Parametric Technology Corporation

Getting Started with Pro/TOOLKIT® for Pro/ENGINEER® Wildfire® 5.0

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Contents

Introduction

Getting Started with Pro/TOOLKIT introduces the techniques and practices of developing applications with Pro/TOOLKIT for Pro/ENGINEER Wildfire 5.0. Pro/TOOLKIT is supported on all platforms, but this guide deals only with Windows-specific information. This guide outlines the installation procedure for Pro/TOOLKIT and helps you locate the Pro/TOOLKIT functions and documentation. Familiarity with the basics of Pro/TOOLKIT will help you understand and create advanced applications.

Intended Audience

This guide is for programmers experienced with C/C++ programming prior to working with Pro/TOOLKIT. The experience of the programmer should include:

- Training in fundamentals of Pro/ENGINEER Wildfire 4.0 or later, or equivalent
- Good experience with using Pro/ENGINEER in the areas being customized
- C/C++ experience with knowledge of pointers, data structures, and dynamic memory management
- Use of Microsoft Visual Studio

In addition, you must have the Pro/TOOLKIT development license to develop, build, and test applications.

Scope and Purpose

This guide is not a complete summary of Pro/TOOLKIT techniques. It directs you through the process of building and testing a simple Pro/TOOLKIT application. It introduces the basic concepts of

Pro/TOOLKIT to new users. It also provides pointers to resources that enhance your knowledge about Pro/TOOLKIT.

The guide focuses only on running a Pro/TOOLKIT DLL application in an interactive session of Pro/ENGINEER. It does not cover any other application configuration.

Comments

PTC welcomes your suggestions and comments on its documentation. You can send comments to the following e-mail address:

doc-webhelp@ptc.com

Please include the name of the application and its release number with your comments. For online books, provide the book title.

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Pro/TOOLKIT Concepts

Pro/TOOLKIT is the customization toolkit for Pro/ENGINEER. Customers and partners can expand the capabilities of Pro/ENGINEER by writing C or C++ programming language code using Pro/TOOLKIT and then seamlessly integrating the resulting application into Pro/ENGINEER. PTC provides new releases of Pro/TOOLKIT concurrently with releases of Pro/ENGINEER.

Pro/TOOLKIT uses an object-oriented design. A library of C functions provides safe and controlled access to the Pro/ENGINEER database and applications. Many data structures for transfer of information between Pro/ENGINEER and the application are not directly visible to the application. Contents of these data structures are accessible only with Pro/TOOLKIT functions. The sections in this chapter describe the capabilities and modes of communication of Pro/TOOLKIT.

What Can You Do with Pro/TOOLKIT?

With Pro/TOOLKIT you can:

- Automate modeling for derived or single-use models driven by geometric or parametric constraints
- Monitor the state of the user's interactive session to enforce company rules or offer design advice
- Integrate external applications requiring access to Pro/ENGINEER data or operations
- Extend the Pro/ENGINEER user interface with custom processes seamlessly embedded into the interface
- Automate tedious or difficult Pro/ENGINEER operations with applications designed to save design time and prevent mistakes.
- Create processes to run automatically without a user interface on demand or at designated times.

Communication Modes for Pro/TOOLKIT

Pro/TOOLKIT supports synchronous applications that are invoked from commands within a session of Pro/ENGINEER. Modes of communication for synchronous applications may be:

- **DLL mode**—A dynamically-linked library (DLL) is loaded by the Pro/ENGINEER executable at runtime. Communication between the DLL and Pro/ENGINEER is as fast as possible and hence the DLL mode is the preferred mode for application development.
- **Spawn (multiprocess) mode** —A separate executable is spawned by Pro/ENGINEER. Spawn-mode applications interact with Pro/ENGINEER through interprocess communications and hence are slower than the DLL mode. This mode is typically used as a part of asynchronous mode applications, where the external application starts or connects to external sessions of Pro/ENGINEER as needed.

Another mode available is asynchronous mode applications, where the external application starts or connects to external sessions of Pro/ENGINEER as needed.

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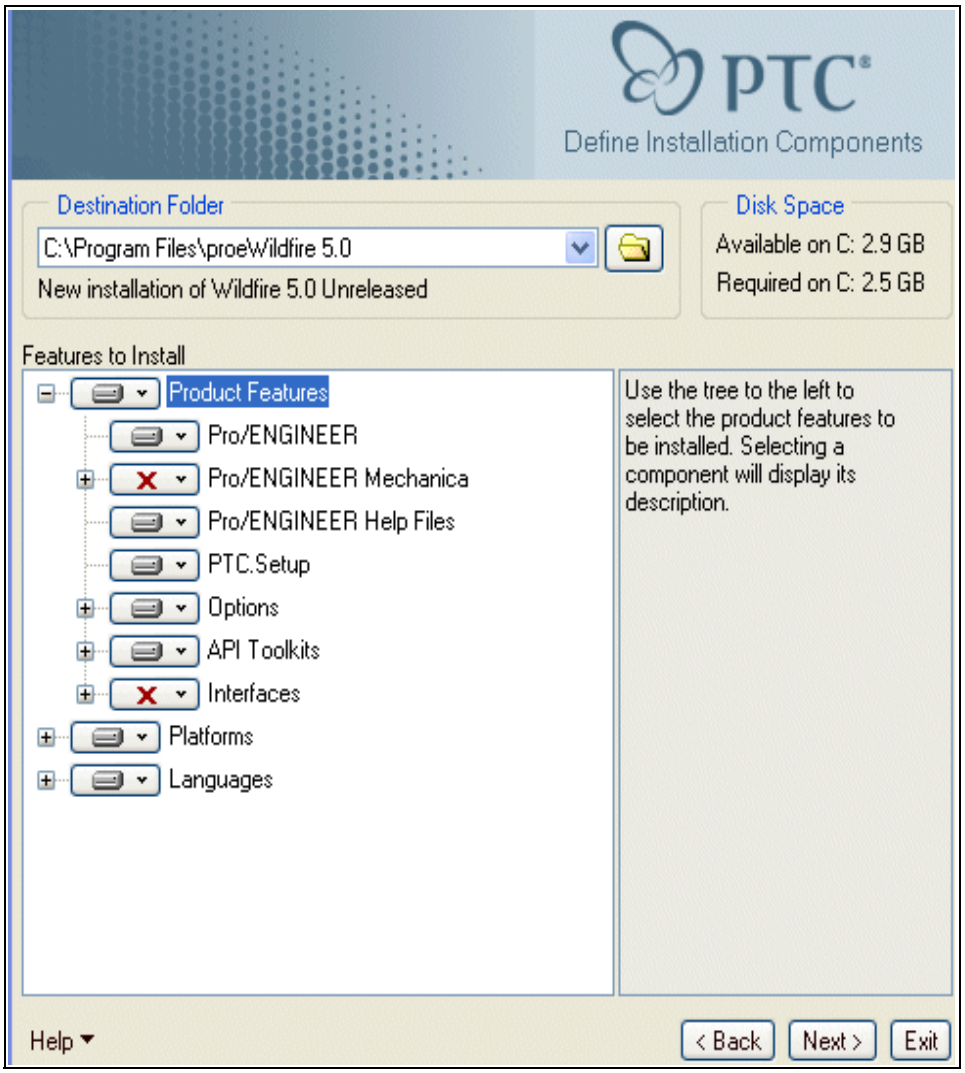
Installing and Testing the Pro/TOOLKIT Development Environment

This chapter discusses the process to install Pro/TOOLKIT and to test the development environment. The test application and other sample code described in this guide assume the use of a Windows environment.

Installing Pro/TOOLKIT

Pro/TOOLKIT is on the Pro/ENGINEER CD-ROM. When you install Pro/ENGINEER, select **API Toolkits** to install Pro/TOOLKIT.



An installation of Pro/TOOLKIT contains directories under the Pro/ENGINEER load point.

Directory	Description
`protoolkit`	Top-level directory
`protoolkit/includes`	Include files
`protoolkit/<machine_type>/obj`	Library files and sample makefiles
`protoolkit/protk_appls`	Sample application source and message files

Setting Up the Development Environment

Before you build your first Pro/TOOLKIT application, set up the supported compilers, sample make files, and the appropriate licensing for your application development environment.

Platform and Compiler Support

Pro/TOOLKIT runs on the same platforms as Pro/ENGINEER. The Platform Support notes at www.ptc.com/partners/hardware/current/support.htm describes the compilers supported by PTC.

Licensing for Pro/TOOLKIT

Pro/TOOLKIT requires a license for developing and testing applications. To check if you have the Pro/TOOLKIT license option, run the `Ptcstatus` utility from the Pro/ENGINEER load point. Check for the license option 14, or contact your system administrator.

When you first build an application using Pro/TOOLKIT, the application is considered "locked." The application requires the Pro/TOOLKIT development license when you test it in Pro/ENGINEER. Loading a locked application into a session of Pro/ENGINEER that lacks the Pro/TOOLKIT license causes an error as the application starts.

Before you distribute an executable for a Pro/TOOLKIT application to your end user, you must unlock it. Unlocking allows the end user to run the application without having the Pro/TOOLKIT license. The unlocking process is initiated with the following command:

<proe_loadpoint>`/bin/protk_unlock <filename>`

In the previous command, `filename` is the full path to the Pro/TOOLKIT application.

Testing the Pro/TOOLKIT Installation

After you have installed Pro/TOOLKIT, compile, link, and run a simple Pro/TOOLKIT application on each computer for development use. This process provides an independent test of the following items:

- The installation of Pro/TOOLKIT is present, complete, and visible.
- The version of Pro/ENGINEER has the Pro/TOOLKIT license option added to it.
- All the necessary C development tools, especially the C compiler and linker, are present in versions supported by Pro/TOOLKIT.

Makefiles

PTC provides sample makefiles for each platform. These makefiles:

- Document the compiler and linker flags to be used for each platform
- Serve as templates for structuring your own application makefiles

Refer to these makefiles when creating a new application. Update the flags in your application makefiles when moving to a new release of Pro/ENGINEER.

Using the Microsoft Visual Studio Solution

PTC provides a ready-to-use Visual Studio solution on the Windows platform to build and test Pro/TOOLKIT applications by using an appropriate makefile. For the version of Visual Studio compatible with the release of Pro/TOOLKIT, refer to the hardware notes at http://www.ptc.com/partners/hardware/current/support.htm.

This ready-to-use Visual Studio solution has the following advantages:

- Provides an effective way to build and test sample applications provided by PTC.
- Provides a preconfigured Visual Studio development environment for use with Pro/TOOLKIT.
- Supports **Intellisense** for Pro/TOOLKIT functions.

Note

The supported version of Visual Studio changes with every release of Pro/TOOLKIT, and hence the compiler flags and libraries also change. For every release, you must download the latest version of the ready-to-use solution from the Pro/TOOLKIT load point.

When you install Pro/TOOLKIT, the file *protk_install_example.zip* is installed under the Pro/TOOLKIT load point at `protoolkit/<machine_type>/obj`. To use this solution:

1. Unzip *protk_install_example.zip*. The following files and directories are available:

Directory or File	Description
make_install.sln	Specifies the ready-to-use Visual Studio solution file.
`make_install`	Contains the makefile project and the *protk.dat* file.

2. Set the environment variable `PROE_INSTALL_PATH` to point to the Pro/ENGINEER installation directory.
3. Open Microsoft Visual Studio.
4. Click **File** > **Open** > **Project/Solution**. The **Open Project** dialog opens.
5. Browse the `protk_install_example` directory and select *make_install.sln*.
6. Click **Open** to access the solution file.

The `make_install` makefile project is available in Visual Studio.

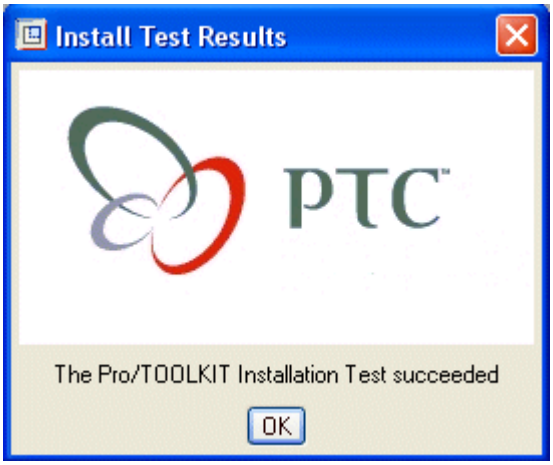
Running the Makefile Project

1. Click **Build** > **Build make_install**. The application should build without errors. This creates the Pro/TOOLKIT DLL file called *pt_inst_test.dll*. If the application fails, check that the environment variable `PROE_INSTALL_PATH` is set correctly.
2. Modify the *exec_file* and *text_dir* fields in the *protk.dat* file located in the `make_install` directory to specify the full path to *pt_inst_test.dll* and "`\text`", respectively. For example,

```
exec_file <full_path>\pt_inst_test.dll
text_dir <full_path>\text
```

3. Start Pro/ENGINEER and click **Tools**>**Auxiliary Applications**>**Register** to register the updated *protk.dat file*. The **Register Auxiliary application** dialog box opens.
4. Browse to the <*full_path*> and select *protk.dat*. The Pro/TOOLKIT application adds the command **Install Test** to the Pro/ENGINEER **File** menu.

5. Click **File** > **Install Test**. The Pro/TOOLKIT **Install Test Results** message window opens, indicating that the installation test has succeeded.



6. Click **OK**.

To run other sample applications provided by PTC, follow these steps:

1. Copy the required makefile from <*proe_loadpoint*>`\protoolkit\i486_nt\obj` to the `make_install` directory of the ready-to-use Visual Studio solution.

   If you are working on a 64-bit Windows platform, copy the file from <*proe_loadpoint*>`\protoolkit\x86e_win64\obj`.

2. Copy the text directory associated with the sample application from <*proe_loadpoint*>`\protoolkit` to the `make_install` directory.

3. Open Visual Studio and set the values of the following variables in the the makefile:

```
PROTOOL_SRC = $(PROE_INSTALL_PATH)/protoolkit
PROTOOL_SYS = $(PROTOOL_SRC)/$(PRO_MACHINE_TYPE)
PRODEV_SRC = $(PROE_INSTALL_PATH)/prodevelop
PRODEV_SYS = $(PROTOOL_SRC)/$(PRO_MACHINE_TYPE)
```

4. Click **Project** > **Properties** to update the **NMake** properties of the project.

5. Click **Build** > **Rebuild make_install**. The application builds and creates a new *.dll* file.

6. Update the *protk.dat* file located in the `make_install` directory with the name of the sample application and the DLL file.

7. Modify the *exec_file* and *text_dir* fields in the *protk.dat* file to specify the full path to the *.dll* file and "`\text`" directory, respectively.

8. Start Pro/ENGINEER and click **Tools**>**Auxiliary Applications**>**Register** to register the updated *protk.dat* file. The **Register Auxiliary application** dialog box opens.

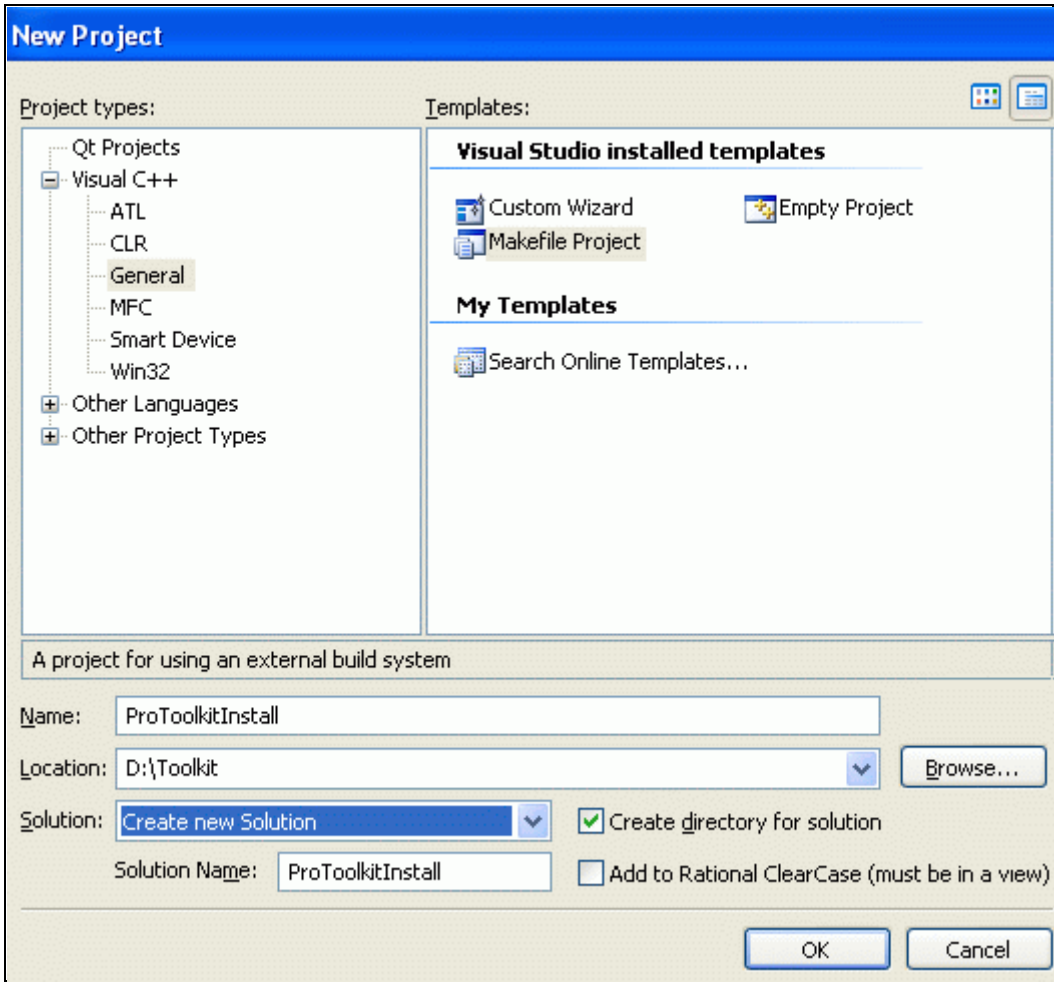
9. Browse to the full path and select *protk.dat*. The Pro/TOOLKIT application runs.

Creating Your Own Microsoft Visual Studio Project

The Pro/TOOLKIT load point includes the source of a simple application called `pt_install_test` designed specifically to help you test the installation. The steps to build and run the test application follow.

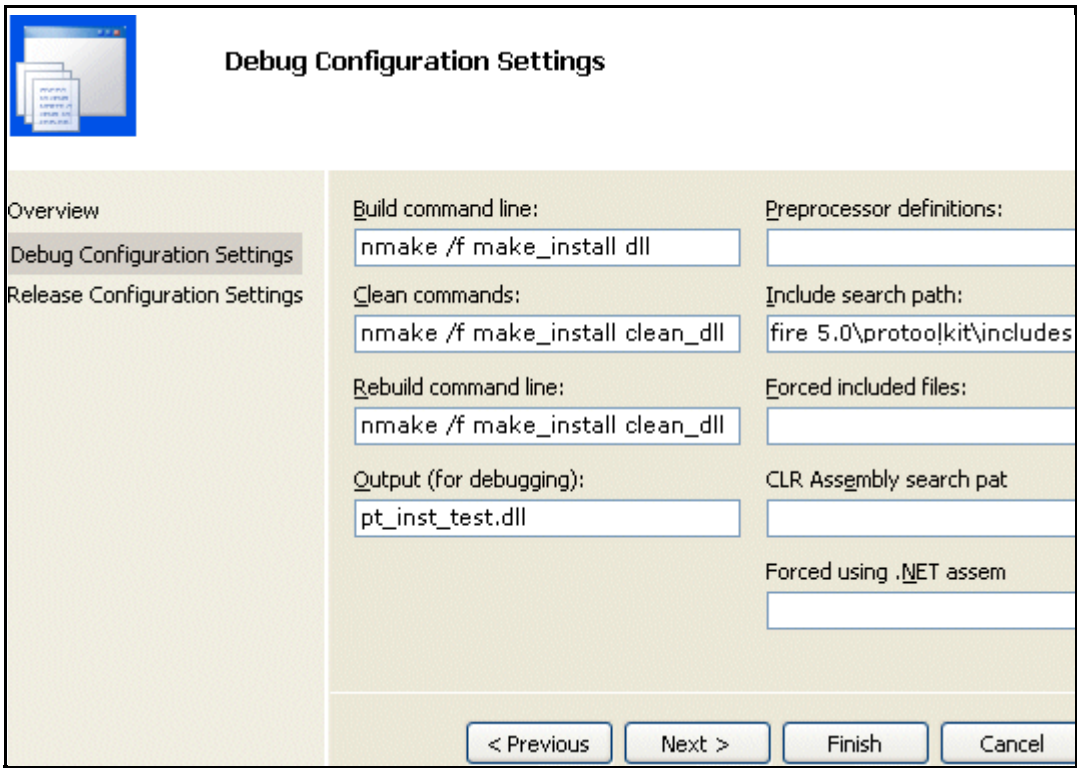
1. Open Microsoft Visual Studio.

2. Create a project named `ProTOOLKITInstall` in an empty directory. Set this project to be a makefile project.



3. Set the **Debug Configuration Settings** to run the Pro/ENGINEER makefile as shown in the following table and figure:

Setting	**Value**
Command line	`nmake /f make_install dll`
Output	`pt_inst_test.dll`
Clean/rebuild all commands	`nmake /f make_install clean_dll`
Include search path	*<proe_loadpoint>*`\protoolkit\includes`



4. Set the **Release Configuration Settings** to the same settings as the **Debug Configuration Settings**. Click **Finish**.
5. Copy the file *make_install* from <*proe_loadpoint*>`\protoolkit\i486_nt\obj` to your project directory, that is, the directory `ProTOOLKITInstall` that also contains `ProTOOLKITInstall.vcproj`. If you are working on a 64-bit Windows platform, copy the file from <*proe_loadpoint*>`\protoolkit\x86e_win64\obj`.
6. Click **Project** > **Add Existing Item** to add the makefile to the project. In the **Add Existing Item** window, view all files and select the file *make_install*.
7. Edit the setting for `PROTOOL_SRC` (`EXTERNAL USE - DEFAULT`) in *make_install* to point to the Pro/TOOLKIT installation directory, that is, <*proe_loadpoint*>`\protoolkit`.

Note

If the Pro/ENGINEER load point is in a directory containing spaces, use the DOS short names, for example:

```
c:/Progra~1/proeWi~1.0/protoolkit
```

8. Click **Build** > **Rebuild Solution**.

   The application should build without errors. This creates the Pro/TOOLKIT DLL file called *pt_inst_test.dll*. If it fails, check that the path to the Pro/TOOLKIT installation directory is set correctly in the makefile in step 7.

9. In the `install_test` directory, create a text file called *protk.dat*. This registry file provides Pro/ENGINEER information about the Pro/TOOLKIT application. The *protk.dat* file should contain the following lines:

```
name install_test
startup dll
exec_file pt_inst_test.dll
text_dir <proe_loadpoint>/protoolkit/protk_appls/pt_install_test
end
```

10. Run Pro/ENGINEER from the directory that contains the *protk.dat* file. The Pro/TOOLKIT application adds the command **Install Test** to the Pro/ENGINEER **File** menu.

    If you encounter an error, or if the Pro/TOOLKIT command does not appear in the Pro/ENGINEER **File** menu, verify if the Pro/ENGINEER version that you ran has the Pro/TOOLKIT license included.

11. Click **File** > **Install Test**. The Pro/TOOLKIT **Install Test Results** message window opens, indicating whether the installation test has succeeded.

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Using the Pro/TOOLKIT Documentation

The previous chapters assisted you with the setup of the Pro/TOOLKIT development environment. You will learn how to effectively use the documentation and extended resources in this chapter. PTC includes the following documentation with Pro/TOOLKIT:

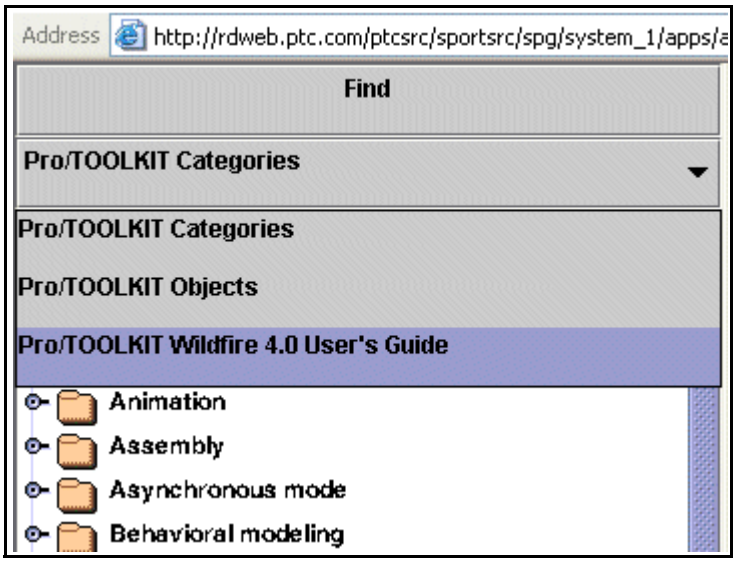
- Pro/TOOLKIT APIWizard—An online document with cross-links between the user's guide, function descriptions, and sample applications.
- *Pro/TOOLKIT User's Guide*—A PDF version of the Pro/TOOLKIT User's Guide.
- *Pro/TOOLKIT Release Notes*—A printable document that provides release-specific information for Pro/TOOLKIT.

Using the Pro/TOOLKIT APIWizard

The Pro/TOOLKIT APIWizard is installed in the directory <*proe_loadpoint*>`/protoolkit/protkdoc`. Start the APIWizard by pointing your browser to the `index.html` file. The Pro/TOOLKIT APIWizard starts. With the APIWizard, you can browse documentation for objects, functions, and the *Pro/TOOLKIT User's Guide*. The following sections describe how to display and use the APIWizard frames in your Web browser.

Using the Selection Frame

The selection frame on the left of the Pro/TOOLKIT APIWizard, controls what data appears in the display frame on the right. Specify the data to view by choosing **Pro/TOOLKIT Categories**, or **Pro/TOOLKIT Objects**, or **Pro/TOOLKIT User's Guide** menu items as shown below.

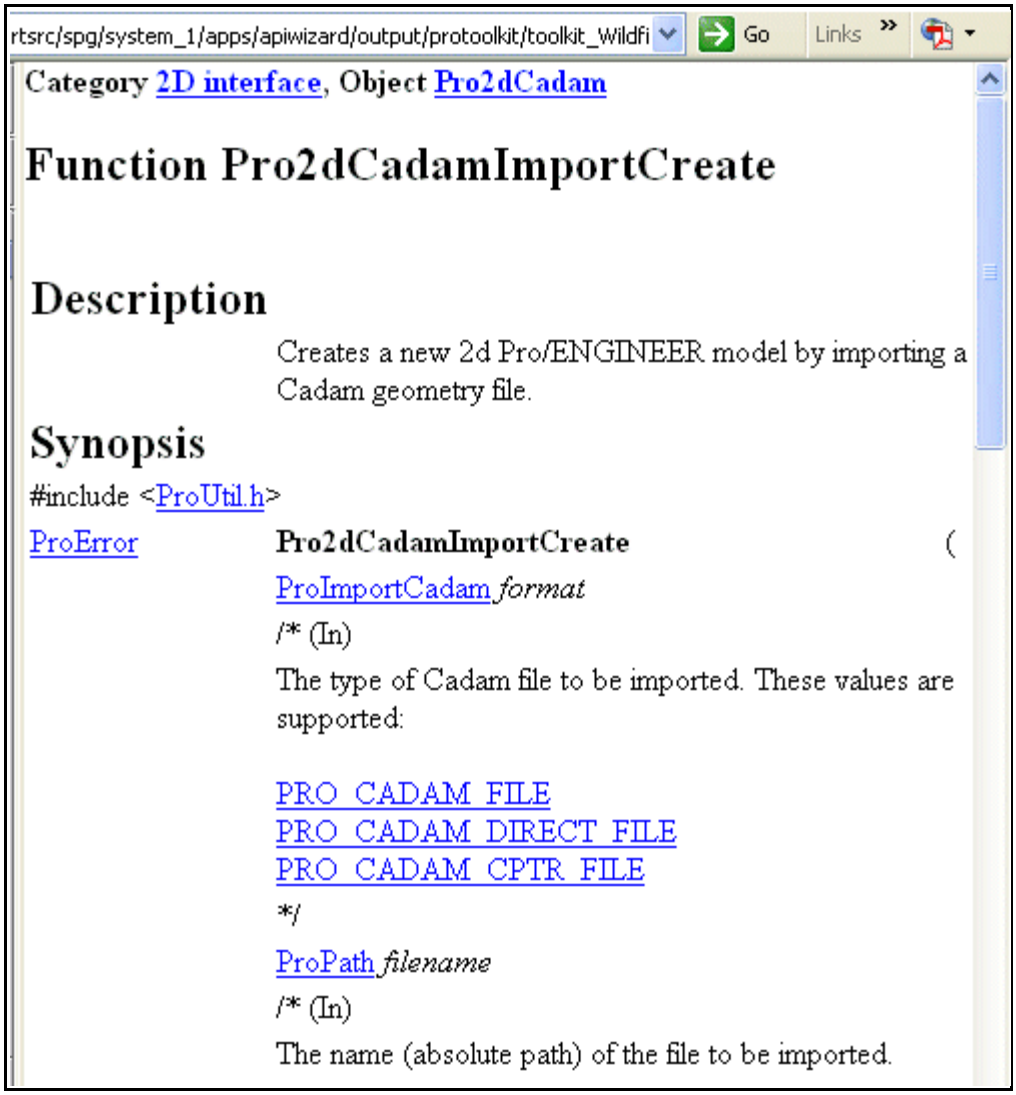


- **Categories**—Displays an alphabetical list of the Pro/TOOLKIT function categories. Pro/TOOLKIT objects and functions are displayed as subnodes of the categories.
- **Objects**—Displays an alphabetical list of the Pro/TOOLKIT objects. Pro/TOOLKIT functions are displayed as subnodes of the objects.
- **User's Guide**—Displays the *Pro/TOOLKIT User's Guide* table of contents in a tree structure. All chapters are displayed as subnodes of the guide.

Use the **Find** button in the left selection frame to search for data from the *Pro/TOOLKIT User's Guide* or for API specifications from the header files.

Using the Display Frame

The display frame on the right of the Pro/TOOLKIT APIWizard is as shown below.



It presents the following items:

- User's guide contents
- Object and object hierarchy descriptions
- Function descriptions
- Header files
- Code examples for functions

Viewing the PDF Version of the User's Guide

Pro/TOOLKIT User's Guide introduces you to Pro/TOOLKIT, the features it offers, and techniques and background knowledge required to use the Pro/TOOLKIT functions effectively. To view and print the PDF book, you must have Adobe Acrobat Reader installed. See www.adobe.com/supportservice/custsupport/download.html to download a free version of Acrobat Reader. The *Pro/TOOLKIT User's Guide* is installed at <*proe_loadpoint*>`/protoolkit/protkdoc`. Open the file `tkuse.pdf` using Acrobat Reader.

Using the Release Notes

Pro/TOOLKIT Release Notes provides release-specific information for Pro/TOOLKIT. It describes new functions of Pro/TOOLKIT and also includes critical functions that require adjustment of existing code. It also lists the changes in Pro/ENGINEER that can affect behavior in Pro/TOOLKIT. The release notes is installed at <*proe_loadpoint*>`/protoolkit`. Use Acrobat Reader to open the file `Protoolkit_Wildfire40_RelNotes.pdf`.

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Using Extended Resources

This chapter provides the resources for support in working with Pro/TOOLKIT for the following areas:

- Example code provided
- Tips for optimum use of the *Pro/TOOLKIT User's Guide*
- Technical Support
- PTC User Community

As you become more familiar with these resources, you'll find that they overlap in areas of expertise. A PTC online account is required to access PTC documentation from the Web. Register for an account at www.ptc.com/appserver/common/account/basic.jsp.

Locating Example Code

PTC provides many sample applications with Pro/TOOLKIT in directories under the path `protoolkit/protk_appls`. This section describes some of the sample applications. You can refer to the APIWizard and the `protoolkit/protk_appls` directory for other sample applications.

pt_userguide

Location	Makefile
`protoolkit/protk_appls/pt_userguide`	`make_userguide`

Consolidates examples that access the user interface. All these examples are also in the *Pro/TOOLKIT User's Guide*.

pt_examples

Location	Makefile
`protoolkit/protk_appls/pt_examples`	`make_examples`

Consists of examples of Pro/TOOLKIT applications. It provides a user interface to access many areas of Pro/TOOLKIT. This application covers Pro/TOOLKIT functions and modules, including user interface functions based on **ProMenubar** and **ProMenu**. The directory `pt_examples` includes subdirectories containing utility functions.

pt_async

Location	Makefile
`protoolkit/protk_appls/pt_async`	`make_async`

Provides an example application for simple and full asynchronous mode.

Other Sample Applications

The following table lists all the sample applications available with the Pro/TOOLKIT installation. Please refer to the *Pro/TOOLKIT User's Guide* for more information.

Sample Application	Location	Makefile
pt_inst_cxx	protoolkit/protk_appls/pt_install_cxx	make_install_cxx
pt_inst_test_md	protoolkit/protk_appls/pt_install_test	make_install_md
pt_autoaxis	protoolkit/protk_appls/pt_autoaxis	make_autoaxis
pt_geardesign	protoolkit/protk_appls/pt_geardesign	make_geardesign
pt_async_md	protoolkit/protk_appls/pt_async	make_async_md
pt_async_mt	protoolkit/protk_appls/pt_async	make_async_mt
pt_async_pic	protoolkit/protk_appls/pt_async_pic	make_async_pic
pt_simple_async	protoolkit/protk_appls/pt_simple_async	make_simple_async
pt_basic	protoolkit/protk_appls/pt_basic	make_basic
pt_af_examples	protoolkit/protk_appls/pt_af_examples	make_af_examples
pt_udf_examples	protoolkit/protk_appls/pt_udf_examples	make_udf_examples
pt_mech_examples	protoolkit/protk_appls/pt_mech_examples	make_mech_examples

Using the User's Guide

The *Pro/TOOLKIT User's Guide* is the primary resource to extend your knowledge of Pro/TOOLKIT. Tips on how to use the guide follow:

- Chapter 1 deals with fundamentals. Beginners should study it thoroughly.
- Next, complete chapters 4-21 grouped under the Core and User Interface functional areas. They contain basic information useful to almost all Pro/TOOLKIT users.
- After that, you can jump to any of chapters 22-64 that describes the functionality in the areas that you intend to customize.

Contacting PTC Technical Support

Technical support for Pro/ENGINEER and Pro/TOOLKIT is available 24 hours a day, 7 days a week. You can contact Technical Support by phone, fax, e-mail, or FTP. You can easily access the most current technical support contact information from within Pro/ENGINEER by clicking the **Support** link on the Pro/ENGINEER homepage.

Joining the PTC/USER Community

PTC/USER Community provides education and communication services for users of PTC software. This nonprofit corporation offers an annual international conference and connects you to more experienced PTC software users, including Pro/TOOLKIT developers. Visit www.ptcuser.org for more details.

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