The last four can return the following integer values:

- -1 no action to be taken
- 1 advertised (only for features)
- 2 not present
- 3 on the local computer
- 4 run from the source

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A few examples to make things clearer:

- `(&FeatureName = 3) AND NOT (!FeatureName = 3)`
Run action only if the product will be installed locally. Do not run action on a reinstallation. The term `&FeatureName = 3` means the action is to install the feature locally. The term `NOT (!FeatureName = 3)` means the feature is not installed locally.
- `(&FeatureName = 2) AND (!FeatureName = 3)` Run action only if the feature will be uninstalled. This condition only checks for a transition of the feature from an installed state of local to the absent state.
- `(?ComponentName = 3) AND ($ComponentName = 2 OR $ComponentName = 4)` Run action only if the component was installed locally, but is transitioning out of state. The term `?ComponentName = 3` means the component is installed locally. The term `$ComponentName = 2` means that the action state on the component is absent. The term `$ComponentName = 4` means that the action state on the component is run from source. Note that an action state of advertise is not valid for a component.
- `?ComponentName = $ComponentName` Run action only on the reinstallation of a component.

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Formatted Strings

Strings appearing in control texts can be formatted. We have already used property names in square brackets but there are more complicated rules around here, too. First if the property name is not valid in [Property], the whole substring is left unchanged.

This rule is somewhat different if the square brackets are

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nested. `[[Property]]` will first look up `Property`, then use its value as another property name, then look this second property up. In any of these property names are not found, the whole substring will be considered an empty string.

Backslashes can be used as escape characters to denote characters otherwise having special meaning (like square brackets).

The substring `[~]` is replaced with a null character. This makes it possible to compile REG_MULTI_SZ registry strings.

The `#[filekey]` notation will return the full path of the file with the specified `Id` but only after `CostInitialize`, `FileCost` or `CostFinalize` have been run. The path will depend on whether the file belongs to a component that is installed locally or from the source.

The `$componentkey` notation will return the install directory of the specified component but only after `CostInitialize`, `FileCost` or `CostFinalize` have been run. The path will depend on whether the file belongs to a component that is installed locally or from the source.

The `![filekey]` notation is usually equivalent to `#[filekey]` with the exception of the `Value` attribute of `Registry` or `IniFile` tags. In these cases, it will return the full short path of the file.

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WiX makes it possible to inject strings defined outside (eg. on a command line) to be used in the source. The compiler, Candle, supports preprocessor variables and uses the `$(var.Foo)` syntax. You can provide the value either in the source file itself:

```
<?define Foo = "bar" ?>
```

or with a command line switch:

```
candle -dFoo=bar
```

Light, the linker, has a similar scheme with bind-time variables and uses a slightly different syntax: `!(wix.Foo)`. The command line is similar:

```
light -dFoo=bar
```

Localized strings use the `!(loc.Foo)` notation. The linker expects these strings to be provided in a `.wxl` localization file with the syntax:

```
<String Id="Foo" Overridable="yes">bar</String>
```

The localization file is also specified on the command line:

```
light -loc path
```

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The main difference between localization and other string is the overridable nature of the former. While a library or extension module can have a default value for the string, it can be overridden late during the process of linking.

In order to assign any of these values to a regular Windows Installer property, use the `Property` tag:

```
<Property Id="Foo1" Value="$(var.Foo)" />
<Property Id="Foo2" Value="!(wix.Foo)" />
<Property Id="Foo3" Value="$(env.Foo)" />
```

Environment variables can be accessed using the `$(env.Foo)` syntax.

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DDE connections

Shell connections using DDE (Dynamic Data Exchange) can be set up as follows:

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```
<ProgId Id='Program.xyz' Description='Program handling .xyz' Advertise='yes'>
    <Extension Id='xyz' ContentType='text/sql'>
        <Verb Id='open' Sequence='1' Command='Open' Argument='"%1"' />
    </Extension>
    <Extension Id='xyz0' ContentType='text/sql'>
        <Verb Id='open' Sequence='1' Command='Open' Argument='"%1"' />
    </Extension>
</ProgId>

<Component Id='regSetup' Guid='YOURGUID-6D8A-4AE2-9D9F-3E074F13A029'>
    <Registry Root='HKLM' KeyPath='yes' Key='SOFTWARE\Classes\Program.xyz\shell\open\ddeexec' Type='string' Value='[[]open("%1")[]]' />
    <Registry Root='HKLM' Key='SOFTWARE\Classes\Program.xyz\shell\open\ddeexec\application' Type='string' Value='Program.xyz' />
    <Registry Root='HKLM' Key='SOFTWARE\Classes\Program.xyz\shell\open\ddeexec\topic' Type='string' Value='System' />
</Component>
```

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Creating Directories

In some cases we have to create new directories without actually installing any file into them. Here is how:

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```
<Directory Id="TARGETDIR" Name="SourceDir">
    <Directory Id="ProgramFilesFolder" Name="PFiles">
        <Directory Id="test" Name="test">
            <Component Id="test" Guid="YOURGUID-4884-4A01-AA04-84B92D222428"
                SharedDllRefCount="no" KeyPath="no" NeverOverwrite="no" Permanent="no" Transitive="no"
                Win64="no" Location="either">
                <CreateFolder/>
            </Component>
        </Directory>
    </Directory>
</Directory>

<Feature Id="test" Title="testfolder" Level="1">
    <ComponentRef Id="test"/>
</Feature>
```

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Multi-media installations

We have already mentioned multi-media installations (where the files don't fit on a single CD, for instance) in the first lesson. You will need several `Media` tags in your source file to describe the separate physical media. Unlike with the earlier installations, you can't embed the

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file archives into the .msi file, of course. Also, you have to specify both a readable (and localizable, if necessary) prompt for the benefit of the user and a volume label (that has to match the actual volume label on the physical media). The installer will use this second to decide whether the user has inserted the expected media:

```
<Media Id='1' Cabinet='Sample1.cab' EmbedCab='no'
      DiskPrompt="CD-ROM #1" VolumeLabel="FOOBAR_DIS
K1" />

<Media Id='2' Cabinet='Sample2.cab' EmbedCab='no'
      DiskPrompt="CD-ROM #2" VolumeLabel="FOOBAR_DIS
K2" />
```

To craft the actual message asking the user to insert the correct media, Windows Installer requires a `DiskPrompt` property, too. You need to use a formatted string, [1] will be replaced with the contents of the `DiskPrompt` attribute of the corresponding `Media` tag:

```
<Property Id='DiskPrompt' Value="Acme's Foobar
1.0 Installation [1]" />
```

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Add or Remove Programs Entries

In the Programs and Features Control Panel tool, applications can have various entries like phone number and Internet contact information. To specify those, add any of the following properties to your source file:

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```
<Property Id='ARPCOMMENTS'>any comments</Property>
<Property Id='ARPCONTACT'>contact info</Property>
<Property Id='ARPHELPLINK'>URL for technical support</Property>
<Property Id='ARPURLINFOABOUT'>URL for general info about the product</Property>
<Property Id='ARPURLUPDATEINFO'>URL for product updates</Property>
<Property Id='ARPHELPTELEPHONE'>URL for technical support</Property>
<Property Id='ARPREADME'>path</Property>
<Property Id='ARPSIZE'>app size in kilobytes</Property>
```

ARPSIZE seems to be superfluous at first sight. However, testing shows that Programs and Features reports a completely bogus value (over 4 GB) for very small packages. In this case, providing the package size manually can help overcome this annoying but harmless nuisance.

To specify the icon used to the left of the application entry, use a reference to a `Icon/@Id` attribute (as we saw with the `Shortcut` tag, don't forget to append the same extension to the identifier, too).

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```
<Property Id='ARPPRODUCTICON'>appicon.ico</Property>
...
<Icon Id="appicon.ico" SourceFile="Application.ico" />
```

A couple of other properties can control how the application behaves in Add or Remove Programs. To suppress the *Modify* button (or to force the installer into product removal instead of maintenance prior to Windows 2000), use:

```
<Property Id='ARPNOMODIFY'>1</Property>
```

To disable the *Remove* button (or to completely remove the application from this list prior to Windows 2000), use:

```
<Property Id='ARPNOREMOVE'>1</Property>
```

To remove the application altogether from this list on Windows 2000 or XP, you have to use this one instead:

```
<Property Id='ARPSYSTEMCOMPONENT'>1</Property>
```

To suppress the *Repair* functionality, use:

```
<Property Id='ARPNOREPAIR'>1</Property>
```

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New User on the Block

The WiX toolset has additional libraries that allow the installer to perform additional tasks like adding a new user account:

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```
<Component>
  <user:User Id='NewUser' Name='username' Password='password' />
</Component>
```

When you link the installation package, you have to link it against the appropriate WiX extension module:

```
light.exe -ext WixUtilExtension -out Sample.msi
Sample.wixobj
```

This library also provides the means to create folder shares. Just put the following code fragment inside any `Component` to create a share on the folder the component installs into:

```
<user:User Id='Everyone' Name='Everyone' CreateUser='no' FailIfExists='no' RemoveOnUninstall='no' />
<user:FileShare Id='MainExecutableShare' Description='Foobar 1.0 share' Name='FoobarShare'>
  <user:Permission GenericRead='yes' ReadPermission='yes' Read='yes' GenericExecute='yes' User='Everyone' />
</user:FileShare>
```

The attributes of `FileShare` are self-documenting. To specify the permissions that go with the share, you need to use a `Permission` element and that in turn requires a `User` to be specified. We don't want to create a new user

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here (see `CreateUser`) nor to remove it when we uninstall our product (see `RemoveOnUninstall`). For the actual permissions, we can choose from a selection of attributes like `Delete`, `Execute`, `Read`, `Write`, `GenericExecute`, `GenericRead`, `GenericWrite`, `TakeOwnership`, `ReadAttributes`, `WriteAttributes`. See the WiX help file to learn all available attributes.

Also note that you can use `Permission` tags inside `CreateFolder` elements as well. Some extra attributes (`CreateChild`, `CreateFile`, `DeleteChild`, `Traverse`) are reserved for this case.

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Environmentally Friendly

To install environment variables, use the `Environment` tag in a component:

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```
<Environment Id='UpdatePath' Name='PATH' Action='set' Permanent='yes' System='yes' Part='last' Value='[INSTALLDIR]' />
```

The `Action` attribute specifies what to do when the component is installed, its possible values are `create`, `set` and `remove`. The `Part` attribute governs the way the new value is assigned: `all` replaces the previous value with the new one, `first` prepends it to the original value, `last` appends to it. `Permanent='yes'` makes the environment variable stay when the product is removed, otherwise, it will be removed as well. `System` specifies whether the environment variable should be added to the system or the user environment space. Make sure you use all-uppercase names.

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XML

More and more programs use XML-based configuration files these days instead of the older .ini style. WiX contains prefabricated custom actions to modify such files during installation and uninstallation. Let's suppose that we install a Settings.xml file together with our application. Originally, the file only contains the outermost tags:

```
<settings>
</settings>
```

We want the installer to add new nodes, one of those with attribute values:

```
<settings>
  <add key="a_key" value="a_value">key_item
    <inside>inside_item</inside>
  </add>
</settings>
```

To achieve this, we can use the `XmlFile` tag. Apart from its usual attributes like `Id` and `File`, its `Action`, `Name` and `Value` attributes will determine what to do in the XML file while the `ElementPath` specifies where to do it. This last attribute uses the standard [XPath specification language](#) (<http://www.w3.org/TR/xpath>) to describe the XML node the actual operation will be applied to.

- Action=`createElement` a new element named `Name` will be created as a child of the one specified in `ElementPath`
- Action=`setValue` If `Name` is omitted, the inner text of the element specified in `ElementPath` will be set to `Value`. If both `Name` and `Value` are specified, the node specified in `ElementPath` will receive an attribute named `Name` with a value of `Value`.
- Action=`deleteValue` If both `Name` and `Value` are omitted, the inner text of the element specified in `ElementPath` will

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be deleted. If `Name` is specified, the attribute named `Name` will be deleted from the node specified in `ElementPath`.

So, to carry out the modifications we planned, we need the following entries (note that we have to provide our own sequencing, this is important to ensure that the changes will be removed in the proper reverse order upon uninstallation):

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```
<Component Id='Settings' Guid='YOURGUID-574D-4A9  
A-A266-5B5EC2C022A4'>  
    <File Id='XmlSettings' Name='settings.xml' Dis  
kId='1' Source='settings.xml' Vital='yes' />  
    <util:XmlFile Id='XmlSettings1' File='[INSTALL  
DIR]settings.xml'  
        Action='createElement' Name='add' ElementPat  
h='//settings' Sequence='1' />  
    <util:XmlFile Id='XmlSettings2' File='[INSTALL  
DIR]settings.xml'  
        Action='setValue' Name='key' Value='a_key' E  
lementPath='//settings/add' Sequence='2' />  
    <util:XmlFile Id='XmlSettings3' File='[INSTALL  
DIR]settings.xml'  
        Action='setValue' Name='value' Value='a_valu  
e' ElementPath='//settings/add' Sequence='3' />  
    <util:XmlFile Id='XmlSettings4' File='[INSTALL  
DIR]settings.xml'  
        Action='setValue' Value='key_item' ElementPa  
th='//settings/add' Sequence='4' />  
    <util:XmlFile Id='XmlSettings5' File='[INSTALL  
DIR]settings.xml'  
        Action='createElement' Name='inside' Element  
Path='//settings/add' Sequence='5' />  
    <util:XmlFile Id='XmlSettings6' File='[INSTALL  
DIR]settings.xml'  
        Action='setValue' Value='inside_item' Elemen  
tPath='//settings/add/inside' Sequence='6' />  
</Component>
```

If there are several nodes of the same name in the XML file, we can use the usual XPath format of 'node[@attr="value"]' to specify which one we refer to. As `ElementPath` expects a formatted string, we have to

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escape the brackets with backslashes (`[\\[]` and `[\\]]`) to keep them from being evaluated as properties.

As this functionality resides in the standard utilities module, we have to link against that:

```
light.exe -ext WixUtilExtension -out Sample.msi  
Sample.wixobj
```

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COM+ Applications

The WiX toolset has a custom action library that allows the installer to create COM+ packages, add components to them and create and set roles.

When you build the installation package, you have to compile and link it against the appropriate WiX library. The candle and light command lines to do this are:

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```
candle -ext WixComPlusExtension Sample.wxs  
light -ext WixComPlusExtension Sample.wixobj
```

You also need to reference the COM+ schema in your WiX source as follows:

```
<?xml version="1.0" encoding="UTF-8"?>  
<Wix xmlns="http://schemas.microsoft.com/wix/2006/wi" xmlns:complus="http://schemas.microsoft.com/wix/ComPlusExtension">
```

To create a package (My COM+ Application) and add a standard COM DLL (MyCOM.dll) to the package:

```
<Component Id="MyCOM_dll" DiskId="1" Guid="YOURGUID-242F-4B82-BDC7-588E59E9F393">  
    <File Id="MyCOM_dll" Name="MyCOM.dll" Source="MyCOM.dll" KeyPath="yes" Vital="yes" />  
    <complus:ComPlusApplication Id="MyCOM" Name="My COM+ Application">  
        <complus:ComPlusAssembly Id="MyComPlusAssembly" Type="native" DllPath="#MyCOM_dll">  
            <complus:ComPlusComponent Id="MyCOM" CLSID="YOURCLSID-CA74-4DC7-BAEF-25AF03BC5F67" />  
        </complus:ComPlusAssembly>  
    </complus:ComPlusApplication>  
</Component>
```

To create a package (My COM+ Application) and add a .Net assembly (MydotNet.dll) that is not in the GAC to the package:

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```
<Component Id="MydotNet_dll" DiskId="1" Guid="Y0  
URGUID-242F-4B82-BDC7-588E59E9F393">  
    <File Id="MydotNet_dll" Name="MydotNet.dll" So  
urce="MydotNet.dll" KeyPath="yes" Assembly="no"  
/>  
    <complus:ComPlusApplication Id="MydotNet" Nam  
e="My COM+ Application">  
        <complus:ComPlusAssembly Id="MyComPlusAssemb  
ly" DllPath="[#MydotNet_dll]" TlbPath="[#MydotNe  
t_tlb]" Type=".net" RegisterInCommit="yes">  
            <complus:ComPlusComponent Id="CheckInterfa  
ce" CLSID="YOURCLSID-241E-4472-8C71-61A22BAF991  
4"/>  
        </complus:ComPlusAssembly>  
    </complus:ComPlusApplication>  
</Component>  
  
<Component Id="MydotNet_tlb" DiskId="1" Guid="Y0  
URGUID-242F-4B82-BDC7-588E59E9F394">  
    <File Id="MydotNet_tlb" Name="MydotNet.tlb" So  
urce="MydotNet.tlb" KeyPath="yes" />  
</Component>
```

To create a package (My COM+ Application) and add a .Net assembly (MydotNet.dll) that is in the GAC to the package:

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```
<Component Id="MydotNet_dll" DiskId="1" Guid="Y0  
URGUID-242F-4B82-BDC7-588E59E9F393">  
    <File Id="MydotNet_dll" Name="MydotNet.dll" So  
urce="MydotNet.dll" KeyPath="yes" Assembly=".ne  
t" />  
    <complus:ComPlusApplication Id="MydotNet" Name  
="My COM+ Application">  
        <complus:ComPlusAssembly Id="MyComPlusAssemb  
ly" TlbPath="[#MydotNet_tlb]" Type=".net" DllPat  
hFromGAC="yes" RegisterInCommit="yes">  
            <complus:ComPlusComponent Id="CheckInterfa  
ce" CLSID="YOURCLSID-241E-4472-8C71-61A22BAF991  
4"/>  
        </complus:ComPlusAssembly>  
    </complus:ComPlusApplication>  
</Component>  
  
<Component Id="MydotNet_tlb" DiskId="1" Guid="Y0  
URGUID-242F-4B82-BDC7-588E59E9F394">  
    <File Id="MydotNet_tlb" Name="MydotNet.tlb" So  
urce="MydotNet.tlb" KeyPath="yes" />  
</Component>
```

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Version by version

The `InstallerVersion` attribute of the `Package` tag describes which Installer version the installation package requires. In the tutorial, we have been using the value 100 (meaning version 1.0) because we wanted to show the lowest common denominator. The actual versions are shown in this table in connection with the corresponding Windows version:

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- **1.x: pre-XP:** Basic MSI support, 32-bit only
- **2.0: XP, 2000 Server SP3:** 64-bit support
- **3.0: XP SP2:** improved patching
- **3.1: XP SP3, 2003 Server SP2:** improved user interface
- **4.0: Vista, Server 2008:** UAC, restart manager
- **4.5: XP SP3, Vista and Server 2008 SP2:** multi-package transactions, embedded UI, embedded chainer, improved patching
- **5.0: Windows 7, 2008 Server R2:** permissions configuration, improved service control, improved UI, dual-mode per-user and per-machine packages

As a general rule, we suggest specifying up to version 3.1 unless a later version is really called for. This version of Windows Installer is supported back to Windows 2000.

There are more detailed changelogs ([http://msdn.microsoft.com/en-us/library/aa372796\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/aa372796(VS.85).aspx)) and descriptions ([http://msdn.microsoft.com/en-us/library/aa371185\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/aa371185(VS.85).aspx)) available. Those documents also note which packages are not automatically updated with Windows Update but are available as redistributable downloads.

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Creating a Database

To create an SQL database, we first need a user with the proper credentials. The user name and password are stored in properties, you can use any usual UI elements or custom actions to set them. Note that this is the same User tag we used to [create a new user account \(/docs/wix/v3/tutorial/com-expression-syntax-miscellanea/new-user-on-the-block\)](/docs/wix/v3/tutorial/com-expression-syntax-miscellanea/new-user-on-the-block) but it was used inside a Component tag

then. Outside any component, it will not create the user, it only will define the credentials for other operations to use. As the tags, as well as the SQL functionality, are present in extension modules, we have to mention them in the opening tag of the source file:

```
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'
      xmlns:util='http://schemas.microsoft.com/wix/UtilExtension'
      xmlns:sql='http://schemas.microsoft.com/wix/SqlExtension'>
```

Also, because they belong to their own namespace, we have to decorate them during use:

```
<util:User Id='SQLUser' Name='[SQLUSER]' Password='[SQLPASSWORD]' />
```

The creation of the database itself goes into a component, as usual. `SqlDatabase` refers to the previous `User` declaration, specifies the database name, server and instance. Not specifying `Server` will make it install on the SQL Server running on the target machine. Other attributes specify how to proceed in different situations. `ConfirmOverwrite` determines what to do if the database already exists and the `CreateOnInstall`, `CreateOnUninstall`, `DropOnInstall`, and `DropOnUninstall` attributes dictate the required behavior on install and uninstall.

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The nested `SqlScript` tag will determine what to do with the empty database just created. We can execute any valid SQL script here, residing in a separate file. The `BinaryKey` attribute will provide the link to the .sql script file. Other attributes will specify the behavior if an error occurs (`ContinueOnError`) or will determine when to execute the script (`ExecuteOnInstall`, `ExecuteOnUninstall`, `RollbackOnInstall`, `RollbackOnUninstall`). With more than one script present for execution, they can be sequenced using the `Sequence` attribute.

```
<Component Id='SqlComponent' Guid='YOURGUID-D8C7-4102-BA84-9702188FA316'>
    <sql:SqlDatabase Id='SqlDatabase' Database='Foobar' User='SQLUser' Server='[SQLSERVER]' CreateOnInstall='yes' DropOnUninstall='yes' ContinueOnError='yes'>
        <sql:SqlScript Id='CreateTable' BinaryKey='CreateTable' ExecuteOnInstall='yes' />
    </sql:SqlDatabase>
</Component>
```

All that remains is to include the .sql file:

```
<Binary Id='CreateTable' SourceFile='CreateTable.sql' />
```

The file it refers to will contain usual SQL commands to create a database table:

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```
CREATE TABLE Test (Value1 CHAR(50), Value2 INTEGER)
CREATE INDEX TestIndex ON Test (Value1)
```

When building the installation package, you have to link it against the appropriate WiX modules:

```
candle.exe -ext WixUtilExtension -ext WixSqlExtension SampleSQL.wxs
light.exe -ext WixUtilExtension -ext WixSqlExtension SampleSQL.wixobj
```

You can download the complete [SampleSQL \(/system/files/samples/SampleSQL.zip\)](#).

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User Interface Revisited

As we have already discussed in Lesson 2, WiX comes with its own standard user interface library. Although this library caters for most standard needs, a time might come when you might need to craft your own user interface. But even if you only want to customize and modify the standard one, you need to learn how WiX does it in the

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background. To accomplish this, we start again from scratch.

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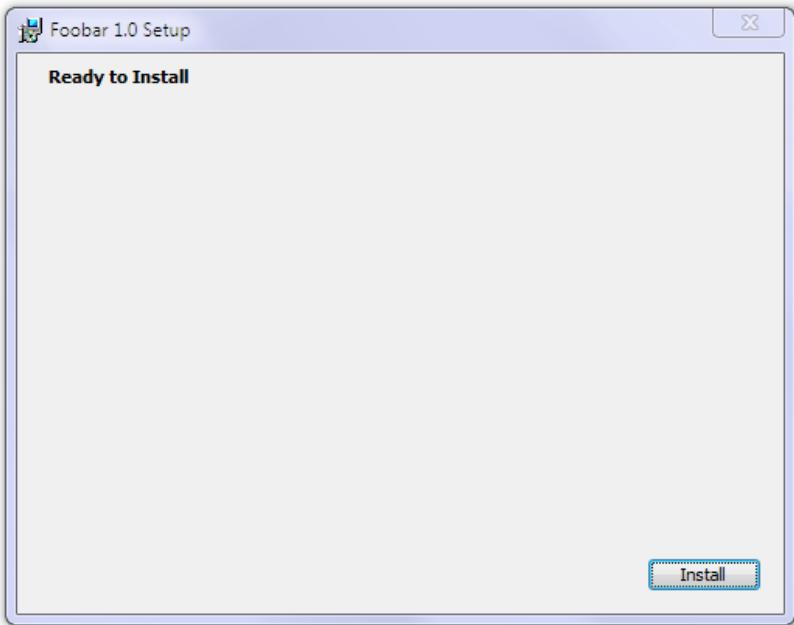
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A Single Dialog



We start with a single, simple interface---nothing but a title and a single button to start the installation with.

Dialogs must always have a unique identifier. The dialog size is standard because the wizard we use has a standard size. The `Title` is straightforward but note that here too, you can reference properties using the square bracket notation. Quite handy as you don't have to re-edit the whole UI part when you create an installer package for a new product. `ProductName` is automatically defined to denote the product name you have defined in the `Product` tag at the very beginning of the source file.

```
<Dialog Id="InstallDlg" Width="370" Height="270"  
Title="[ProductName] Setup" NoMinimize="yes">
```

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Everything we add to the dialog will be a control. A `Type` attribute describes the kind of control (`Billboard` , `Bitmap` , `CheckBox` , `ComboBox` , `DirectoryCombo` , `DirectoryList` , `Edit` , `GroupBox` , `Icon` , `Line` , `ListBox` , `ListView` , `MaskedEdit` , `PathEdit` , `ProgressBar` , `PushButton` , `RadioButtonGroup` , `ScrollableText` , `SelectionTree` , `Text` , `VolumeCostList` or `VolumeSelectCombo`). For simple text (called static text in usual Windows parlance because it doesn't do anything, you can't click on it, it is just there), we use the type `Text` . We specify position and dimensions.

Title text elements are marked `Transparent` , for the benefit of the general case. These texts overlay the banner bitmap at the top. As they are written in black over a white background now, transparency doesn't do any difference but if you would provide a full banner picture extending below the title text and colored text, it would make for nice visual effects. `NoPrefix` only controls whether ampersand characters are displayed verbatim or used as shortcut specifiers, as usual in the Windows GUI.

```
<Control Id="Title" Type="Text" X="15" Y="6" Width="200" Height="15" Transparent="yes" NoPrefix="yes">
    <Text>{\DlgTitleFont}Ready to Install</Text>
</Control>
```

You have two ways of specifying the text of the control: either the `Text` child tag inside the control or the `Text`

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attribute:

```
<Control Id="Title" Type="Text" X="15" Y="6" Width="200" Height="15" Transparent="yes" NoPrefix="yes"  
Text="{\DlgTitleFont}Ready to Install"/>
```

We can refer to font styles using `TextStyle` tags. We also need to include a standard property, `DefaultUIFont` and associate a font with it because the installer needs it to determine the default font.

```
<Property Id="DefaultUIFont">DlgFont8</Property>  
<TextStyle Id="DlgFont8" FaceName="Tahoma" Size="8" />  
<TextStyle Id="DlgTitleFont" FaceName="Tahoma" Size="8" Bold="yes" />
```

Our only active control will be a push button (of type `PushButton`). Again, we specify position and dimensions. As the only one, it will be our default button too (sensitive to pressing the Enter key). Active user interface elements that do something when the user activates them will also have a `Publish` tag nested inside to define what to do when the activation happens. There is a long list of possible standard events to select from, `EndDialog` is one of them). So, the action will now be `EndDialog` with a value of `Return`, meaning to dismiss the dialog the normal way, without any error to be signaled:

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```
<Control Id="Install" Type="PushButton" X="304"
Y="243" Width="56" Height="17" Default="yes" Tex
t="Install">
    <Publish Event="EndDialog" Value="Return" />
</Control>
```

So, we already have our dialog but we have to schedule it into the normal course of events. Go to the part just before the closing `UI` tag and make the following changes: clear `AdminUISequence` as we are not worrying about administrative install now.

`InstallUISequence` has already been mentioned but now it's time to discuss its interaction with `InstallExecuteSequence`.

The course of standard actions is broken into two at the middle, the `InstallValidate` action, which is responsible for the verification of available disk space and also for notifying the user if one or more files to be overwritten by the installation are currently in use. Actions up to `InstallValidate` (including various dialog boxes) are listed in `InstallUISequence` while those following this action can be found in `InstallExecuteSequence`. There are exceptions, though, to this rule. `InstallUISequence` is not consulted during an installation with basic UI or no UI at all, so `InstallExecuteSequence` has to be standalone even in this case. To this end, it duplicates some actions from the other table as well. If we check out our current sample with Orca, `InstallUISequence` will contain:

- ValidateProductID
- CostInitialize
- FileCost
- CostFinalize
- ExecuteAction

These are actions we already know, except for the last one. During installation, both tables will be consulted initially and the actions executed in order of their sequence number (as the duplicated actions have the same number in both tables, this won't create any ambiguity). `ExecuteAction` is scheduled to the point where all information collection necessary to begin the actual installation has already been completed. Execution then passes to `InstallExecuteSequence` to perform the actions responsible for the actual process of installation.

Consequently, we have to schedule our single dialog box after the last action in the preparation process, `CostFinalize` but still before `ExecuteAction`:

```
<InstallUISequence>
  <Show Dialog="InstallDlg" After="CostFinalize"
  />
</InstallUISequence>
```

Build this sample ([SampleCustomUI \(/system/files/samples/SampleCustomUI.zip\)](#)) and run it. You will be presented a dialog and when you press the Install button, our usual three files will be installed. Note that there will be no

progress dialog, just a silent install. Also, you can't cancel the installation, if you start it, you have to finish it.

Note that the built-in validator of WiX will emit ICE 20 warnings about some missing features of the standard user interface. Because the starting versions of our custom UI lesson are far from being a full standard interface, these warnings can be suppressed using a command line switch:

```
candle.exe SampleCustomUI1.wxs  
light.exe -sice:ICE20 SampleCustomUI1.wixobj
```

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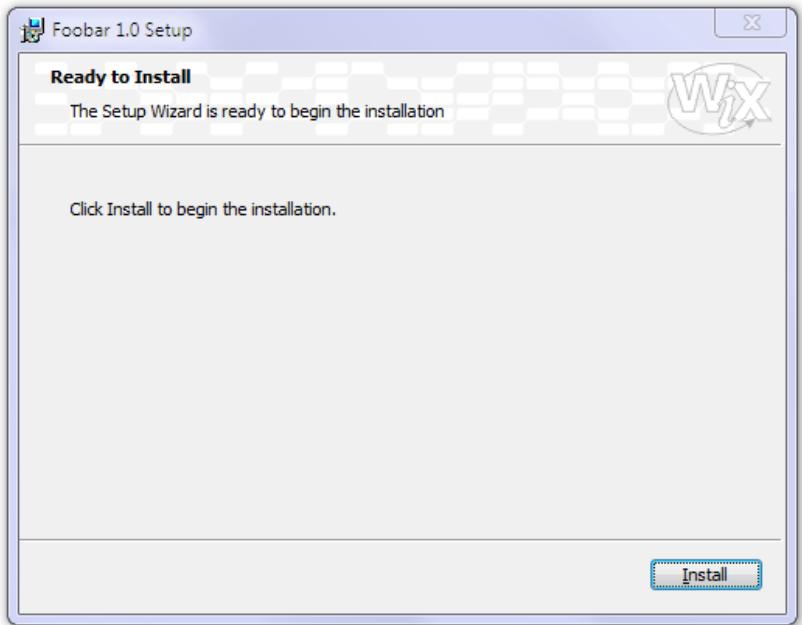
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Tuning Up

In our SampleCustomUI2, we stay with the same single dialog but tune it up a little bit.



```
<Dialog Id="InstallDlg" Width="370" Height="270"
Title="[ProductName] Setup" NoMinimize="yes">
```

This is only a small change: instead of specifying the button text directly, we use a property. This will make localization easier at a later stage:

```
<Control Id="Install" Type="PushButton" X="304"
Y="243" Width="56" Height="17"
Default="yes" Text="[ButtonText_Install]">
<Publish Event="EndDialog" Value="Return" />
</Control>
```

A simple banner bitmap at the top of the dialog. Note that we use a property to refer to the binary attachment.

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Although it is specified in the `Text` attribute, this is not a text but the `Id` of the bitmap stored in the package.

```
<Control Id="BannerBitmap" Type="Bitmap" X="0" Y="0" Width="370" Height="44" TabSkip="no" Text="BannerBitmap" />
```

Two text lines, one transparent over the banner bitmap and another one in the actual dialog work area:

```
<Control Id="Description" Type="Text" X="25" Y="23" Width="280" Height="15" Transparent="yes" NoPrefix="yes">
  <Text>The [Wizard] is ready to begin the installation</Text>
</Control>

<Control Id="Text" Type="Text" X="25" Y="70" Width="320" Height="20">
  <Text>Click Install to begin the installation.</Text>
</Control>
```

A horizontal line to mark the bottom of the dialog area---aesthetics, nothing else:

```
<Control Id="BottomLine" Type="Line" X="0" Y="234" Width="370" Height="0" />
```

Finally, the title and the embossed line just below the

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banner bitmap:

```
<Control Id="Title" Type="Text" X="15" Y="6" Width="200" Height="15"
    Transparent="yes" NoPrefix="yes">
    <Text>{\DlgTitleFont}Ready to Install</Text>
</Control>

<Control Id="BannerLine" Type="Line" X="0" Y="4
4" Width="370" Height="0" />
```

Let's not forget that we referenced a banner bitmap so we have to include it in the package:

```
<Binary Id="bannrbmp" SourceFile="Binary\Banner.
bmp" />
```

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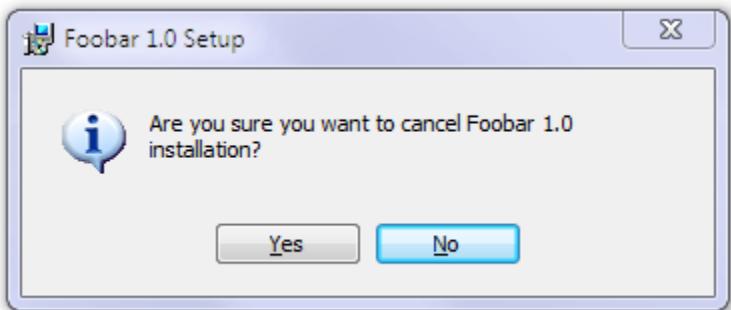
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Interactions

Building dialogs is rather simple (although there are many more control types we can stuff our pages with), it's making them interact that's really interesting. In SampleCustomUI3, we add a second dialog, allowing the user to cancel the installation process:



To achieve this, we need the dialog itself. It will have two push buttons but note the difference in terminology. A message box like this can have two outcomes, *cancelling* it and *okaying* it: going on with what it says. The question will be worded differently here: when we cancel the cancellation dialog, we vote for going on with the installation. Hence, we call our first, default button, with the text *No* our cancel button:

```
<Dialog Id="CancelDlg" Width="260" Height="85" Title="[ProductName] Setup" NoMinimize="yes">
  <Control Id="No" Type="PushButton" X="132" Y="57" Width="56" Height="17"
    Default="yes" Cancel="yes" Text="[ButtonText_No]">
    <Publish Event="EndDialog" Value="Return">1
  </Publish>
</Control>
```

If the user clicks on this button, we signal the `EndDialog` event with a value of `Return`. As its name implies, this simply dismisses the dialog and resumes the original operation. The `Publish` tag has a condition, the number 1

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that always evaluates to true (a zero would evaluate to false), thus, the event will be signaled unconditionally.

Our second button, with the text `Yes` will trigger the same `EndDialog` event but with a different value: `Exit`. This is used to abort the whole installation process:

```
<Control Id="Yes" Type="PushButton" X="72" Y="57" Width="56" Height="17" Text="[ButtonText_Yes]">
  <Publish Event="EndDialog" Value="Exit">1</Publish>
</Control>
```

The rest is now simple, text and icon. Don't forget to add the `Binary` tag to include the icon in the package:

```
<Control Id="Text" Type="Text" X="48" Y="15" Width="194" Height="30">
  <Text>Are you sure you want to cancel [ProductName] installation?</Text>
</Control>

<Control Id="Icon" Type="Icon" X="15" Y="15" Width="24" Height="24"
  ToolTip="Information icon" FixedSize="yes" IconSize="32" Text="[InfoIcon]" />
</Dialog>

<Binary Id="info" SourceFile="Binary\Info.ico" />
```

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We also need some modification in our `InstallDlg` dialog. We moved our `Install` button to the left to make room for the `Cancel` button. This one will fire a `SpawnDialog` event, specifying the name of the dialog to be launched. As already mentioned in the previous lesson, `SpawnDialog` starts a new child dialog without removing the current one and proceeds when the user dismisses this second dialog:

```
<Control Id="Cancel" Type="PushButton" X="304" Y="243" Width="56" Height="17"
    Cancel="yes" Text="[{ButtonText_Cancel}]">
    <Publish Event="SpawnDialog" Value="CancelDlg">1</Publish>
</Control>
```

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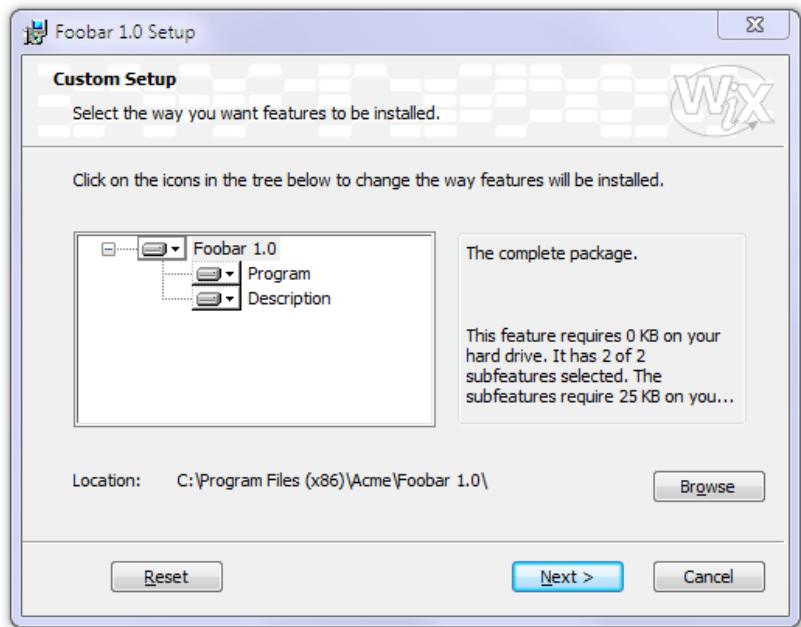
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Customizations Galore

Now we'll do something much more ambitious. We will allow the user to customize the setup, to decide which features to install and to tell the installer where to install the files to.



First of all, to reduce the complexity of our samples, we send all textual items into a separate fragment file `UI_Texts.wxs`. The actual texts come from the WiX source and list all possible entries eventually needed by our UI experiments. We will simply call it with a reference and use the following build process:

```
candle.exe SampleCustomUI4.wxs UI_Texts.wxs  
light.exe -out SampleCustomUI4.msi SampleCustomU  
I4.wixobj UI_Texts.wixobj
```

We start a new dialog that will offer the necessary controls---first of all, a tree view of the features. It will be quite simple because the controls of the `SelectionTree` type are not simple treeview controls but they are linked

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by the installer to the available features and their selection status:

```
<Dialog Id="CustomizeDlg" Width="370" Height="270" Title="[ProductName] Setup"
    NoMinimize="yes" TrackDiskSpace="yes">
    <Control Id="Tree" Type="SelectionTree" X="25" Y="85" Width="175" Height="95"
        Property="_BrowseProperty" Sunken="yes" TabSkip="no" Text="Tree of selections" />
```

The dialog will have several push buttons. `Browse` will be enabled by the installer automatically if we used the `ConfigurableDirectory` attribute in the `Feature` tag. There are several control events to be used in relation to selection trees, `SelectionBrowse` will launch the specified browse dialog so that the user can modify the path to install to. We'll return to this browse dialog in a short while:

```
<Control Id="Browse" Type="PushButton" X="304" Y="200" Width="56" Height="17"
    Text="[ButtonText_Browse]">
    <Publish Event="SelectionBrowse" Value="BrowseDlg">1</Publish>
</Control>
```

The `Reset` button uses a prefabricated event, called `Reset` to return all controls in the dialog to the status they were in when the dialog was created. This undoes all

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feature customizations made by the user.

This button not only sends event messages but makes itself a recipient for similar messages by *subscribing* to an event. `SelectionNoItems` will disable buttons that subscribe to it if the selection tree has no nodes:

```
<Control Id="Reset" Type="PushButton" X="42" Y="243" Width="56" Height="17"
    Text="[ButtonText_Reset]">
    <Publish Event="Reset" Value="0">1</Publish>
    <Subscribe Event="SelectionNoItems" Attribute="Enabled" />
</Control>
```

There will be other buttons and simple controls in the dialog that are already familiar to us. We don't detail them any more here, check out the source file for reference. What we check in detail is the box at the right of the dialog. A `Text` control will be used to display information about the item the user has currently selected in the selection tree. Although the control has an initial text (`Multiline description of the currently selected item`), this will not appear but will be replaced by the actual selection information. This happens because the control subscribes to the `SelectionDescription` event. As soon as there is a change in the selection, the installer will report the new description to any control subscribing to this event:

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```
<Control Id="Box" Type="GroupBox" X="210" Y="81"
Width="140" Height="98" />

<Control Id="ItemDescription" Type="Text" X="21
5" Y="90" Width="131" Height="30">
    <Text>Multiline description of the currently
selected item.</Text>
    <Subscribe Event="SelectionDescription" Attr
ibute="Text" />
</Control>
```

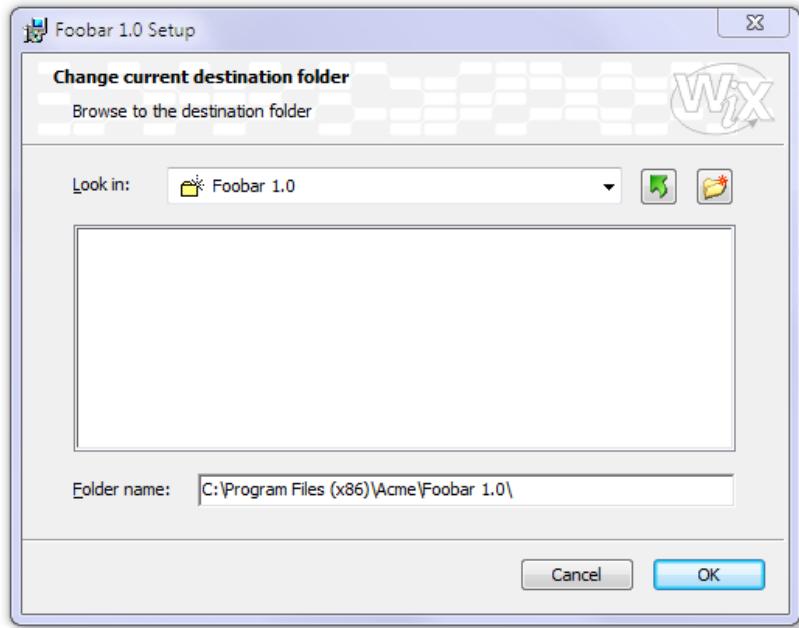
The same happens to the other controls. `ItemSize` subscribes to receive the size of the current selection, `Location` to learn the path selected by the user. The last two also check whether there is a path to be set. If there is none, both the label and the path display will be suppressed. This is what makes the path selection disappear when you travel the selection tree and go to the subnodes instead of the main one:

```
<Control Id="ItemSize" Type="Text" X="215" Y="130" Width="131" Height="45">
    <Text>The size of the currently selected item.</Text>
    <Subscribe Event="SelectionSize" Attribute="Text" />
</Control>

<Control Id="Location" Type="Text" X="75" Y="200" Width="215" Height="20">
    <Text><The selections path></Text>
    <Subscribe Event="SelectionPath" Attribute="Text" />
    <Subscribe Event="SelectionPathOn" Attribute="Visible" />
</Control>

<Control Id="LocationLabel" Type="Text" X="25" Y="200" Width="50" Height="10" Text="Location:>
    <Subscribe Event="SelectionPathOn" Attribute="Visible" />
</Control>
```

We told the installer to call our `BrowseDlg` dialog when the user clicks on the `Browse` button, so we have to provide this dialog as well:



If you go back and check out the previous `Dialog` tag, you'll see a `Property` reference. We specify it here, in our path edit control again---this is what creates the link between the dialog asking for the path and this one providing it. Setting `Indirect` tells the installer to modify not the property directly mentioned (`_BrowseProperty`) but the property that this property holds the name of.

```
<Dialog Id="BrowseDlg" Width="370" Height="270"
    Title="[ProductName] Setup" NoMinimize="yes">
    <Control Id="PathEdit" Type="PathEdit" X="84"
        Y="202" Width="261" Height="18"
        Property="_BrowseProperty" Indirect="yes" />
```

When the user is satisfied with the newly selected path

and hits OK, the property value will be set by the `SetTargetPath` event. The installer also checks whether the selected path is valid. If the user decides not to set the path after all, we use the `Reset` event to return everything to the initial settings and will then close the dialog without actually setting the path:

```
<Control Id="OK" Type="PushButton" X="304" Y="243" Width="56" Height="17"
    Default="yes" Text="[ButtonText_OK]">
    <Publish Event="SetTargetPath" Value="[_BrowseProperty]">1</Publish>
    <Publish Event="EndDialog" Value="Return">1
  </Publish>
</Control>

<Control Id="Cancel" Type="PushButton" X="240" Y="243" Width="56" Height="17"
    Cancel="yes" Text="[ButtonText_Cancel]">
    <Publish Event="Reset" Value="0">1</Publish>
    <Publish Event="EndDialog" Value="Return">1
  </Publish>
</Control>
```

A `DirectoryCombo` control displays the path stored in the referenced property in a hierarchical, tree-like view.

```
<Control Id="ComboLabel" Type="Text" X="25" Y="5  
8" Width="44" Height="10"  
TabSkip="no" Text="&Look in:" />  
  
<Control Id="DirectoryCombo" Type="DirectoryComb  
o" X="70" Y="55" Width="220" Height="80"  
Property="_BrowseProperty" Indirect="yes" Fi  
xed="yes" Remote="yes">  
    <Subscribe Event="IgnoreChange" Attribute="I  
gnoreChange" />  
</Control>
```

Two buttons with icons will be associated with the directory selection controls and will send the appropriate events when pressed:

```
<Control Id="Up" Type="PushButton" X="298" Y="5  
5" Width="19" Height="19"  
ToolTip="Up One Level" Icon="yes" FixedSize  
="yes" IconSize="16" Text="Up">  
    <Publish Event="DirectoryListUp" Value="0">1  
</Publish>  
</Control>  
  
<Control Id="NewFolder" Type="PushButton" X="32  
5" Y="55" Width="19" Height="19"  
ToolTip="Create A New Folder" Icon="yes" Fix  
edSize="yes" IconSize="16" Text="New">  
    <Publish Event="DirectoryListNew" Value="0">1</Publish>  
</Control>
```

And finally, a large `DirectoryList` in the middle, linked to the other directory control elements by the fact that it references the same property. All these controls will interact automatically as expected:

```
<Control Id="DirectoryList" Type="DirectoryList"
X="25" Y="83" Width="320" Height="110"
Property="_BrowseProperty" Sunken="yes" Indirect="yes" TabSkip="no" />
```

The rest of the dialog is of no particular interest any more, check out the source if you feel the need.

There are only a couple of minor things left to do before we can build our `SampleCustomUI4`. We modify our `InstallDlg` dialog by adding a `Back` button so that the user can go back to the customization dialog:

```
<Control Id="Back" Type="PushButton" X="180" Y="243" Width="56" Height="17"
Text="[ButtonText_Back]">
<Publish Event="NewDialog" Value="CustomizeDlg">1</Publish>
</Control>
```

We have to modify the scheduling of our first dialog to make it appear in a phase where the customization should take place. Although there are alternatives to do that, we now schedule to the `MigrateFeatureStates` event. This event only happens during upgrading and installation, not

during product removal or maintenance, right when it reads the feature selection of the previously installed product (if such a product exists). So, it will be the perfect place to show our customization dialog with the appropriate feature selection even in installation packages much more complicated than our current sample:

```
<InstallUISequence>
    <Show Dialog="CustomizeDlg" After="MigrateFeat
ureStates">NOT Installed</Show>
</InstallUISequence>
```

And finally, we don't forget to include the two new icons we needed in the browse dialog:

```
<Binary Id="Up" SourceFile="Binary\Up.ico" />
<Binary Id="New" SourceFile="Binary\New.ico" />
```

Customizing Customizations

If we need to select the features to be installed automatically or based on other conditions, or maybe we want to create a completely new interface for the user to select them (for instance, checkboxes instead of SelectionTree), we can link the following events to the appropriate control (the Next button, for instance) to enable or disable the installation of a given feature:

```
<Publish Event="AddLocal" Value="FeatureId">...c  
ondition...</Publish>  
<Publish Event="Remove" Value="FeatureId">...con  
dition...</Publish>
```

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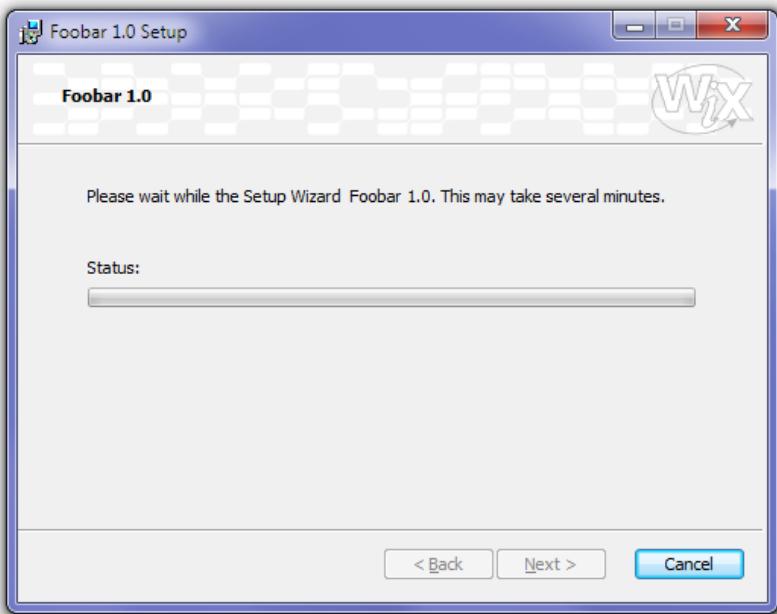
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Is This Progress?

Something still missing from our growing user interface is
a page showing how the installation process progresses.



We define this dialog to be *modeless* because we need the control to return to the installer. This will in turn send the dialog progress messages to be processed.

```
<Dialog Id="ProgressDlg" Width="370" Height="270" Title="[ProductName] Setup" Modeless="yes">
```

The `Back` and `Next` buttons will be disabled by default---there's no reason to keep them active, the user can't use them, anyway. If necessary, `Cancel` can be used to abort the installation:

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```
<Control Id="Cancel" Type="PushButton" X="304" Y="243" Width="56" Height="17"
    Default="yes" Cancel="yes" Text="[ButtonText_Cancel]">
    <Publish Event="SpawnDialog" Value="CancelDlg">1</Publish>
</Control>
<Control Id="BannerBitmap" Type="Bitmap" X="0" Y="0" Width="370" Height="44"
    TabSkip="no" Text="[BannerBitmap]" />
<Control Id="Back" Type="PushButton" X="180" Y="243" Width="56" Height="17"
    Disabled="yes" Text="[ButtonText_Back]" />
<Control Id="Next" Type="PushButton" X="236" Y="243" Width="56" Height="17"
    Disabled="yes" Text="[ButtonText_Next]" />
```

The text control just above the progress bar subscribes to the `ActionText` event, thus the installer keeps publishing the name of the current installation action to it:

```
<Control Id="ActionText" Type="Text" X="70" Y="100" Width="265" Height="10">
    <Subscribe Event="ActionText" Attribute="Text" />
</Control>
```

If you are not satisfied with a description of the major steps but would like to see the details of the individual files as they are deployed, you can also use the `ActionData` event instead:

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```
<Control Id="ActionData" Type="Text" X="70" Y="100" Width="265" Height="30">
    <Subscribe Event="ActionData" Attribute="Text" />
</Control>
```

In addition to some uninteresting controls, we finally have the workhorse of this dialog, a control of `ProgressBar` type. Just like with `SelectionTree`, the control provided by the installer is not just a generic progress bar but one linked directly to the installation process. By subscribing to the `SetProgress` event with an attribute `Progress` the installer will keep sending progress messages for display. `ProgressBlocks=yes` calls for the newer type progress bar with blocks. Setting it to `no` will revert to the old-style continuous bar from the Windows 95 era:

```
<Control Id="ProgressBar" Type="ProgressBar" X="35" Y="115" Width="300" Height="10"
    ProgressBlocks="yes" Text="Progress done">
    <Subscribe Event="SetProgress" Attribute="Progress" />
</Control>

<Control Id="StatusLabel" Type="Text" X="35" Y="100" Width="35" Height="10"
    Text="Status:" />
```

To integrate our progress page with the rest of the installation package, we only have to modify our `InstallDlg` dialog to call this dialog. The rest will be

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done automagically:

```
<Dialog Id="InstallDlg" Width="370" Height="270"
    Title="[ProductName] Setup" NoMinimize="yes">
    <Control Id="Install" Type="PushButton" X="23
        6" Y="243" Width="56" Height="17"
        Default="yes" Text="[ButtonText_Install]">
        <Publish Event="NewDialog" Value="ProgressDl
        g" />
    </Control>
```

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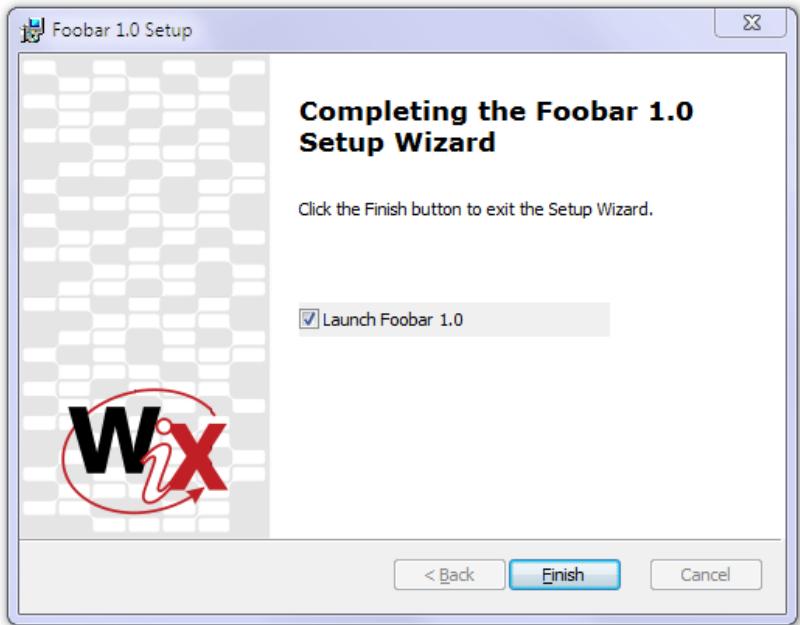
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Well Done

There is only one thing missing, a way to launch the application after the installation. This will also show us how to use a checkbox and make decisions depending on its state.



The newly added dialog looks like this:

```
<Dialog Id="ExitDlg" Width="370" Height="270" Title="[ProductName] Setup" NoMinimize="yes">
```

The **Finish** button will have two tasks to carry out: first, to dismiss the dialog itself (and with this, to end the installation package itself) and second, to launch the application if the user chose to do so:

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```
<Control Id="Finish" Type="PushButton" X="236" Y="243" Width="56" Height="17"
    Default="yes" Cancel="yes" Text="[ButtonText _Finish]">
    <Publish Event="EndDialog" Value="Return">1
    </Publish>
    <Publish Event='DoAction' Value='LaunchFile'>(NOT Installed) AND (LAUNCHPRODUCT = 1)</Publish>
</Control>
```

The checkbox control in the dialog box has both its initial setting (CheckBoxValue) and an associated property (LAUNCHPRODUCT) that will be used to read its state:

```
<Control Id="Launch" Type="CheckBox" X="135" Y="120" Width="150" Height="17"
    Property='LAUNCHPRODUCT' CheckBoxValue='1'>
    <Text>Launch [ProductName]</Text>
</Control>
```

The action published by the Finish button is an already familiar custom action. Don't forget the Return attribute to make sure the installer can close while the application stays running:

```
<CustomAction Id='LaunchFile' FileKey='FoobarEXE'
    ' ExeCommand=' ' Return="asyncNoWait" />
```

The Exit dialog will be scheduled upon successful

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□ Is This Progress? (</docs/wix/v3/tutorial/user-interface-revisited/is-this-progress/>)

completion (see the next section for details):

```
<InstallUISequence>
    <Show Dialog="ExitDlg" OnExit="success" />
</InstallUISequence>
```

Checkboxes and properties are linked but only when events occur, when the user sets or clears them. Initially, without user interaction, nothing makes the property receive the default value we've set in the `Control` tag.

We have to make sure we initialize the property ourselves:

```
<Property Id="LAUNCHPRODUCT">1</Property>
```

Before you build the SampleCustomUI6, make sure you replace the dummy .exe file with something that will actually run.

And a common complaint: no, the checkbox can't have a transparent background. If you have a bitmap in the background, it will be ugly, just like in our example above. The only workaround is to reduce the width of the checkbox to the actual box itself and to place an additional static text (these can be made transparent) adjacent to it.

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/tutorial/user-interface-revisited/is-this-progress/)

▶ Well Done (/docs/wix/v3/tutorial/user-interface-revisited/well-done/)

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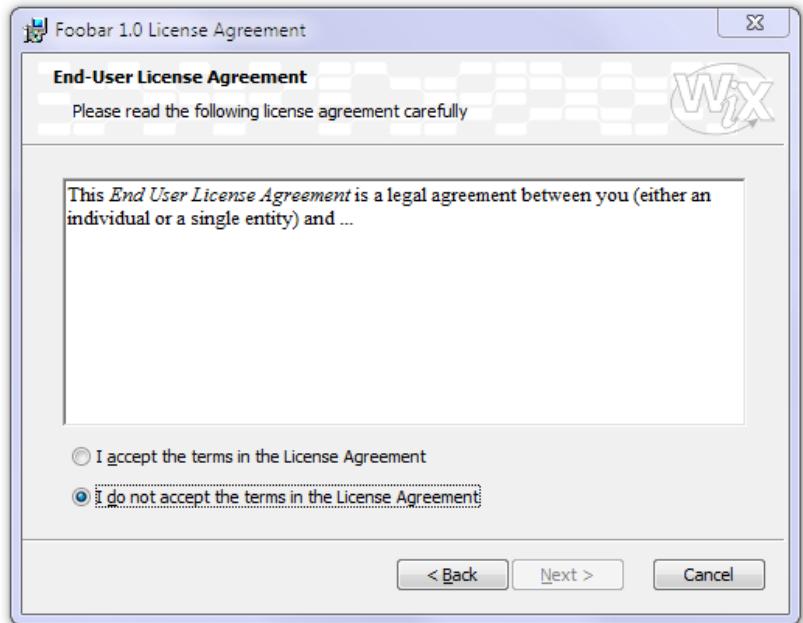
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/ [User Interface Revisited \(/docs/wix/v3/tutorial/user-interface-revisited/\)](/docs/wix/v3/tutorial/user-interface-revisited/) / Legalese

Legalese

There are a few other niceties left, like a license agreement page:



```
<Dialog Id="LicenseAgreementDlg" Width="370" Height="270"
        Title="[ProductName] License Agreement" NoMinimize="yes">
```

For a radio button group, we'll have a separate description later in the source, the link is established by the `Property` attribute:

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```
<Control Id="Buttons" Type="RadioButtonGroup"
  X="20" Y="187" Width="330" Height="40" Property="IAgree" />

<Control Id="Back" Type="PushButton" X="180" Y="243" Width="56" Height="17"
  Text="[ButtonText_Back]">
  <Publish Event="NewDialog" Value="WelcomeDlg">
  1</Publish>
</Control>

<Control Id="Next" Type="PushButton" X="236" Y="243" Width="56" Height="17"
  Default="yes" Text="[ButtonText_Next]">
```

The selection of the next dialog is a bit trickier now. In some installations, we don't want to ask for the user name, company name and registration key. It would also be possible to modify the UI accordingly (simply not to call that page in the sequence of pages) but this solution is much more elegant. Somewhere among the properties we have one called `ShowUserRegistrationDlg`. If we set it to one, the User Registration page will be shown. If set to zero, this page will be skipped. This means two `NewDialog` events, one for each possible case:

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```
<Publish Event="NewDialog" Value="UserRegistrationDlg">
    <![CDATA[IAgree = "Yes" AND ShowUserRegistrationDlg = 1]]>
</Publish>

<Publish Event="NewDialog" Value="SetupTypeDlg">
    <![CDATA[IAgree = "Yes" AND ShowUserRegistrationDlg <> 1]]>
</Publish>
```

SpawnDialog and SpawnWaitDialog events don't replace the previous page but start a new, child dialog box. The first will wait for user interaction to be dismissed but the second will only be visible until the conditional expression remains false. In our case, it is a wait dialog only visible while the installer is calculating the disk requirement. For a small installation package like our sample, this takes no time at all, so you aren't likely to have the chance of seeing this dialog in action. However, let's have it there just in case. CostingComplete is a predefined property that is set to 1 when the disk requirement calculations are finished.

```
<Publish Event="SpawnWaitDialog" Value="WaitForCostingDlg">
    CostingComplete = 1
</Publish>
```

And, finally, the well known nuisance: the Next button will

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stay disabled until the user has signaled their acceptance of the license agreement. We already used `Condition` tags at the upper level (launch conditions to determine whether the whole installation process should run) or inside `Feature` tags (to conditionally disable the installation of various features). This is their third use, inside `Control` tags. Using their `Action` attribute, they can *disable*, *enable*, *hide* or *show* the control, or to revert it to its *default* state), if the condition inside the tag evaluates to true:

```
<Condition Action="disable">
    <![CDATA[IAgree <> "Yes"]]>
</Condition>

<Condition Action="enable">
    IAgree = "Yes"
</Condition>
```

The following parts are already familiar:

```
<Control Id="Cancel" Type="PushButton" X="304" Y="243" Width="56" Height="17"
    Cancel="yes" Text="[ButtonText_Cancel]">
    <Publish Event="SpawnDialog" Value="CancelDlg"
    >1</Publish>
</Control>

<Control Id="BannerBitmap" Type="Bitmap" X="0" Y="0" Width="370" Height="44"
    TabSkip="no" Text="[BannerBitmap]" />
```

The text of the license agreement comes next. We open up a sunken text with scrollable contents. The actual text comes into the inner `Text` tag. You can use RTF-style text here, so the best idea is to author your license agreement in a word processor and export it to RTF (Wordpad is probably the best word processor for this purpose, more sophisticated ones might create much more verbose RTF files; even if you use those, consider re-saving the final version from Wordpad):

```
<Control Id="AgreementText" Type="ScrollableText" X="20" Y="60" Width="330" Height="120"
    Sunken="yes" TabSkip="no">
    <Text SourceFile="Binary\License.rtf" />
</Control>
```

You could also specify the agreement text right here in the source file but the previous solution seems much easier to maintain:

```
<Text>{\rtf1\ansi\ansicpg1252\deff0\deftab720
  {\fonttbl{\f0\froman\fprq2 Times New Roma
n;}}
  {\colortbl\red0\green0\blue0;}
  \deflang1033\horzdoc{\*\fchars }{\*\lchars }
  \pard\plain\f0\fs20
  This End User License Agreement is a legal a
greement between you
  (either an individual or a single entity) an
d ...
}
```

And the remaining part is really simple and deserves no detailed description. A few title lines here, a horizontal line there make up the rest of the dialog.

```
<Control Id="Description" Type="Text" X="25" Y="
23" Width="280" Height="15"
  Transparent="yes" NoPrefix="yes">
  <Text>Please read the following license agreem
ent carefully</Text>
</Control>
<Control Id="BottomLine" Type="Line" X="0" Y="23
4" Width="370" Height="0" />
<Control Id="Title" Type="Text" X="15" Y="6" Wid
th="200" Height="15"
  Transparent="yes" NoPrefix="yes">
  <Text>{\DlgTitleFont}End-User License Agreeemen
t</Text>
</Control>
<Control Id="BannerLine" Type="Line" X="0" Y="4
4" Width="374" Height="0" />
```

We still have a little debt to take care of. In the first control of the dialog, we referred to a radio button group description and left it pending. So, here it is. Note the property replacement in the `Text` attribute, this is how you can define font, size and color for your texts:

```
<RadioButtonGroup Property="IAgree">
    <RadioButton Text="{\DlgFont8}I &accept the
terms in the License Agreement"
        Value="Yes" X="5" Y="0" Width="250" Heig
ht="15" />
    <RadioButton Text="{\DlgFont8}I &do not acce
pt the terms in the License Agreement"
        Value="No" X="5" Y="20" Width="250" Heig
ht="15" />
</RadioButtonGroup>
```

But where these font specifiers come from, you might ask? OK, here they are. A nice, centralized way to specify various text styles and simply refer to them from everywhere throughout the user interface. For color, you can use the `Red`, `Green` and `Blue` attributes (a value between 0 and 255 for each), for additional decoration, `Bold`, `Italic`, `Underline` and `Strike`:

```
<TextStyle Id="DlgFont8" FaceName="Tahoma" Size="8" />
<TextStyle Id="DlgTitleFont" FaceName="Tahoma" Size="8" Bold="yes" />
<TextStyle Id="VerdanaBold13" FaceName="Verdana" Size="13" Bold="yes" />
```

We end our source file with the properties---basically, our variables with their initialization values. Some are used as shorthand notation for user interface element texts, you need to localize them as well. Take care of the ampersand and angle bracket characters: you either wrap the whole value into a CDATA wrapper or you have to use XML entities for these tricky characters (compare the values of `ButtonText_Next` and `ButtonText_Back`):

```
<Property Id="ALLUSERS">2</Property>
<Property Id="ROOTDRIVE"><![CDATA[C:\]]></Property>
<Property Id="Setup">Setup</Property>
<Property Id="ButtonText_Next">&Next &gt;</Property>
<Property Id="ButtonText_Back"><![CDATA[< &Back]]></Property>
```

We had files coming with us in the installation package we don't want to install with our product but are needed for the user interface: bitmaps and icons. We mention them at the end of the source file. We've referred to them earlier using their `Id` identifier but now we specify the actual file

names. These files will be placed into the .msi rather than the .cab file, even if we ask for a separate cabinet:

```
<Binary Id="Up" SourceFile="Binary\Up.ico" />
<Binary Id="New" SourceFile="Binary\New.ico" />
<Binary Id="custicon" SourceFile="Binary\Custom.
ico" />
<Binary Id="repairic" SourceFile="Binary\Repair.
ico" />
<Binary Id="exclamic" SourceFile="Binary\Exclam.
ico" />
<Binary Id="removico" SourceFile="Binary\Remove.
ico" />
<Binary Id="completi" SourceFile="Binary\Complet
e.ico" />
<Binary Id="insticon" SourceFile="Binary\Typica
l.ico" />
<Binary Id="info" SourceFile="Binary\Info.ico" /
>
<Binary Id="bannrbmp" SourceFile="Binary\Banner.
bmp" />
<Binary Id="dlg bmp" SourceFile="Binary\Dialog.bm
p" />
<Icon Id="Foobar10.exe" SourceFile="FoobarAppl1
0.exe" />
```

If you want to change the bitmaps or icons, just do so in the Binary directory. The front page bitmap (named `Dialog.bmp` here) is a 503 by 314 pixel BMP while the top banner bitmap has 500 by 63 pixels. But note that Windows Installer might stretch or shrink these bitmaps if the system font and display resolution settings of the user ask for a scaling of the whole interface. To avoid ugly

scaling artefacts, make sure you use appropriate bitmaps. Avoid thin lines supposed to look uniform across the picture, never incorporate text into the bitmaps (letters in logos are OK but small text meant to be read is not). And, above all, avoid dithered areas and checkered backgrounds, those might look very awkward when scaled. To get an idea, experiment with various scaling factors in your picture editor, making sure you turn off sophisticated algorithms like bicubic sampling; Windows will only use plain stretching and shrinking.

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Out of Order

There are a few dialog boxes that don't fit into the normal sequence of wizard pages but represent errors or similar out-of-sequence conditions. We can specify them using the `OnExit` attribute in the `Show` tag used for scheduling. The value can be *success*, *cancel*, *error* or *suspend*.

```
<InstallUISequence>
  <Show Dialog="FatalError" OnExit="error" />
  <Show Dialog="UserExit" OnExit="cancel" />
  <Show Dialog="ExitDialog" OnExit="success" />
  ...
</InstallUISequence>
```

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↳ Up (</docs/wix/v3/tutorial/user-interface-revisited/>)

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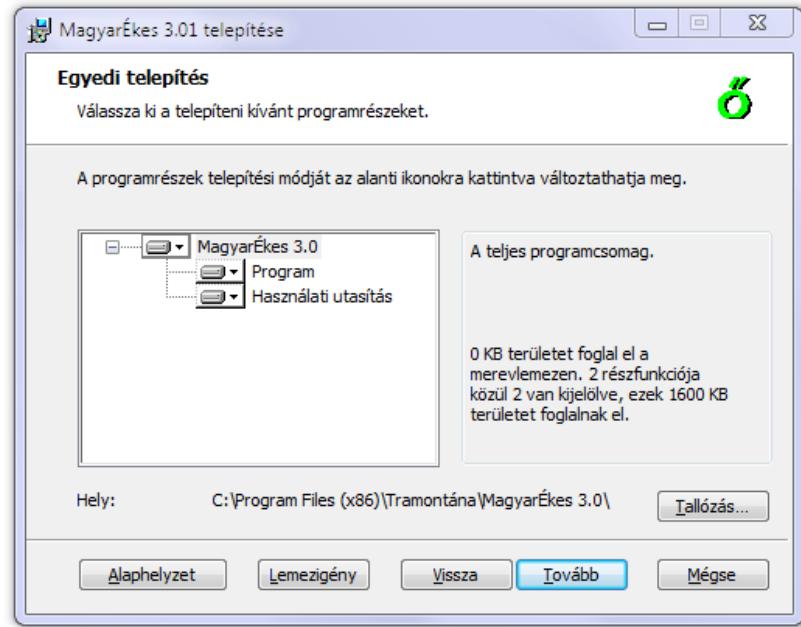
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Dontcha Speak English?



Installation packages have a large amount of text visible to the user: dialog text, informative or error messages. We moved them out into a separate fragment. To localize the installer, we could simply create parallel copies of this file translated to other languages. However, WiX offers an even better approach to localization that allows the systematic collection of all localizable strings and their replacement as late as during the linking phase. For each textual data in your source (including filenames), you can use preprocessor style references:

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```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'>

    <Product Name='Foobar 1.0' Id='YOURGUID-86C7-4
D14-AEC0-86416A69ABDE'
        Language='!(loc.LANG)' Codepage='1252' Versi
on='1.0.0' Manufacturer='Acme Ltd.'>

        <Package Id='*' Keywords='!(loc.Keywords)'
            Description='!(loc.Description)' Comments=
'!(loc.Comments)'
            InstallerVersion='100' Languages='1033' Co
mpressed='yes' SummaryCodepage='1252' />
```

The actual meaning of all these variables will be listed in a localization file with an extension of .wxl:

```
<?xml version="1.0" encoding="utf-8"?>
<WixLocalization Culture="en-us" xmlns="http://s
chemas.microsoft.com/wix/2006/localization">
    <String Id="LANG" Overridable="yes">1033</Stri
ng>
    <String Id="Keywords" Overridable="yes">Instal
ler</String>
    <String Id="Description" Overridable="yes">Acm
e's Foobar 1.0 Installer</String>
    <String Id="Comments" Overridable="yes">Foobar
is a registered trademark of Acme Ltd.</String>
</WixLocalization>
```

To compile the package with a specific language file, you

- ▶ Events and Actions (</docs/wix/v3/tutorial/events-and-actions/>)
- ▶ Upgrades and Modularization (</docs/wix/v3/tutorial/upgrades-and-modularization/>)
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 - Is This Progress? (</docs/wix/v3/tutorial/user-interface-revisited/is-this-progress/>)

simply pass its name to the WiX linker:

```
candle.exe Sample.wxs  
light.exe Sample.wixobj -loc Language.wxl
```

This concludes our user interface tour. We examined most of the controls provided by the installer. For additional details and possible attributes of the controls, consult the WiX and MSDN documentations. Armed with this knowledge, you can analyze the full interface library of the toolset (remember, it is open source). Although it has quite a few additional pages, their structure and interaction is just the same.

◀ [Out of Order \(/docs/wix/v3/tutorial/user-interface-revisited/out-of-order/\)](/docs/wix/v3/tutorial/user-interface-revisited/out-of-order/)
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□ [Well Done \(/docs/wix/v3/tutorial/user-interface-revisited/well-done/\)](/docs/wix/v3/tutorial/user-interface-revisited/well-done/)

□ [Legalese \(/docs/wix/v3/tutorial/user-interface-revisited/legalese/\)](/docs/wix/v3/tutorial/user-interface-revisited/legalese/)

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□ [Dontcha Speak English? \(/docs/wix/v3/tutorial/user-interface-revisited/dontcha-speak-english/\)](/docs/wix/v3/tutorial/user-interface-revisited/dontcha-speak-english/)

▶ [Transforms \(/docs/wix/v3/tutorial/transforms/\)](/docs/wix/v3/tutorial/transforms/)

▶ [Standard Libraries \(/docs/wix/v3/tutorial/standard-libraries/\)](/docs/wix/v3/tutorial/standard-libraries/)

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Transforms

Transforms are used to change one installer into another. A transform applied to an already existing installer can alter any of the tables inside, modifying the behavior of the installer accordingly. One thing a transform cannot do is to modify the files embedded in the package.

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/ Morphing Installers

Morphing Installers

One interesting reason to use transforms is to modify the user interface strings to another language. As we have already discussed earlier, WiX allows the WixUI interface languages to be localized. Using that, we could provide installers in various languages. But if we need more than one language, this simpler solution only allows us to create parallel installers, all of them in their own language

all right but storing all files to be deployed several times.

Transforms can help us in this case. We can start with our basic installer (this could be English or anything else). Each language we add will practically be an on-the-fly patch, called by Windows Installer before the first page appears, to translate the UI strings to a specific language. Thus, all languages will share the same installation package, the files to be installed only appearing once, and each new language will only add a small amount to the package size.

We can start our installation with a small bootstrapper. The bootstrapper can list the available languages, maybe defaulting to the language of the operating system it is running on but allowing the user to chose any language. When finished, the bootstrapper can launch the actual installation specifying which transform to apply.

To create such a multi-language installer, there is surprisingly little to change:

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```
<?xml version='1.0' encoding='windows-1252'?>
<Wix xmlns='http://schemas.microsoft.com/wix/2006/wi'>

    <Product Name='Foobar 1.0' Id='YOURGUID-86C7-4D14-AEC0-86416A69ABDE' UpgradeCode='YOURGUID-7349-453F-94F6-BCB5110BA4FD'
        Language='1033' Codepage='${var.codepage}' Version='1.0.0' Manufacturer='Acme Ltd.'>

        <Package Id='*' Keywords='Installer' Description="Acme's Foobar 1.0 Installer"
            Comments='Foobar is a registered trademark of Acme Ltd.' Manufacturer='Acme Ltd.'
            InstallerVersion='100' Languages='1033' Compressed='yes' SummaryCodepage='${var.codepage}' />

        ...
    </Wix>
```

As the first step, we will build these separate localized installers, much like before but each file should have the appropriate codepage specified, as shown in the table of supported languages:

- ▶ [Events and Actions \(/docs/wix/v3/tutorial/events-and-actions/\)](#)
- ▶ [Upgrades and Modularization \(/docs/wix/v3/tutorial/upgrades-and-modularization/\)](#)
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```
candle.exe SampleMulti.wxs -dcodepage=1252  
light.exe -ext WixUIExtension -cultures:en-us -o  
ut SampleMulti.msi SampleMulti.wixobj  
  
candle.exe SampleMulti.wxs -dcodepage=1250  
light.exe -ext WixUIExtension -cultures:hu-hu -o  
ut Sample_Hu-hu.msi SampleMulti.wixobj  
  
candle.exe SampleMulti.wxs -dcodepage=1252  
light.exe -ext WixUIExtension -cultures:fr-fr -o  
ut Sample_Fr-fr.msi SampleMulti.wixobj
```

Then WiX's transform tool, Torch, compares each localized installer to the base one (SampleMulti.msi) and creates an .mst transform file in turn comprising the differences between the two:

```
torch.exe -p -t language SampleMulti.msi Sample_  
Hu-hu.msi -out hu-hu.mst  
torch.exe -p -t language SampleMulti.msi Sample_  
Fr-fr.msi -out fr-fr.mst
```

Our bootstrap installer can then call the base installer package with the appropriate language package specified:

```
msiexec /i SampleMulti.msi TRANSFORMS="fr-fr.ms  
t"
```

Apart from the need for the bootstrapper, we also need to

distribute the transform files separately. A better approach (not currently supported by WiX but available with the [EmbedTransform tool \(/system/files/samples /EmbedTransform.zip\)](#)) is to embed the transforms into the original package:

```
EmbedTransform.exe SampleMulti.msi hu-hu.mst  
EmbedTransform.exe SampleMulti.msi fr-fr.mst
```

The only difference in its use is that a colon preceding the name instructs Windows Installer to look for the transform file inside the package:

```
msiexec /i SampleMulti.msi TRANSFORMS=":fr-fr.ms  
t"
```

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Standard Libraries

There are a few additional libraries bundled with WiX helping us, installer developers to accomplish common tasks. We will examine them in detail but let's start with a simple sample first.

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</standard-libraries/custom-actions-and-user-interface/>

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Custom Actions and User Interface

Our [SampleListbox \(/system/files/samples
/SampleListbox.zip\)](/system/files/samples) demonstrates how a custom action can collect data that is to be displayed in the user interface. We will use the WcaUtil custom action library bundled with WiX to help us accomplish this. This library contains many convenience functions that make it easier

to write custom actions in C++. These include functions to get and set properties both in a raw format and formatted, modifying the installer databases or logging to the Windows Installer log file.

We will modify the stock UI slightly to accommodate a new dialog, `InstallDlg`. We've already seen in previous lessons how to accomplish this. So, there is nothing here we don't already know: we specify and schedule our custom action; we specify our listbox to be linked to a public property.

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```
<CustomAction Id="FillingListbox" BinaryKey="FillListbox" DllEntry="FillListbox" />

<UI>
  <Dialog Id="InstallDlg" Width="370" Height="270" Title="[ProductName] Setup" NoMinimize="yes">
    ...
    <Control Id="FilledListbox" Type="ListBox" Sorted="yes" Indirect="no" Property="LISTBOXVALUES" X="10" Y="50" Width="200" Height="130" />
  </Dialog>

  <InstallUISequence>
    <Custom Action="FillingListbox" After="CostFinalize" />
    <Show Dialog="InstallDlg" After="FillingListbox" />
  </InstallUISequence>
</UI>

<Binary Id="FillListbox" SourceFile="FillListbox.dll" />
```

The custom action will use WcaUtil to initiate and close our connection to the installer as well as to inject the values appearing in the public property, reflected in the listbox connected to this property:

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```
#include <windows.h>
#include <msi.h>
#include <msiquery.h>
#include "wcautil.h"

#pragma comment(linker, "/EXPORT:FillListbox=_FillListbox@4")

extern "C" UINT __stdcall FillListbox(MSIHANDLE hInstall) {
    HRESULT hResult = WcaInitialize(hInstall, "FillListbox");
    if (FAILED(hResult)) return ERROR_INSTALL_FAILURE;

    MSIHANDLE hTable = NULL;
    MSIHANDLE hColumns = NULL;

    hResult = WcaAddTempRecord(&hTable, &hColumns,
        L"ListBox", NULL, 0, 3, L"LISTBOXVALUES", 1, L"Item 1");
    hResult = WcaAddTempRecord(&hTable, &hColumns,
        L"ListBox", NULL, 0, 3, L"LISTBOXVALUES", 2, L"Item 2");
    hResult = WcaAddTempRecord(&hTable, &hColumns,
        L"ListBox", NULL, 0, 3, L"LISTBOXVALUES", 3, L"Item 3");

    if (hTable)
        MsiCloseHandle(hTable);
    if (hColumns)
        MsiCloseHandle(hColumns);
    return WcaFinalize(hResult);
}
```

► Localization (/docs/wix/v3/tutorial/localization/)

Apart from msilib.dll, you also need to link against dutil.dll and wcautil.dll when building the DLL. Those files are installed with the WiX toolset.

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Silence, Please!

The standard custom action to start an executable might not be the best solution if the program to be launched happens to be a console application rather than something with the usual graphical user interface. In these cases, we might want to avoid the command line console windows to flash up for a moment.

WixUtilExtension has a special custom action called

`CAQuietExec` just for these occasions. It expects to find the command line to be run in a predetermined property called `QtExecCmdLine`. The execution can be either immediate or deferred.

```
<Property Id="QtExecCmdLine" Value="something.exe"/>
<CustomAction Id="SilentLaunch" BinaryKey="WixCA" DllEntry="CAQuietExec" Execute="immediate" Return="check" />

<InstallExecuteSequence>
  <Custom Action="SilentLaunch" After="..." />
</InstallExecuteSequence>
```

To run 64-bit executables, use the `CAQuietExec64` custom action and `QtExec64CmdLine` property instead.

To build, we have to link against the standard library:

```
candle.exe Sample.wxs
light.exe -ext WixUtilExtension Sample.wixobj
```

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What to do

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