Using GPS

The GNAT Programming System

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1 Introduction

GPS is a complete integrated development environment that gives access to a wide range of tools and integrates them smoothly.

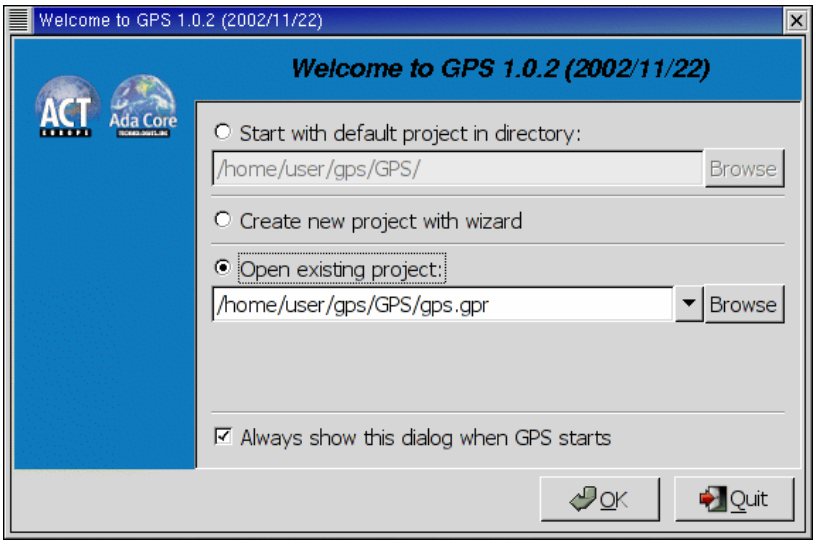
GPS gives access to built-in file editing; HTML based help system; complete compile/build/run cycle; intelligent source navigation; project management; general graph technology giving access to many different browsers such as source dependency, project dependency, call graphs, etc. . .; fully integrated visual debugger, based on the GVD technology, and enhanced for inclusion in GPS; generic version control system, providing access to CVS, ClearCase, and possibly others in the future; many other tools such as a visual comparison, automatic generation of files, source reformatting.

GPS is fully customizable, providing several levels of customizations: a first level, available through the preferences and key manager dialogs; a second level, which allows you to customize your menu items, tool bar and key bindings; a third level, which allows you to automate processing through scripts; and a fourth level, which allows any kind of very specific or tight integration, due to the open nature of GPS, and to its architecture. See Chapter 15 [Customizing and Extending GPS], page 123 for more details.

GPS also integrates with existing editors such as Emacs and Vi, see Section 5.6 [Using an External Editor], page 36.

2 Description of the Main Windows

2.1 The Welcome Dialog



When starting GPS, a welcome dialog is displayed by default, giving the following choices:

Start with default project in directory

If you select this option and click on the `OK` button, GPS will create a default internal project with the following properties:

The project supports Ada files only, using the default GNAT naming scheme: `.ads` for spec files, `.adb` for body files.

A single source directory corresponding to the current directory. The current directory can be set by modifying the text entry on clicking on the `Browse` button. All the Ada files found in this directory will be considered as part of the default project.

The object directory where the object and executable files will be put, corresponding also to the current directory.

Create new project with wizard

Selecting this option and clicking on the `OK` button will start a wizard allowing you to specify most of the properties for a new project. Once the project is created, GPS will save it and

load it automatically. See Section 7.6 [The Project Wizard], page 55 for more details on the project wizard.

Open existing project
You can select an existing project by clicking on the `Browse` button, or by using a previously loaded project listed in the combo box. When a project is selected, clicking on the `OK` button will load this project and open the main window.

Always show this dialog when GPS starts
If unset, the welcome dialog won't be shown in future sessions. In this case, GPS will behave as follows: it will first look for a `-P` switch on the command line, and load the corresponding project if present. Then, it will look for a project file in the current directory and will load the first project file found.

If no project file can be found in the current directory, GPS will start with the default project.

To reset this property, go to the menu `Edit->Preferences`. See Section 15.1 [The Preferences Dialog], page 123.

Quit If you click on this button, GPS will terminate immediately.

When you specify a -P switch on the command line, or if there is only one project file in the current directory, GPS will start immediately with the project file specified, instead of displaying the welcome dialog.

In addition, if you specify source files on the command line, GPS will also start immediately, using the default project if no project is specified.

By default, files specified on the command line are taken as is and can be absolute or relative pathnames. In addition, if you prepend a filename with the = character, then GPS will look for the file in the source search path of the project.

2.2 The Menu Bar

This is a standard menu bar that gives access to all the global functionalities of GPS. It is usually easier to access a given functionality using the various contextual menus provided throughout GPS: these menus give direct access to the most relevant actions given the current context (e.g. a project, a directory, a file, an entity, . . .). Contextual menus pop up when the right mouse button is clicked.

The menu bar gives access to the following items:

File See [The File Menu], page 30.

Edit See [The Edit Menu], page 33.

Navigate See Section 6.2 [The Navigate Menu], page 44.

VCS See Section 12.2 [The VCS Menu], page 112.

Project See Section 7.5 [The Project Menu], page 54.

Build See Section 9.1 [The Build Menu], page 73.

Debug See Section 11.1 [The Debug Menu], page 87.

Tools See Section 13.1 [The Tools Menu], page 117.

Window See Chapter 4 [Multiple Document Interface], page 15.

Help See Section 3.1 [The Help Menu], page 13.

2.3 The Tool Bar

The tool bar provides shortcuts via buttons to some typical actions: creating a new file, opening a file, saving the current file; undo/redo last editing; cut to clipboard, copy to clipboard, paste from clipboard; go to previous/next location; start/continue the debugging session, step/next execution, finish current procedure.

The icon on the far right of the tool bar will be animated to indicate that an action (e.g. a build or a search) is going on in the background.

2.4 The Work Space

The whole work space is based on a multiple document interface, See Chapter 4 [Multiple Document Interface], page 15.

2.5 The Project Explorer

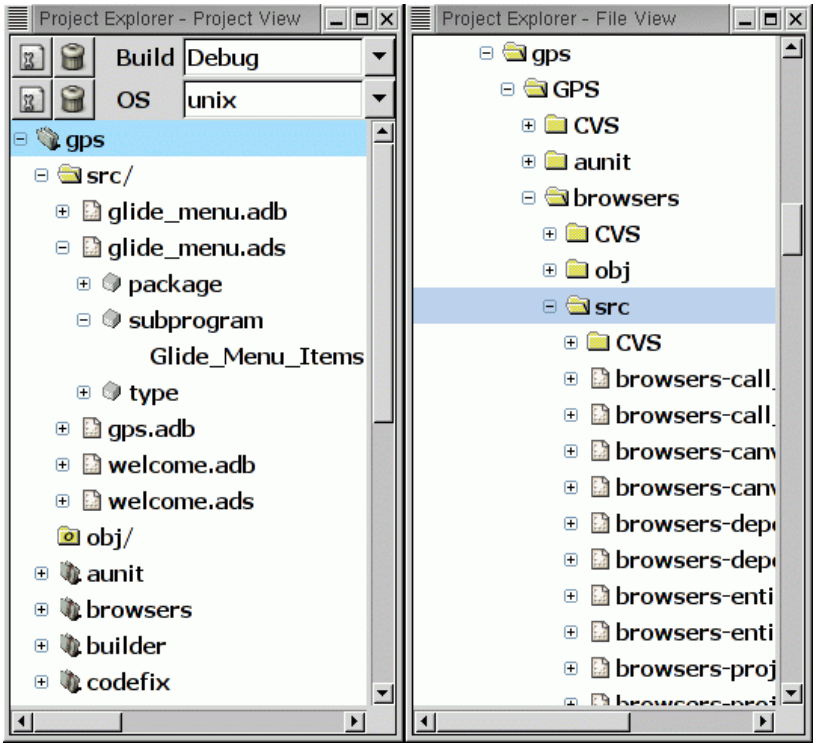
The project explorer is composed of multiple views which can be accessed by default by clicking on the corresponding pages, or if they are not shown by using the `Project` menu items.

2.5.1 The explorer views

The explorer views are initially displayed on the left side of the GPS window. Their goal is to show a full view of the various components of your projects. These various components are presented below.

Under Windows, it is possible to drop files (coming e.g. from the Explorer) in any of these views with the following behavior: a project file dropped will be loaded; any other file will open a source editor on this file.

The following screen-shot displays the two pages side-by-side: on the left, the `Project View`, and on the right the `File View`.



Each view provides an interactive search capability allowing you to quickly search in the information currently displayed. The default key to start an interactive search is ⟨Ctrl-i⟩. This will open a small window at the bottom of the explorer where you can interactively type names. The first matching name in the tree will be selected while you type it. You can then also use the ⟨up⟩ and ⟨down⟩ keys to navigate through all the items matching the current text.

The various components that are displayed in these explorers are the following:

projects As mentioned before, all the sources you are working with are put under control of projects. These projects are a way to store the switches to use for the various tools, as well as a number of other properties.

They can be organized into a project hierarchy, where a root project can import other projects, with their own set of sources.

Initially, a default project is created, that includes all the sources in the current directory.

The `Project View` page of the explorer displays this project hierarchy: the top node in this view is the root project of your application (generally, this is where the source file that contains the main subprogram will be located). Then a node is displayed for each imported project, and recursively for their own imported projects.

A given project might appear multiple times in the `Project View`, if it is imported by several other projects.

There exists a second display for this project view, which lists all projects with no hierarchy: all projects appear only once in the explorer, at the top level. This display might be useful for deep project hierarchies, to make it easier to find projects in the explorer.

This display is activated through the contextual menu entry `Show flat view`, which acts as a switch between the two displays.

A special icon with an exclamation mark is displayed if the project was modified, but not saved yet. You can choose to save it at any time by right-clicking on it. GPS will remind you to save it before any compilation.

directories

The files inside a project can be organized into several physical directories on the disk. These directories are displayed under each project node in the `Project View`, or directly mimicking their physical organization on the disk (including Windows drives) in the `File View`.

In the `Project View`, you can chose whether you want to see the absolute path names for the directories or paths relative to the location of the project. This is done through the `Show absolute paths` contextual menu.

Special nodes are created for object and executables directories. No files are shown for these.

files

The source files themselves are stored in the directories, and displayed under the corresponding nodes. Note that in the `Project View`, only the source files that actually belong to the project (i.e. are written in a language supported by that project and follow its naming scheme) are actually visible. For more information on supported languages, See Section 7.2 [Supported Languages], page 49.

The `File View` will display all the files that actually exist on the disk. Filters can be set through the contextual menu to

only show the files and directories that belong to the project hierarchy. See the menu `Show files from project only`.

A given file might appear multiple times in the `Project View`, if the project it belongs to is imported by several other projects.

entities If you open the node for a source file, the file is parsed by one of the fast parsers integrated in GPS so that all entities declared in the project can be shown. These entities are grouped into various categories, which depend on the language. Typical categories include subprograms, packages, types, variables, tasks,. . .

Double-clicking on a file, or simple clicking on any entity will open a source editor and display respectively the first line in this file or the line on which the entity is defined.

Moving the mouse over the different components displayed on the project explorer view will open tooltips with some more information depending on the type of component:

projects The tooltip contains the project full pathname.

directories The tooltip contains the directory full pathname and the project name in which it is defined.

files The tooltip contains the base filename and the project name in which it is defined.

entities The tooltip contains the entity name and parameters for routines followed by the location in the form filename:line where it is declared.

If you open the search dialog through the `Navigate->Find...` menu, you have the possibility to search for anything in the explorer, either a file or an entity. Note that searching for an entity might be a little slow if you have lots of files.

A contextual menu, named `Locate in Explorer`, is also provided when inside a source editor. This will automatically search for the first entry for this file in the explorer. This contextual menu is also available in other modules, e.g. when selecting a file in the `Dependency Browser`.

2.5.2 The configuration variables

As described in the GNAT User's Guide, the project files can be configured through external variables (typically environment variables). This means that e.g. the exact list of source files, or the exact switches to use to compile the application can be changed when the value of these external variables is changed.

GPS provides a simple access to these variables, through a special area on top of the `Project View`. These variables are called `Configuration Variables`, since they provide various scenarios for the same set of project files.

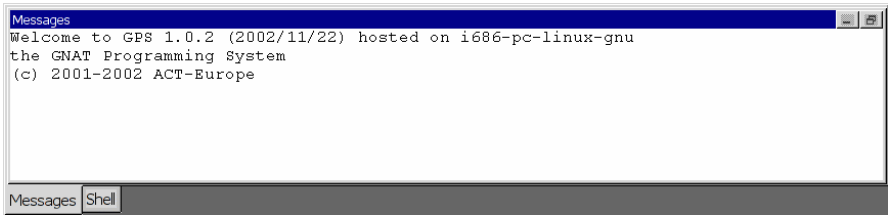
A combo box is displayed in this area for each environment variable the project depends on. The current value of the variable can be set simply by selecting it from the pop-down window that appears when you click on the arrow on the right of the variable name

New variables can be added through the contextual menu `Add Configuration Variable` in the `Project View`. The list of possible values for a variable can be changed by clicking on the button on the left of the variable's name.

Whenever you change the value of one of the variables, the project is automatically recomputed, and the list of source files or directories is changed dynamically to reflect the new status of the project. Starting a new compilation at that point will use the new switches, and all the aspects of GPS are immediately affected according to the new setup.

2.6 The Messages Window

The Messages window is used by GPS to display information and feedback about operations, such as build output, information about processes launched, error messages.



This is a read-only window, which means that only output is available, no input is possible.

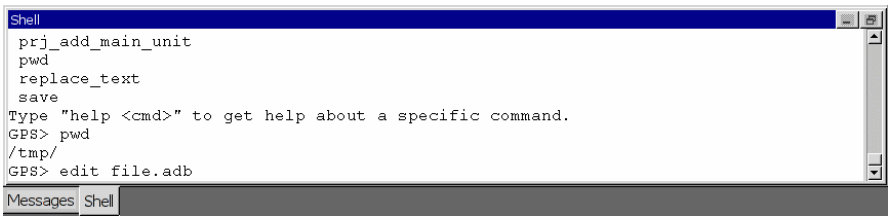
For an input/output window, see Section 2.9 [The Execution Window], page 11 and also Section 2.7 [The Shell and Python Windows], page 9.

2.7 The Shell and Python Windows

These windows give access to the various scripting languages supported by GPS, and allow you to type commands such as editing a file or compiling without using the menu items or the mouse.

Some of these windows, especially the python window, might not be visible in your version of GPS, if GPS wasn't compiled with the support for that specific scripting language.

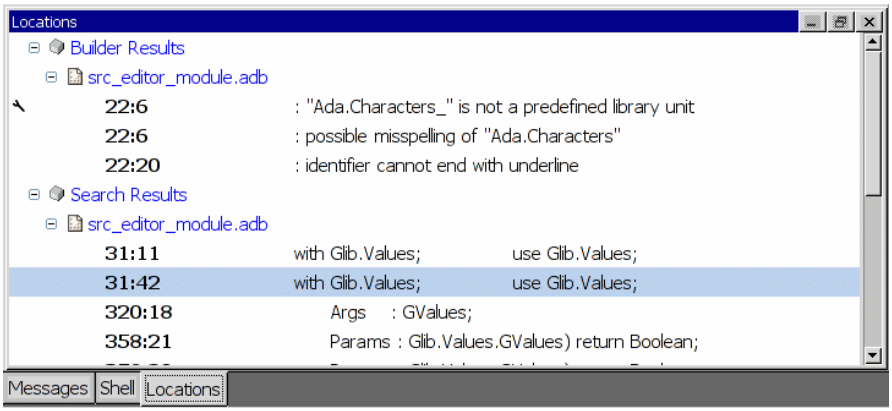
See Section 15.7 [Scripting GPS], page 193 for more information on using scripting languages within GPS.



You can use the ⟨up⟩ and ⟨down⟩ keys to navigate through the history of commands.

2.8 The Locations Tree

The Location Tree is filled whenever GPS needs to display a list of locations in the source files (typically, when performing a global search, compilation results, and so on).



The Location Tree shows a hierarchy of categories, which contain files, which contain locations. Clicking on a location item will bring up a file editor at the requested place. Right-clicking on file or category items brings up a contextual menu allowing you to remove the corresponding node from the view.

Every time a new category is created, as a result of a compilation or a search operation for instance, the first entry of that category is automatically selected, and the corresponding editor opened. This behavior can be controlled through a preference `Jump To First Location`.

To navigate through the next and previous location (also called `Tag`), you can use the menu items `Navigate->Previous Tag` and `Navigate->Next Tag`, or the corresponding key bindings.

Left-clicking on a line in the Location Tree brings up a contextual menu with the following entries:

Sort by subcategory
: Toggle the sorting of the entries by sub-categories. This is useful, for example, for separating the warnings from the errors in the build results.

Jump to location
: Open the location contained in the message, if any.

In some cases, a wrench icon will be associated on the left of a compilation message. See Section 13.3 [Code Fixing], page 118 for more information on how to make advantage of this icon.

2.9 The Execution Window

Each time a program is launched using the menu `Build->Run`, a new execution window is created to provide input and output for this program.

In order to allow post mortem analysis and copy/pasting, the execution windows are not destroyed when the application terminates.

To close an execution window, click on the cross icon on the top right corner of the window, or use the menu `File->Close`, or the menu `Window->Close` or the key binding ⟨Ctrl-W⟩.

If you close the execution window while the application is still running, a dialog window is displayed, asking whether you want to kill the application, or to cancel the close operation.

2.10 The Status Line

The status line is composed of two areas: on the left a status bar and on the right one or several progress bars.

The status bar is used to display temporary information about GPS operations. Note that most of the information GPS displays can be found in the `Messages` window.

The progress bars are used to display information about on going operations such as builds, searches, or VCS commands. These tasks operate

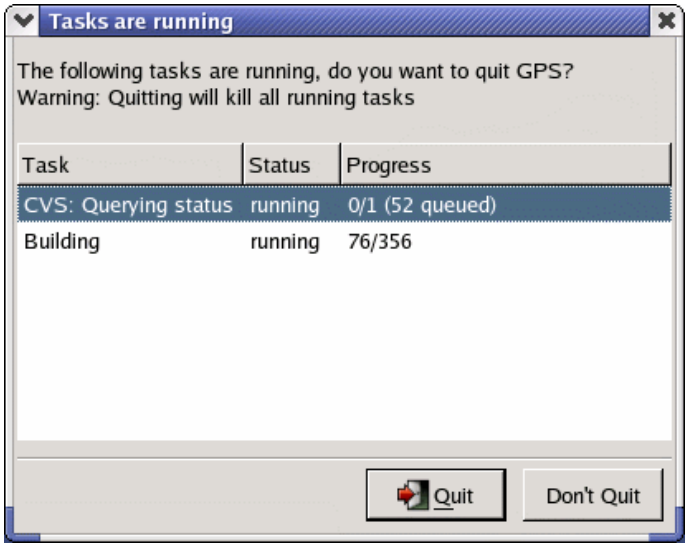
in the background, and can be paused/resumed via a contextual menu. This contextual menu is available by right-clicking on the progress bars themselves or on the corresponding lines in the Task Manager. See Section 2.11 [The Task Manager], page 12

2.11 The Task Manager

The Task Manager window lists all the currently running GPS operations that run in the background, such as builds, searches or VCS commands.

For each of these tasks, the Task Manager shows the status of the task, and the current progress. The execution of theses tasks can be suspended using a contextual menu, brought up by right-clicking on a line.

When exiting GPS, if there are tasks running in the Task Manager, a window will display those tasks. You can also bring up a contextual menu on the items in this window. You can force the exit at any time by pressing the confirmation button, which will kill all remaining tasks, or continue working in GPS by pressing the Cancel button.



3 Integrated Help

By default when you start GPS, the working area contains a help window displaying HTML help files. On-line help for the GNAT tools is available from the `Help` menu item.

Since HTML pages can contain lots of complex information, resizing the help window can take some time, making the user interface less responsive. It is therefore recommended to close the `Help` window when not using it. You can reopen this window at any time using the `Help` menu item.

For the best use of the integrated help, it is recommended to load small HTML pages each time instead of long pages which will be slow to load and display.

3.1 The Help Menu

The Help menu item provides the following entries:

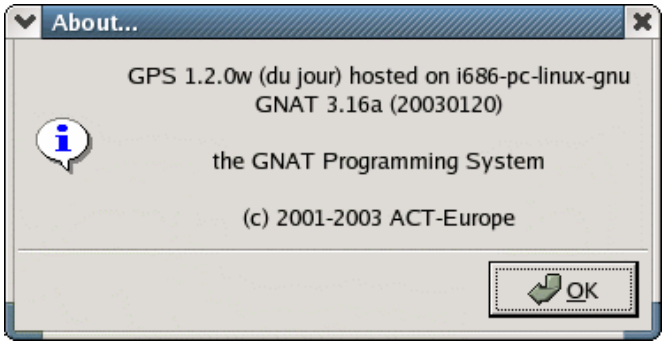
Contents
: This opens a special HTML file that contains links for all the documentation files currently registered in GPS, See Section 3.2 [Adding New Help Files], page 14.

Zoom in Increase the size of the font used to display the help file.

Zoom out
: Decrease the size of the font used to display the help file.

Open HTML file...
: Open a file selection dialog to load an HTML file.

About Display a dialog giving information about the versions of GPS and GNAT used:



This menu contains a number of additional entries, depending on what documentation packages were installed on your system. See the next section to see how to add new help files.

The help window also provides a contextual menu that gives the possibility to copy the current selection to the clipboard.

3.2 Adding New Help Files

GPS will search for the help files in the list of directories set in the environment variable `GPS_DOC_PATH` (a colon-separated list of directories on Unix systems, or semicolon-separated list of directories on Windows systems). In addition, the default directory `<prefix>/doc/gps/html` is also searched. If the file cannot be found in any of these directories, the corresponding menu item will be disabled.

The environment variable `GPS_DOC_PATH` can either be set by each user in his own environment, or can be set system-wide by modifying the small wrapper script '`gps`' itself on Unix systems.

It can also be set programmatically through the GPS shell or any of the scripting languages. This is done with

```
GPS.add_doc_directory ("/home/foo")
```

The specific list of files shown in the menus is set by reading the index files in each of the directories in `GPS_DOC_PATH`. These index files must be called '`gps_index.xml`'.

The format of these index files is specified in see Section 15.4.16 [Adding documentation], page 177.

4 Multiple Document Interface

All the windows that are part of the GPS environment are under control of what is commonly called a multiple document interface (MDI for short). This is a common paradigm on windowing systems, where related windows are put into a bigger window which is itself under control of the system or the windows manager.

This means that, by default, no matter how many editors, browsers, explorers,... windows you have opened, your system will still see only one window (On Windows systems, the task bar shows only one icon). However, you can organize the GPS windows exactly the way you want, all inside the GPS main window.

For instance, you can choose to iconify some windows which are temporarily useless to you; you can choose to put some windows on top of others; you can resize all the windows to the size you want; and so on.

This section will show the various capacities that GPS provides to help you organize your workspace.

4.1 Selecting Windows

At any time, there is only one selected window in GPS (the **active window**). You can select a window either by clicking in its title bar, which will then get a different color, or by selecting its name in the menu `Window`.

Alternatively, windows can be selected with the keyboard. By default, the selection key is ⟨Alt-Tab⟩. When you press it, a temporary dialog is popped-up on the screen, with the name of the window that will be selected when the key is released. If you press the selection key multiple times, this will iterate over all the windows currently open in GPS.

This interactive selection dialog is associated with a filter, displayed below the name of the selected window. If you maintain ⟨Alt⟩ pressed while pressing other keys than ⟨Tab⟩, this will modify the current filter. From then on, pressing ⟨Alt-Tab⟩ will only iterate through those windows that match the filter.

The filter is matched by any window whose name contains the letter you have typed. For instance, if you are currently editing the files '`unit1.adb`' and '`file.adb`', pressing ⟨t⟩ will only leave '`unit1.adb`' selectable.

4.2 Closing Windows

Wherever the windows are displayed, they are always closed in the same manner. In the right side of the title bar of the window, three small

buttons are displayed. The rightmost button is a cross. Clicking on this button will close the window.

When a window is closed, the focus is given to the window of the same part of the MDI (each of the docks or the middle area) that previously had the focus. Therefore, if you simply open an editor as a result of a cross-reference query, you can simply close that editor to go back to where you were before.

Alternatively, you can also select the window by clicking anywhere in its title bar, and then select the menu `Window->Close`

4.3 Maximized and Iconified Windows

The MDI is initially split into three parts: one window to the left, one to the bottom, and a bigger one that occupies the remaining space.

The first two will be discussed in Section 4.4 [Docked Windows], page 19. The third area is the one that provides the most flexibility:

maximized windows

The windows in this area are initially maximized. This means that if you have several windows, a notebook will be created, and only one window will be visible at any given time. You select the window you want to see by clicking on the appropriate tab.

Note that if there are a lot of windows, two small arrows will appear on the right of the tabs. Clicking on these arrows will show the remaining tabs.

You can go back to this maximized state in two ways: either select the menu `Window->Maximize All`, or click on the middle button on the right of the title bar of any window (this button shows two small squares, and will toggle between maximized and unmaximized states.

You can also double-click on the title bar of any of the window, or in the tabs that appear at the bottom when multiple windows are stored in the central area.

unmaximized windows

Instead of putting all the windows inside a notebook, GPS lets you organize them freely when they are unmaximized. Select the menu `Window->Unmaximize All`, or click again in the middle button on the right of the title bar.

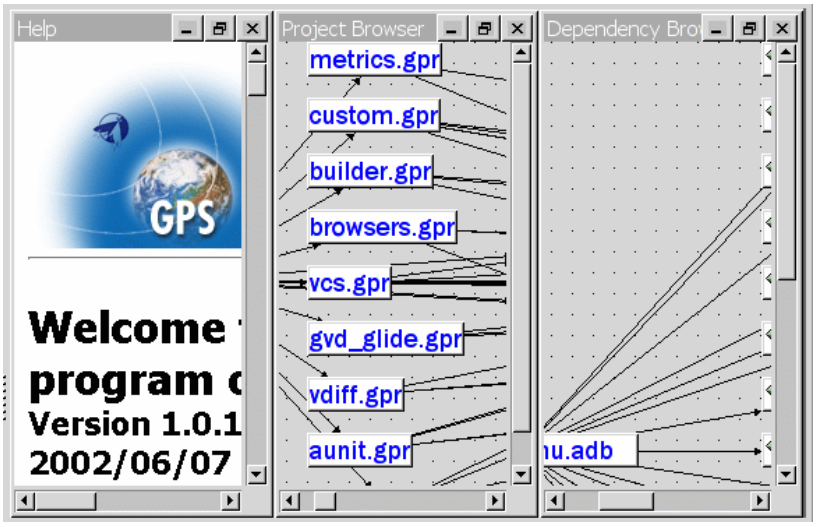
In this mode, the windows can be resized freely by clicking on the border of any side or in one of their four corners, as usual on windowing systems.

They can also be moved around. As a result, you can choose for instance to display several windows side by side, or one on top of the others.

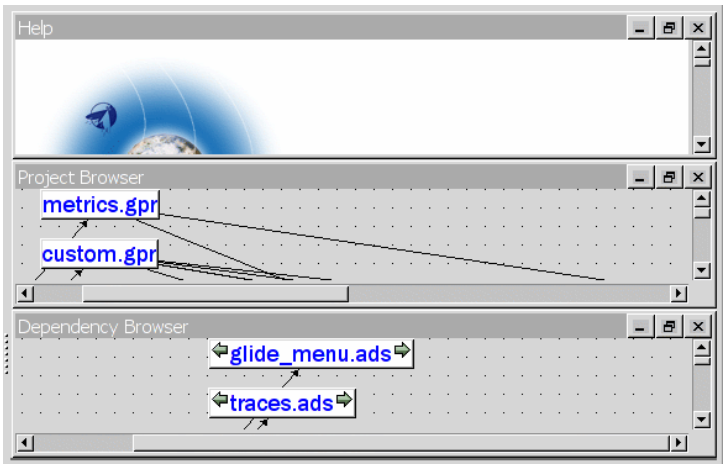
To make it easier to get to these standard organizations, GPS provides a few shortcuts through menus:

`Window->Cascade`
: All the windows will be resized to the same size, and be moved one on top of the other, so that the top and left sides of all windows are visible. This way, you can easily select any window

`Window->Tile Horizontally`
: All the windows are resized to the same dimensions, and are put side by side, from left to right. No window will overlap any other.



`Window->Tile Vertically`
: All the windows are resized to the same dimensions, and are put side by side, from top to bottom. No window will overlap any other.



Iconified windows

When the windows are unmaximized, you can also choose to temporarily iconify some of them. This is done by clicking on the leftmost button in the title bar (the one that shows a single line).

The window will then be resized so that only part of its title bar is visible, and none of its actual contents. Icons can still be moved around as you want, but they cannot be resized. You need to first de-iconify the window, by clicking once again on the same button.

When de-iconified, a window will restore the size and position it had before it was iconified.

4.4 Docked Windows

As mentioned before, the GPS work space is initially split into three windows. The one on the left and the one at the bottom are called **docking area**.

They have a different behavior from the central area, since windows in these areas are necessarily grouped into a notebook. Thus, only one of them is visible at any given time, and you select the one you want to see by clicking on its name in the tabs area.

GPS includes four such areas, one on each side of the main area. Some visual objects will initially be displayed in one of these docking areas instead of in the central one, like the project explorer, the message window,. . . Although you cannot control this initial position, it is possible to change it later on (Section 4.7 [Moving Windows], page 21).

However, you can still choose precisely the dimension you want for this docking area (either its width for the left and right areas, or its height for the top and bottom ones).

Between each docking area and the central one, there is a small handle (on which a series of dots are drawn), that you can move interactively with the mouse, to resize the docking areas). By default, when you move such a handle, a line will appear on top of all other windows in GPS to show you the new position the docking area will have when you release the mouse. You can set up a preference (menu `Edit->Preferences`) to

indicate that you want the resizing to be opaque, that is that you want to see the windows as you resize them.

Note that when a window is **docked** (i.e. put in a docking area), some of the buttons in its title bar are grayed out and inactive.

A simple way to dock a window is to select it, and then select the menu `Window->Docked`. We will see in Section 4.7 [Moving Windows], page 21 that there is a more intuitive way to do the same thing.

In some cases GPS will change the color and size of the title (name) of a window in the notebook tab. This indicates that the window content has been updated, but the window wasn't visible. Typically, this is used to indicate that new messages have been written in the messages or console window.

4.5 Splitting Windows

The window in the central area of the MDI can be split at will, through any combination of horizontal and vertical splits. This feature requires at least two windows (text editors, browsers,...) to be superimposed in the central area. Selecting either the `Window->Split Horizontally` or `Window->Split Vertically` menus will then split the selected window in two. In the left (resp. top) pane, the currently selected window will be left on its own. The rest of the previously superimposed windows will be put in the right (resp. bottom) pane. You can then in turn split these remaining windows to achieve any layout you want.

All split windows can be resized interactively by dragging the handles that separate them, just as is done for docked windows. A preference (menu `Edit->Preferences` controls whether this resizing is done in opaque mode or border mode. In the latter case, only the new handle position will be displayed while the mouse is dragged.

The current layout is lost when you select one of the menus `Window->Cascade`, `Window->Tile Horizontally`, `Window->Tile Vertically` or `Window->Unmaximized`. It is also changed if you destroy the last visible window in a pane. For instance, if you have split the central area in two, with one editor only on each side, closing any editor will result in an unsplit central area.

You may want to bind the key shortcuts to the menus `Window->Split Horizontally` as well as `Window->Split Vertically` using either the preference `Dynamic Key Binding`, or the key manager. In addition, if you want to achieve an effect similar to e.g. the standard Emacs behavior (where ⟨control-x 2⟩ splits a window horizontally, and ⟨control-x 3⟩ splits a window vertically), you can use the key manager (see Section 15.3 [The Key Manager Dialog], page 139).

4.6 Floating Windows

Although the MDI, as described so far, is already extremely flexible, it is possible that you prefer to have several top-level windows under direct control of your system or window manager. This would be the case for instance if you want to benefit from some extra possibilities that your system might provide (virtual desktops, different window decoration depending on the window's type, transparent windows,. . .).

GPS is fully compatible with this behavior, since windows can also be **floating windows**. Any window that is currently embedded in the MDI can be made floating at any time, simply by selecting the window and then selecting the menu `Window->Floating`. The window will then be detached, and can be moved anywhere on your screen, even outside of GPS's main window.

There are two ways to put a floating window back under control of GPS. The more general method is to select the window through its title in the menu `Window`, and then unselect `Window->Floating`.

The second method assumes that the preference **Destroy Floats** in the menu `Edit->Preferences` has been set to false. Then, you can simply close the floating window by clicking in the appropriate title bar button, and the window will be put back in GPS. If you actually want to close it, you need to click once again on the cross button in its title bar.

A special mode is also available in GPS, where all windows are floating. The MDI area in the main window becomes invisible. This can be useful if you rely on windows handling facilities supported by your system or window manager but not available in GPS. This might also be useful if you want to have windows on various virtual desktops, should your window manager support this.

This special mode is activated through a preference (menu `Edit->Preferences`). This preference is entitled **All Floating**.

4.7 Moving Windows

As we have seen, the windows' state can be changed at any time, from maximized to unmaximized to docked to floating and back, in any order.

In all cases, the changes are done either through the buttons in the title bar or through the `Window` menu.

A more intuitive method is also provided, based on the drag-and-drop paradigm. The idea is simply to select a window, wherever it is, and then, by clicking on it and moving the mouse while keeping the left button pressed, drop it anywhere else inside GPS.

Selecting an item so that it can be dragged is done simply by clicking with the left mouse button in its title bar, and keep the button pressed

while moving the mouse. Although this is the general scheme, this would not work for unmaximized items, since the title bar is then used to move them around. In that case, you need to press the ⟨control⟩ key in addition to the left mouse button.

A third possibility can be used for maximized or docked windows: click with the left mouse button in the notebook tab that contains their name. This third option is not available under Microsoft Windows systems.

While you keep the mouse button pressed, and move the mouse around, the selected drop area is highlighted with a dashed border. This shows precisely where the window would be put if you were to release the mouse button at that point.

Here are the various places where a window can be dropped:

The central area

If the windows in that area are unmaximized, the window you are dropping (the current window) will acquire the same state. However, if the windows are currently maximized in the central area, or even if the latter was split horizontally, vertically or any combination of these, the location of the current window is indicated by the dashed rectangle: either in the pane where you released the mouse button, or on one of the sides of that pane (splitting as needed).

Docking areas

The window will be immediately added to this area after dropping it and a new notebook will be created as needed.

In some cases, you might want to create a docking area that is not currently visible (for instance, it is often useful to put the location window in the right docking area).

To achieve this, drop the window on the small handle that surrounds the whole GPS window (a black rectangle will appear on the screen when your mouse is over that area). If you then drop the item, a new docking area will be created.

System window

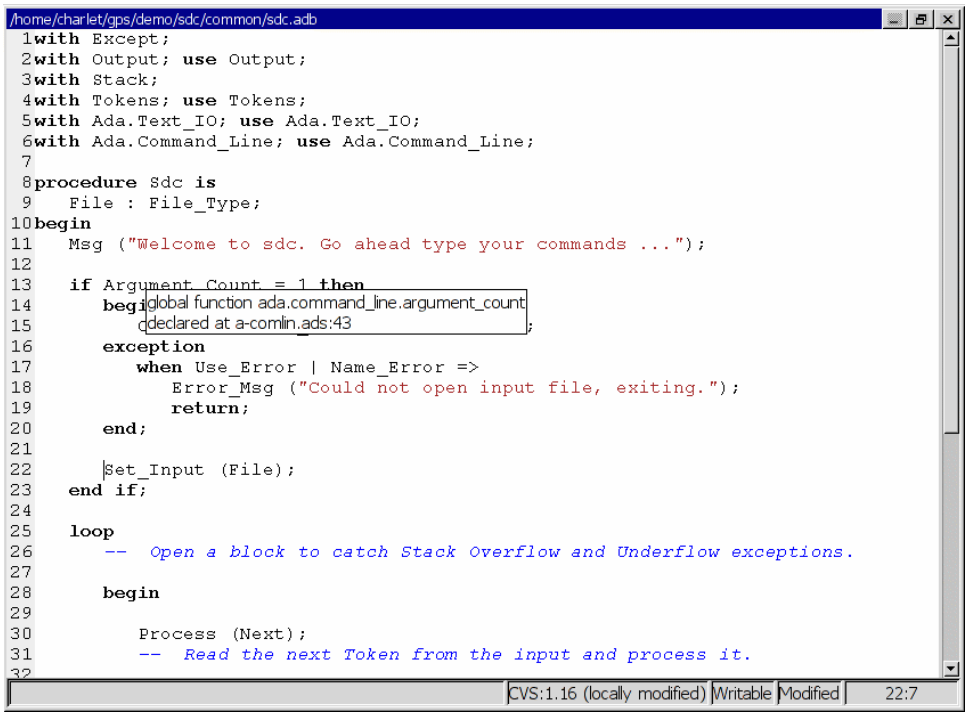
If you drop a window outside of GPS (for instance, on the background of your screen), the window will be floated.

If you maintain the ⟨shift⟩ key pressed while dropping the window, this might result in a copy operation instead of a simple move. For instance, if you are dropping an editor, a new view of the same editor will be created, resulting in two views present in GPS: the original one is left at its initial location, and a second view is created at the new location.

5 Editing Files

5.1 General Information

Source editing is one of the central parts of GPS, giving in turn access to many other functionalities, including extended source navigation and source analyzing tools.



The integrated source editor provides all the usual capabilities found in integrated environments, including:

A title bar
: Showing the full name of the file including path information.

Line number information
: This is the left area of the source editor. Line numbers can be disabled from the preferences. See Section 15.1 [The Preferences Dialog], page 123. Note that this area can also display additional information, such as the current line of execution when debugging, or cvs annotations.

A scrollbar

Located on the right of the editor, it allows you to scroll through the source file.

A Speed Column

This column, when visible, is located on the left of the editor. It allows you to view all the highlighted lines in a file, at a glance. For example, all the lines containing compilation errors are displayed in the Speed Column. See Section 15.1 [The Preferences Dialog], page 123 for information on how to customize the behavior of the Speed Column.

A status bar

Giving information about the file. It is divided in two sections, one on the left and one on the right of the window.

The left section

The first box on the left shows the current subprogram name for languages that support this capability. Currently `Ada`, `C` and `C++` have this ability. See Section 15.1 [The Preferences Dialog], page 123 to enable or disable this feature.

The right section

If the file is maintained under version control, and version control is supported and enabled in GPS, the first box on the left will show VCS information on the file: the VCS kind (e.g. *CVS*), followed by the revision number, and if available, the status of the file.

The second box shows the current editing mode. This is either *Insert* or *Overwrite* and can be changed using the insert keyboard keys by default.

The third box shows the writable state of the file. You can change this state by clicking on the label directly: this will switch between *Writable* and *Read Only*. Note that this will not change the permissions of the file on disk, it will only change the writable state of the source editor within GPS.

When trying to save a file which is read only on the disk, GPS will ask for confirmation, and if possible, will force saving of the file, keeping its read only state.

The fourth box shows whether the file has been modified since the last save. The three possible states are:

Unmodified
: The file has not been modified since the file has been loaded or saved.

Modified
: The file has been modified since last load or save. Note that if you undo all the editing operations until the last save operation, this label will change to *Unmodified*.

Saved
: The file has been saved and not modified since.

The fifth box displays the position of the cursor in the file by a line and a column number.

A contextual menu
: Displayed when you right-click on any area of the source editor. See in particular Section 6.3 [Contextual Menus for Source Navigation], page 45 for more details.

Syntax highlighting
: Based on the programming language associated with the file, reserved words and languages constructs such as comments and strings are highlighted in different colors and fonts. See Section 15.1 [The Preferences Dialog], page 123 for a list of settings that can be customized.

Automatic indentation
: When enabled, lines are automatically indented each time you press the ⟨Enter⟩ key, or by pressing the indentation key. The indentation key is ⟨Ctrl-Tab⟩ by default, and can be changed in the key manager dialog, See Section 15.3 [The Key Manager Dialog], page 139.

  If a set of lines is selected when you press the indentation key, this whole set of lines will be indented.

Tooltips
: When you leave the mouse over a word in the source editor, a small window will automatically pop up if there are relevant contextual information to display about the word.

  The type of information displayed depends on the current state of GPS.

  In normal mode, the entity kind and the location of declaration is displayed when this information is available. That is, when the cross-reference information about the current file has been generated. If there is no relevant information, no tooltip is displayed. See Section 6.1 [Support for Cross-References], page 43 for more information.

In debugging mode, the value of the variable under the mouse is displayed in the pop up window if the variable is known to the debugger. Otherwise, the normal mode information is displayed.

You can disable the automatic pop up of tool tips in the Editor section of the preferences dialog. See Section 15.1 [The Preferences Dialog], page 123.

Word completion

It is useful when editing a file and using often the same words to get automatic word completion. This is possible by typing the ⟨Ctrl-/⟩ key combination (customizable through the key manager dialog) after a partial word: the next possible completion will be inserted in the editor. Typing this key again will cycle through the list of possible completions.

Completions are searched in the edited source file, by first looking at the closest words and then looking further in the source as needed.

Delimiter highlighting

When the cursor is moved before an opening delimiter or after a closing delimiter, then both delimiters will be highlighted. The following characters are considered delimiters: ()[]{}. You can disable highlighting of delimiters in the preferences.

You can also jump to a corresponding delimiter by using the ⟨Ctrl-'⟩ key, that can be configured in the preferences. Typing twice on this key will move the cursor back to its original position.

Current line highlighting

You can configure the editor to highlight the current line with a certain color. See Section 15.1 [The Preferences Dialog], page 123.

Current block highlighting

If this preference is enabled, the editor will highlight the current block of code, e.g. the current `begin...end` block, or loop statement, etc...

The block highlighting will also take into account the changes made in your source code, and will recompute automatically the current block when needed.

This capability is currently implemented for Ada, C and C++ languages.

Block folding

When enabled, the editor will display - icons on the left side, corresponding to the beginning of subprograms. If you

click on one of these icons, all the lines corresponding to this subprogram are hidden, except the first one. As for the block highlighting, these icons are recomputed automatically when you modify your sources and are always kept up to date.

This capability is currently implemented for Ada, C and C++ languages.

Auto save

You can configure the editor to periodically save modified files. See [autosave delay], page 126 for a full description of this capability.

GPS also integrates with existing third party editors such as `Emacs` or `vi`. See Section 5.6 [Using an External Editor], page 36.

5.2 Editing Sources

5.2.1 Key bindings

In addition to the standard keys used to navigate in the editor (up, down, right, left, page up, page down), the integrated editor provides a number of key bindings allowing easy navigation in the file.

In addition, there are several ways to define new key bindings, see Section 15.4.12 [Defining text aliases], page 165 and Section 15.4.7 [Binding actions to keys], page 156.

⟨Ctrl-Shift-⟩ Pressing these two keys allow you to enter characters using their hexadecimal value. For example, pressing ⟨Ctrl-Shift-2-0⟩ will insert a space character (ASCII 32, which is 20 in hexadecimal).

⟨Ctrl-x / Shift-delete⟩
Cut to clipboard

⟨Ctrl-c / Ctrl-insert⟩
Copy to clipboard

⟨Ctrl-v / Shift-insert⟩
Paste from clipboard

⟨Ctrl-s⟩ Save file to disk

⟨Ctrl-z⟩ Undo previous insertion/deletion

⟨Ctrl-r⟩ Redo previous insertion/deletion

⟨Insert⟩ Toggle overwrite mode

⟨Ctrl-a⟩ Select the whole file

⟨Home / Ctrl-Pgup⟩
Go to the beginning of the line

⟨End / Ctrl-Pgdown⟩
Go to the end of the line

⟨Ctrl-Home⟩ Go to the beginning of the file

⟨Ctrl-End⟩ Go to the end of the file

⟨Ctrl-up⟩ Go to the beginning of the line, or to the previous line if already at the beginning of the line.

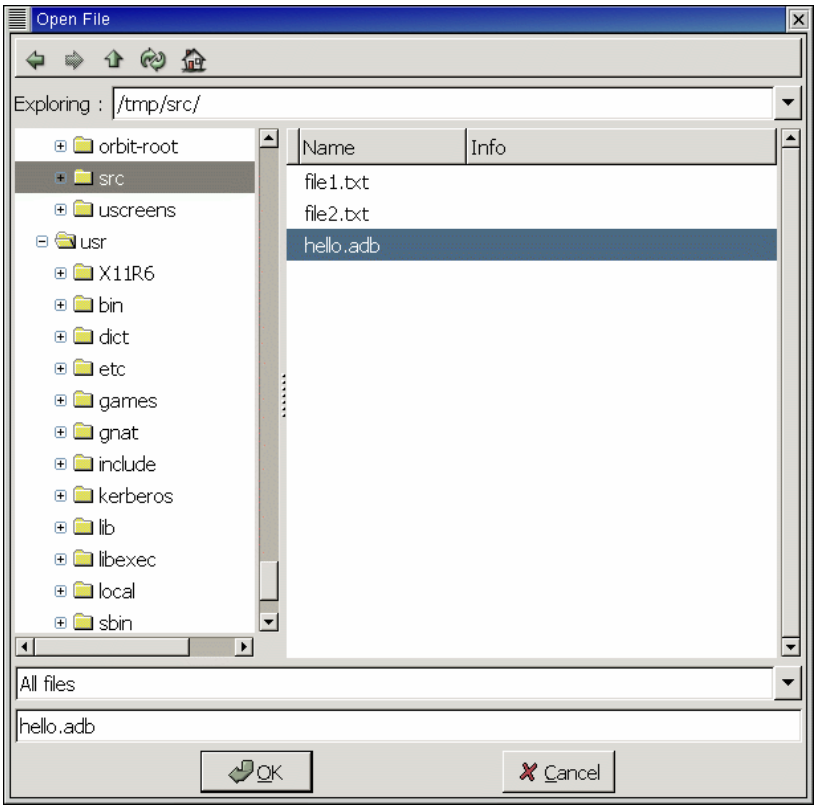
⟨Ctrl-down⟩ Go to the end of the line, or to the beginning of the next line if already at the end of the line.

⟨Ctrl-delete⟩ Delete end of the current word.

⟨Ctrl-backspace⟩
Delete beginning of the current word.

5.3 The File Selector

The file selector is a dialog used to select a file. Under Windows, the default is to use the standard file selection widget. Under other platforms, the file selector is a built-in dialog:



This dialog provides the following areas and capabilities:

- A tool bar on the top composed of five buttons giving access to common navigation features:

  left arrow
  go back in the list of directories visited

  right arrow
  go forward

  up arrow
  go to parent directory

  refresh refresh the contents of the directory

home go to home directory (value of the HOME environment variable, or / if not defined)

- A list with the current directory and the last directories explored. You can modify the current directory by modifying the text entry and hitting ⟨Enter⟩, or by clicking on the right arrow and choose a previous directory in the pop down list displayed.
- A directory tree. You can open or close directories by clicking on the + and - icons on the left of the directories, or navigate using the keyboard keys: ⟨up⟩ and ⟨down⟩ to select the previous or the next directory, ⟨+⟩ and ⟨-⟩ to expand and collapse the current directory, and ⟨backspace⟩ to select the parent directory.
- A file list. This area lists the files contained in the selected directory. If a filter is selected in the filter area, only the relevant files for the given filter are displayed. Depending on the context, the list of files may include additional information about the files, e.g. the kind of a file, its size, etc. . .
- A filter area. Depending on the context, one or several filters are available to select only a subset of files to display. The filter *All files* which is always available will display all files in the directory selected.
- A file name area. This area will display the name of the current file selected, if any. You can also type a file or directory name directly, and complete the name automatically by using the ⟨Tab⟩ key.
- A button bar with the `OK` and `Cancel` buttons. When you have selected the right file, clock on `OK` to confirm, or click on `Cancel` at any time to cancel and close the file selection.

5.4 Menu Items

The main menus that give access to extended functionalities related to source editing are described in this section.

5.4.1 The File Menu

New Open a new untitled source editor. No syntax highlighting is performed until the file is saved, since GPS needs to know the file name in order to choose the programming language associated with a file.

When you save a new file for the first time, GPS will ask you to enter the name of the file. In case you have started typing Ada code, GPS will try to guess based on the first main entity in the editor and on the current naming scheme, what should be the default name of this new file.

New View

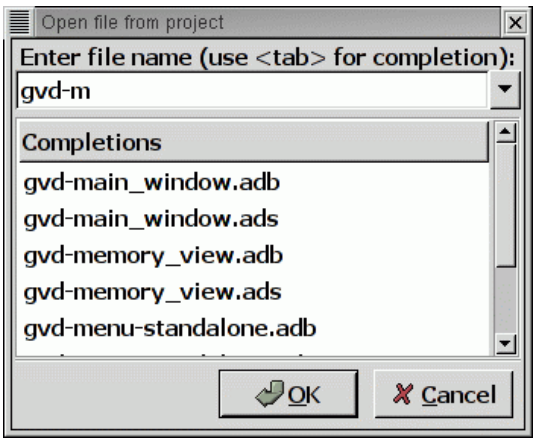
Create a new view of the current editor. The new view shares the same contents: if you modify one of the source views, the other view is updated at the same time. This is particularly useful when you want to display two separate parts of the same file, for example a function spec and its body.

A new view can also be created by keeping the ⟨shift⟩ key pressed while drag-and-dropping the editor (see Section 4.7 [Moving Windows], page 21). This second method is preferred, since you can then specify directly where you want to put the new view. The default when using the menu is that the new view is put on top of the editor itself.

Open... Open a file selection dialog where you can select a file to edit. Under Windows, this is the standard file selector. Under other platforms, this is a built-in file selector described in Section 5.3 [The File Selector], page 28.

Open From Project...

Open a dialog where you can easily and rapidly select a source file from your project.



The first text area allows you to type a file name. You can start the beginning of a file name, and use the ⟨Tab⟩ key to complete the file name. If there are several possible completions, the common prefix will be displayed, and a list of all possible completions will be displayed in the second text area.

You can then either complete the name by typing it, or continue hitting the ⟨Tab⟩ key to cycle through the possible completions, or click on one of the completions in the list displayed.

If you press the down arrow key, the focus will move to the list of completions, so that you can select a file from this list without using the mouse.

Once you have made your choice, click on the `OK` button to validate. Clicking on `Cancel` or hitting the ⟨Esc⟩ key will cancel the operation and close the dialog.

This dialog will only show each file once. If you have extended projects in your hierarchy, some files may be redefined in some extending project. In this case, only the files from the extending project are shown, and you cannot have access through this dialog to the overridden files of the extended project. Of course, you can still use the project explorer or the standard `File->Open` menu to open these files.

Recent Open a sub menu containing a list of the ten most recent files opened in GPS, so that you can reopen them easily.

Save Save the current source editor if needed.

Save As...
Same current file under a different name, using the file selector dialog. See Section 5.3 [The File Selector], page 28.

Save More
Give access to extra save capabilities.

All Save all items, including projects, etc. . .

Desktop Save the desktop to a file. The desktop includes information about files, graphs, . . . and their window size and position in GPS. The desktop is saved per top level project.

Default Desktop
Save the current desktop as the default desktop. The next time you start GPS, if there is no saved desktop associated with the chosen project, then this desktop will be used.

Change Directory...
Open a directory selection dialog that lets you change the current working directory.

Messages
This sub menu gives access to functionalities related to the Messages window. See Section 2.6 [The Messages Window], page 9.

Clear Clear the contents of the Messages window.

Save As... Save the contents of the Messages window to a file. A file selector is displayed to choose the name and location of the file.

Load Contents...
Open a file selector to load the contents of a file in the Messages window. Source locations are identified and loaded in the Locations Tree. See Section 2.8 [The Locations Tree], page 10.

Close Close the current window. This applies to all GPS windows, not only source editors.

Print Print the current window contents, optionally saving it interactively if it has been modified. The Print Command specified in the preferences is used if it is defined. On Unix this command is required; on Windows it is optional.

On Windows, if no command is specified in the preferences the standard Windows print dialog box is displayed. This dialog box allows the user to specify the target printer, the properties of the printer, which pages to print (all, or a specific range of pages), the number of copies to print, and, when more than one copy is specified, whether the pages should be collated. Pressing the Cancel button on the dialog box returns to GPS without printing the window contents; otherwise the specified pages and copies are printed on the selected printer. Each page is printed with a header containing the name of the file (if the window has ever been saved). The page number is printed on the bottom of each page. See [Print Command], page 134.

Exit Exit GPS after confirmation and if needed, confirmation about saving modified windows and editors.

5.4.2 The Edit Menu

Undo Undo previous insertion/deletion in the current editor.

Redo Redo previous insertion/deletion in the current editor.

Cut Cut the current selection and store it in the clipboard.

Copy Copy the current selection to the clipboard.

Paste Paste the contents of the clipboard to the current cursor position.

Select All
Select the whole contents of the current source editor.

Insert File...
Open a file selection dialog and insert the contents of this file in the current source editor, at the current cursor location.

Comment Lines
Comment the current selection or line based on the current programming language syntax.

Uncomment Lines
Remove the comment delimiters from the current selection or line.

Refill Refill text on the selection or current line according to the right margin as defined by the column highlight. see Section 15.1 [The Preferences Dialog], page 123.

Fold all blocks
Collapse all the blocks in the current file.

Unfold all blocks
Uncollapse all the blocks in the current file.

Generate Body
Generate Ada body stub for the current source editor by calling the external tool `gnatstub`.

Pretty Print
Pretty print the current source editor by calling the external tool `gnatpp`. It is possible to specify `gnatpp` switches in the switch editor. See Section 7.8 [The Switches Editor], page 64.

Unit Testing
This sub menu gives access to dialogs that make it easy to generate AUnit stubs. AUnit is an Ada unit testing framework.

New Test Case...
Create a new test case. See AUnit documentation for more details.

New Test Suite...
Create a new test suite. See AUnit documentation for more details.

New Test Harness...
Create a new test harness. See AUnit documentation for more details.

Preferences
Give access to the preferences dialog. See Section 15.1 [The Preferences Dialog], page 123.

Key shortcuts
: Give access to the key manager dialog, to associate commands with special keys. See Section 15.3 [The Key Manager Dialog], page 139.

5.5 Contextual Menus for Editing Files

Whenever you ask for a contextual menu (using e.g. the third button on your mouse) on a source file, you will get access to a number of entries, displayed or not depending on the current context.

Menu entries include the following categories:

Source Navigation
: See Section 6.3 [Contextual Menus for Source Navigation], page 45.

Edit with external editor
: See Section 5.6 [Using an External Editor], page 36.

Dependencies
: See Section 10.3 [Dependency Browser], page 81.

Entity browsing
: See Section 10.4 [Entity Browser], page 84.

Project explorer
: See Section 2.5 [The Project Explorer], page 5.

Version control
: See Section 12.3 [The Version Control Contextual Menu], page 112.

Debugger
: See Section 11.6 [Using the Source Editor when Debugging], page 100.

Case exceptions
: See [Handling of case exceptions], page 35.

5.5.1 Handling of case exceptions

GPS keeps a set of case exceptions that is used by all case insensitive languages. When editing or reformatting a buffer for such a language the case exception dictionary will be checked first. If an exception is found for this word or a substring of the word, it will be used; otherwise the specified casing for keywords or identifiers is used. A substring is defined as a part of the word separated by underscores.

Note that this feature is not activated for entities (keywords or identifiers) for which the casing is set to `Unchanged`. See see Section 15.1 [The Preferences Dialog], page 123.

A contextual menu named **Casing** has the following entries:

Lower *entity*
: Set the selected entity in lower case.

Upper *entity*
: Set the selected entity in upper case.

Mixed *entity*
: Set the selected entity in mixed case (set the first letter and letters before an underscore in upper case, all other letters are set to lower case).

Smart Mixed *entity*
: Set the selected entity in smart mixed case. Idem as above except that upper case letters are kept unchanged.

Add exception for *entity*
: Add the current entity into the case exception dictionary.

Remove exception for *entity*
: Remove the current entity from the case exception dictionary.

To add or remove a substring exception into/from the dictionary you need to first select the substring on the editor. In this case the last two contextual menu entries will be:

Add substring exception for *str*
: Add the selected substring into the case substring exception dictionary.

Remove substring exception for *str*
: Remove the selected substring from the case substring exception dictionary.

5.6 Using an External Editor

GPS is fully integrated with a number of external editors, in particular `Emacs` and `vi`. The choice of the default external editor is done in the preferences. See Section 15.1 [The Preferences Dialog], page 123. The following values are recognized:

`gnuclient`
: This is the recommended client. It is based on Emacs, but needs an extra package to be installed. This is the only client that provides a full integration in GPS, since any extended lisp command can be sent to the Emacs server.

By default, gnuclient will open a new Emacs frame for every file that is opened. You might want to add the following code to your '.emacs' file (create one if needed) so that the same Emacs frame is reused every time:

```
(setq gnuserv-frame (car (frame-list)))
```

See http://www.hpl.hp.co.uk/people/ange/gnuserv/ for more information.

`emacsclient`
: This is a program that is always available if you have installed Emacs. As opposed to starting a new Emacs every time, it will reuse an existing Emacs session. It is then extremely fast to open a file.

`emacs`
: This client will start a new Emacs session every time a file needs to be opened. You should use `emacsclient` instead, since it is much faster, and makes it easier to copy and paste between multiple files. Basically, the only reason to use this external editor is if your system doesn't support `emacsclient`.

`vim`
: `Vim` is a vi-like editor that provides a number of enhancements, for instance syntax highlighting for all the languages supported by GPS. Selecting this external editor will start an xterm (or command window, depending on your system) with a running `vim` process editing the file.

  Note that one limitation of this editor is that if GPS needs to open the same file a second time, it will open a new editor, instead of reusing the existing one.

  To enable this capability, the xterm executable must be found in the PATH, and thus is not supported on Windows systems. Under Windows systems, you can use the `custom` editor instead.

`vi`
: This editor works exactly like vim, but uses the standard `vi` command instead of `vim`.

`custom`
: You can specify any external editor by choosing this item. The full command line used to call the editor can be specified in the preferences (see [custom editor command], page 127).

`none`
: No external editor is used, and the contextual menus simply won't appear.

In the cases that require an Emacs server, GPS will try several solutions if no already running server was found. It will first try to spawn the glide environment distributed with GNAT. If not found in the PATH, it will then start a standard Emacs. The project file currently used in

GPS will be set appropriately the first time Emacs is spawned. This means that if you load a new project in GPS, or modify the paths of the current project, you should kill any running Emacs, so that a new one is spawned by GPS with the appropriate project.

Alternatively, you can reload explicitly the project from Emacs itself by using the menu `Project->Load`

In the preferences, there are three settings that allow you to select the external editor (if left to an empty string, GPS will automatically select the first editor available on your system), to specify the custom editor command, in case you've selector this item, and whether this editor should always be used every time you double-click on a file, or whether you need to explicitly select the contextual menu to open the external editor.

5.7 Using the Clipboard

This section concerns X-Window users who are used to cutting and pasting with the middle mouse button. In the GPS text editor, as in many recent X applications, the *GPS clipboard* is set by explicit cut/copy/paste actions, either through menu items or keyboard shortcuts, and the *primary clipboard* (i.e. the "middle button" clipboard) is set by the current selection.

Therefore, copy/paste between GPS and other X applications using the *primary clipboard* will still work, provided that there is some text currently selected. The *GPS clipboard*, when set, will override the *primary clipboard*.

See `http://www.freedesktop.org/standards/clipboards.txt` for more information.

5.8 Saving Files

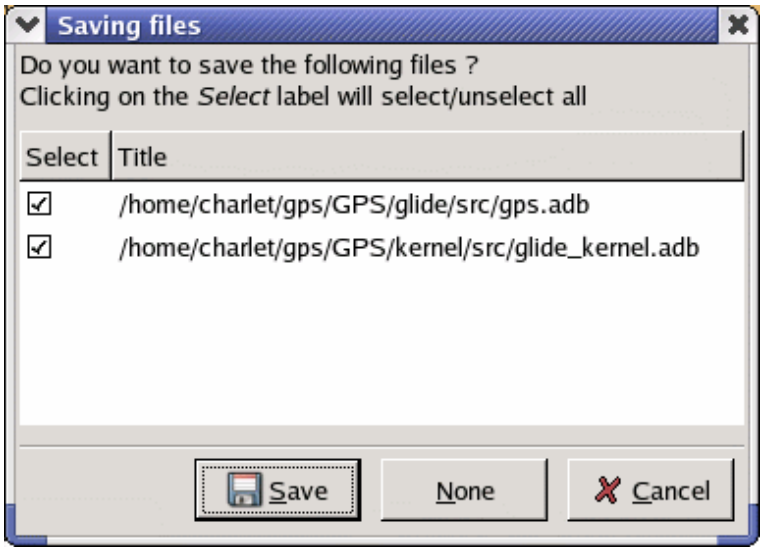
After you have finished modifying your files, you need to save them. The basic method to do that is to select the menu `File->Save`, which saves the currently selected file.

You can also use the menu `File->Save As...` if you want to save the file with another name, or in another directory.

If you have multiple files to save, another possibility is to use the menu `File->Save More->All`. This will open a dialog listing all the currently modified editors that need saving. You can then select individually which one should be saved, and click on `Save` to do the actual saving.

When calling external commands, such as compiling a file, if the `Auto save` preference is disabled, this same dialog is also used, to make sure

that e.g. the compiler will take into account your local changes. If the preference is enabled, the saving is performed automatically.



You can conveniently select or unselect all the files at once by clicking on the title of the first column (labeled *Select*). This will toggle the selection status of the first line, and have the same status for all other editors.

If you press `Cancel` instead of `Save`, no saving will take place, and the action that displayed this dialog is also canceled. Such actions can be for instance starting a compilation command, a VCS operation, or quitting GPS with unsaved files.

5.9 Remote Files

GPS has a basic support for working with files on remote hosts. This includes a number of protocols, described below, which allow you to read a file from a remote host, edit it locally, and then save it transparently to the remote machine.

For now, the support for remote files is only available through the GPS shell window. You start editing a remote file by typing a line similar to

```
Editor.edit protocol://user@machine/full/path
```

where "protocol" should be replaced by the name of the protocol you want to use, "user" is the login name you wish to use on the remote "machine", and "/full/path" is the full path on the remote machine to access the file.

The user name is optional. If it is the same as on the local machine, you can omit the user name as well as the "@" sign.

Likewise, the machine name is optional, if you want to get a file from the local host. This can be used to access files belonging to another user. In this case, you need to specify the "@" sign, but do not insert a machine name right after it.

Remote files can also be used if you want to work with GPS, but the machine on which the files are found isn't supported by GPS.

The following protocols are supported:

ssh This protocol is based on the ssh command line tool, which must therefore be available in the path. It provides encrypted and secure connections to the remote host. Files are transfered in-line, that is the connection is established the first time you access the remote host, and kept open for all further access.

Although ssh can be setup not to require a password, GPS will automatically detect if a password is asked and open a dialog to query it.

The remote system must be a Unix-like system with support for standard Unix commands like `test`, `echo`, `rm` and `ls`.

In the sample shell command above, you would replace the word "protocol" with "ssh" to use this protocol.

rsh This protocol behaves like ssh, except that the connections are not encrypted. However, this protocol is generally available on all Unix machines by default.

It has the same requirements that the ssh protocol. To use it, substitute the word "rsh" to "protocol" in the example above.

telnet This protocol is based on the standard telnet protocol. It behaves much like the two protocols above, with an unencrypted connection.

To use it, substitute the word "telnet" to "protocol" in the example above.

scp This protocol is also based on one of the tools of the ssh suite. It provides encrypted connections, and uses a mixture of ssh and scp connections. Various commands like querying the time stamp of a file are executed through a permanent ssh connection, whereas files are downloaded and uploaded through a one-time scp command.

It basically has the same behavior as the ssh protocol, although it might be slightly slower since a new connection

has to be established every time a file is fetched from, or written to the remote host. However, it might work better than ssh if the file contains 8 bit characters.

To use it, substitute the word "scp" to "protocol" in the example above.

rsync Just like scp is based on ssh, this protocol is based on rsh. It depends on the external tool rsync, and uses a mixture of a rsh connection for commands like querying the time stamp of a file, and one-time connections with rsync to transfer the files.

Rsync is specially optimized to transfer only the parts of a file that are different from the one already on the remote host. Therefore, it will generally provide the best performance when writing the file back to the remote host.

If you set up the environment variable RSYNC_RSH to ssh before starting gps, the connection will then be encrypted when transferring the files.

To use this protocol, substitute the word "rsync" to "protocol" in the example above.

ftp This protocol provides only limited capabilities, but can be used to retrieve or write a file back through an ftp connection, possibly even through an anonymous ftp connection.

To use this protocol, substitute the word "ftp" to "protocol" in the example above.

http This is the usual http protocol to download documents from the web. It is in particular useful for documentation

6 Source Navigation

6.1 Support for Cross-References

GPS provides cross-reference navigation for program entities, such as types, procedures, functions, variables, . . . , defined in your application. The cross-reference support in GPS relies on language-specific tools as explained below.

Ada The GNAT compiler is used to generate the cross-references information needed by GPS. This means that you must compile your application before you browse through the cross-references or view various graphs in GPS. If sources have been modified, you should recompile the modified files.

If you need to navigate through sources that do not compile (e.g after modifications, or while porting an application), GNAT can still generate partial cross-reference information if you specify the `-gnatQ` compilation option. Along with the `-k` option of gnatmake, it is then possible to generate as much relevant information as possible for your non compilable sources.

There are a few special cases where GPS cannot find the external file (called '`ALI file`') that contains the cross-reference information. Most likely, this is either because you haven't compiled your sources yet, or because the source code has changed since the '`ALI file`' was generated.

It could also be that you haven't included in the project the object directories that contain the '`ALI files`'.

In addition, one special case cannot be handled automatically. This is for separate units, whose file names have been crunched through the `gnatkr` command. To handle this, you should force GPS to parse all the '`ALI files`' in the appropriate object directory. This is done by right-clicking on the object directory in the explorer (left-side panel on the main window), and selecting the menu "Parse all xref information".

C/C++ To enable the navigation features for C and C++ source files, you need to first generate a database of symbol references, by going through the menu Build->Recompute C/C++ Xref info. Messages in the console window will indicate the state of the processing. Due to the nature of these languages, in order to provide accurate cross-references, GPS needs to generate the database in two phases: a first pass parses all the files

that have been modified since the previous parsing, and a second pass generates global cross-references by analyzing the complete database. It is thus expected that for large projects, this phase can take a significant amount of CPU to proceed.

In some cases, GPS won't be able to determine the exact function involved in a cross-reference. This will typically occur for overloaded functions, or if multiple functions with the same name, but under different `#ifdef` sections, are defined. In this case, GPS will display a dialog listing the possible choices to resolve the ambiguity.

In addition, the C/C++ parser has the following limitations: namespaces are currently ignored (no specific processing is done for namespaces); minimal support for templates; no attempt is made to process the macros and other preprocessor defines. Macros are considered as special entities, so it is possible to navigate from a macro use to its definition, but the macro content is ignored, which means for example that function calls made through macros won't be detected.

6.2 The Navigate Menu

Find/Replace...
Open the find and replace dialog. See Chapter 8 [Searching and Replacing], page 69.

Find Next
Find next occurrence of the current search. See Chapter 8 [Searching and Replacing], page 69.

Find Previous
Find previous occurrence of the current search. See Chapter 8 [Searching and Replacing], page 69.

Goto Declaration
Go to the declaration/spec of the current entity. The current entity is determined by the word located around the cursor. This item is also accessible through the editor's contextual menu directly. This capability requires the availability of cross-reference information. See Section 6.1 [Support for Cross-References], page 43.

Goto Body
Go to the body/implementation of the current entity. This item is also accessible through the editor's contextual menu

directly. This capability requires the availability of cross-reference information. See Section 6.1 [Support for Cross-References], page 43.

Goto Line...
Open a dialog where you can type a line number, in order to jump to a specific location in the current source editor.

Goto File Spec<->Body
Open the corresponding spec file if the current edited file is a body file, or body file otherwise. This option is only available for the Ada language. This item is also accessible through the editor's contextual menu

Find All References
Find all the references to the current entity in the project. The search is based on the semantic information extracted from the sources, this is not a simple text search. The result of the search is displayed in the location window, see Section 2.8 [The Locations Tree], page 10.

This capability requires support for cross-references. This item is also accessible through the editor's contextual menu

Start Of Statement
Move the cursor position to the start of the current statement, does nothing if the current position is not inside a statement.

End Of Statement
Move the current cursor position to the end of the statement, does nothing if the current position is not inside a statement.

Previous Subprogram
Move the current cursor position to the start of the previous procedure, function, task, protected record or entry.

Next Subprogram
Move the current cursor position to the start of the next procedure, function, task, protected record or entry.

Previous Tag
Go to previous tag/location. See Section 2.8 [The Locations Tree], page 10.

Next Tag Go to next tag/location. See Section 2.8 [The Locations Tree], page 10.

6.3 Contextual Menus for Source Navigation

This contextual menu is available from any source editor. If you right click over an entity, or first select text, the contextual menu will apply to this selection or entity.

Goto declaration of *entity*
: Go to the declaration/spec of *entity*. The current entity is determined by the word located around the cursor or by the current selection if any. This capability requires support for cross-references.

Goto body of *entity*
: Go to the body/implementation of *entity*. This capability requires support for cross-references.

Goto file spec/body
: Open the corresponding spec file if the current edited file is a body file, or body file otherwise. This option is only available for the Ada language.

References
: This item gives access to different capabilities related to listing or displaying references to the current entity or selection.

  Entity `calls`
  : Open or raise the call graph browser on the specified entity and display all the subprograms called by *entity*. See Section 10.2 [Call Graph], page 79.

  Entity `is called by`
  : Open or raise the call graph browser on the specified entity and display all the subprograms calling *entity*. See Section 10.2 [Call Graph], page 79.

    Note that this capability requires a global look up in the project cross-references, which may take a significant amount of time the first time. After a global look up, information is cached in memory, so that further global queries will be faster.

  `Find all references to` *entity*
  : See [Find All References], page 45.

  `Find all local references to` *entity*
  : Find all references to *entity* in the current file (or in the current top level unit for Ada sources). See [Find All References], page 45 for more details.

  `Find all writes to` *entity*
  : Find all writes to an entity. This is a search global to the project. See [Find All References], page 45 for more details.

  `Find all reads of` *entity*
  : Find all non write accesses to an entity. This is a search global to the project. See [Find All References], page 45 for more details.

7 Project Handling

The section on the project explorer (Section 2.5 [The Project Explorer], page 5) has already given a brief overview of what the projects are, and the information they contain.

This chapter provides more in-depth information, and describes how such projects can be created and maintained.

7.1 Description of the Projects

7.1.1 Project files and GNAT tools

This section describes what the projects are, and what information they contain.

The most important thing to note is that the projects used by GPS are the same as the ones used by GNAT. These are text files (using the extension '`.gpr`') which can be edited either manually, with any text editor, or through the more advanced GPS interface.

The exact syntax of the project files is fully described in the GNAT User's Guide (`gnat_ug.html`) and GNAT Reference Manual (`gnat_rm.html`). This is recommended reading if you want to use some of the more advanced capabilities of project files which are not yet supported by the graphical interface.

GPS can load any project file, even those that you have been edited manually. Furthermore, you can manually edit project files created by GPS.

Typically you will not need to edit project files manually, since several graphical tools such as the project wizard (Section 7.6 [The Project Wizard], page 55) and the properties editor(Section 7.7 [The Project Properties Editor], page 62) are provided.

GPS doesn't preserve the layout nor comments of manually created projects after you have edited them in GPS. For instance, multiple case statements in the project will be coalesced into a single case statement. This normalization is required for GPS to be able to preserve the previous semantic of the project in addition to the new settings.

All command-line GNAT tools are project aware, meaning that the notion of project goes well beyond GPS' user interface. Most capabilities of project files can be accessed without using GPS itself, making project files very attractive.

GPS uses the same mechanisms to locate project files as GNAT itself:

- absolute paths

- relative paths. These paths, when used in a with line as described below, are relative to the location of the project that does the with.
- ADA_PROJECT_PATH. If this environment variable is set, it contains a colon-separated (or semicolon under Windows) list of directories in which the project files are searched.

7.1.2 Contents of project files

Project files contain all the information that describe the organization of your source files, object files and executables.

Generally, one project file will not be enough to describe a complex organization. In this case, you will create and use a project hierarchy, with a root project importing other sub projects. Each of the projects and sub projects is responsible for its own set of sources (compiling them with the appropriate switches, put the resulting files in the right directories, . . .).

Each project contains the following information (see the GNAT user's guide for the full list)

- **List of imported projects**: When you are compiling sources from this project, the compiler (either through GNAT or the automatically generated Makefiles) will first make sure that all the imported projects have been correctly recompiled and are up-to-date. This way, dependencies between source files are properly handled.

  If one of the source files of project A depends on some source files from project B, then B must be imported by A. If this isn't the case, the compiler will complain that some of the source files cannot be found.

  One important rule is that each source file name must be unique in the project hierarchy (i.e. a file cannot be under control of two different projects). This ensures that the same file will be found no matter what project is managing the source file that uses
- **List of source directories**: All the sources managed by a project are found in one or more source directories. Each project can have multiple source directories, and a given source directory might be shared by multiple projects.
- **Object directory**: When the sources of the project are compiled, the resulting object files are put into this object directory. There exist exactly one object directory for each project. If you need to split the object files among multiple object directories, you need to create multiple projects importing one another as appropriate.

  When sources from imported sub-projects are recompiled, the resulting object files are put in the sub project's own object directory, and will never pollute the parent's object directory.

- **Exec directory**: When a set of object files is linked into an executable, this executable is put in the exec directory of the project file. If this attribute is unspecified, the object directory is used.
- **List of source files**: The project is responsible for managing a set of source files. These files can be written in any programming languages. Currently, the graphical interface supports Ada, C and C++.

  The default to find this set of source files is to take all the files in the source directories that follow the naming scheme (see below) for each language. In addition if you edit the project file manually, it is possible to provide an explicit list of source files.

  This attribute cannot be modified graphically yet.
- **List of main units**: The main units of a project (or main files in some languages) are the units that contain the main subprogram of the application, and that can be used to link the rest of the application.

  The name of the file is generally related to the name of the executable.

  A given project file hierarchy can be used to compile and link several executables. GPS will automatically update the Compile, Run and Debug menu with the list of executables, based on this list.
- **Naming schemes**: The naming scheme refers to the way files are named for each languages of the project. This is used by GPS to choose the language support to use when a source file is opened. This is also used to know what tools should be used to compile or otherwise work with a source file.
- **Embedded targets and cross environments**: GPS supports cross environment software development: GPS itself can run on a given host, such as GNU/Linux, while compilations, runs and debugging occur on a different remote host, such as Sun/Solaris.

  GPS also supports embedded targets (VxWorks, . . .) by specifying alternate names for the build and debug tools.

  The project file contains the information required to log on the remote host.
- **Tools**: Project files provide a simple way to specify the compiler and debugger commands to use.
- **Switches**: Each tool that is used by GPS (compiler, pretty-printer, debugger, . . .) has its own set of switches. Moreover, these switches may depend on the specific file being processed, and the programming language it is written in.

7.2 Supported Languages

Another information stored in the project is the list of languages that this project knows about. GPS support any number of language, with any name you choose. However, advanced support is only provided by default for some languages (Ada, C and C++), and you can specify other properties of the languages through customization files (see Section 15.4.11 [Adding support for new languages], page 161).

By default, the graphical interface will only give you a choice of languages among the ones that are known to GPS at that point, either through the default GPS support or your customization files. But you can also edit the project files by hand to add support for any language.

Languages are a very important part of the project definition. For each language, you should specify a naming scheme that allows GPS to associate files with that language. You would for instance specify that all '`.adb`' files are Ada, all '`.txt`' files are standard text files, and so on.

Only the files that have a known language associated with them are displayed in the `Project View`, or available for easy selection through the `File->Open From Project` menu. Similarly, only these files are shown in the Version Control System interface.

It is therefore important to properly setup your project to make these files available conveniently in GPS, although of course you can still open any file through the `File->Open` menu.

If your project includes some README files, or other text files, you should add `"txt"` as a language (or any other name you want), and make sure that these files are associated with that language in the `Project properties editor`.

7.3 Scenarios and Configuration Variables

The behavior of projects can be further tailored by the use of scenarios.

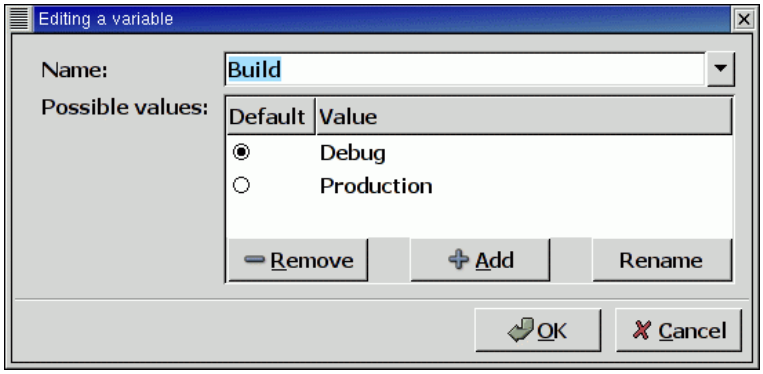
All the attributes of a project, except its list of imported projects, can be chosen based on the value of external variables, whose value is generally coming from the host computer environment, or directly set in GPS (using the small area on top of the project explorer (Section 2.5 [The Project Explorer], page 5).

This facility can for instance be used to compile all the sources either in debug mode (so that the executables can be run in the debugger), or in optimized mode (to reduce the space and increase the speed when delivering the software). In this configuration scenario, all the attributes (source directories, tools, ...) remain the same, except for the compilation switches. It would be more difficult to maintain a completely separate hierarchy of project, and it is much more efficient to create

a new configuration variable and edit the switches for the appropriate scenario (Section 7.7 [The Project Properties Editor], page 62).

7.3.1 Creating new configuration variables

Creating a new scenario variable is done through the contextual menu (right-click) in the project explorer. Select the menu `Add Configuration Variable`. This opens the following dialog:



There are two main areas in this dialog: in the top line, you specify the name of the variable. This name is used for two purposes:

- It is displayed in the project explorer
- This is the name of the environment variable from which the initial value is read. When GPS is started, all configuration variables are initialized from the host computer environment, although you can of course change its value later on inside GPS.

If you click on the arrow on the right of this name area, GPS will display the list of all the environment variables that are currently defined. However, you don't need to pick the name of an existing variable, neither must the variable exist when GPS is started.

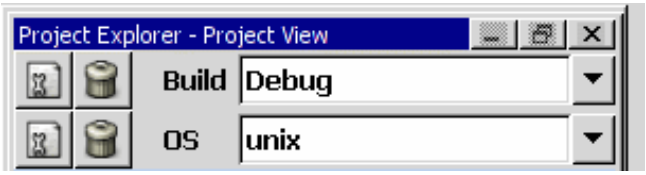
The second part of this dialog is the list of authorized value for this variable. Any other value will generate an error reported by GPS, and the project won't be loaded as a result.

One of these values is the default value (the one whose button in the Default column is selected). This means that if the environment variable doesn't exist when GPS is started, GPS will behave as if it did exist with this default value.

The list of possible values can be edited through the `Remove`, `Add` and `Rename` buttons, although you can also simply click on the value itself to change it.

7.3.2 Editing existing configuration variables

If at least one configuration variable is defined in your project, the area on top of the project explorer will contain something similar to:



This screen shot shows two configuration variables, named `Build` and `OS`, with their current value (resp. `Debug` and `Unix`).

You can easily change the current value of any of these variables by clicking on the arrow on the right of the value. This will display a pop-up window with the list of possible values, from which you select the one you wish to use.

As soon as a new value is selected, GPS will recompute the project explorer (in case source directories, object directories or list of source files have changed). A number of things will also be updated (like the list of executables in the `Compile`, `Run` and `Debug` menus).

Currently, GPS will not recompute the contents of the various browsers (call graph, dependencies, . . .) for this updated project. This would be too expensive to do every time the value changes, and therefore you need to explicitly request an update.

You can change the list of possible values for a configuration variable at any time by clicking on the button to the far left of the variable's name. This will pop up the same dialog that is used to create new variables

Removing a variable is done by clicking on the button immediately to the left of the variable's name. GPS will then display a confirmation dialog.

If you confirm that you want to delete the variable, GPS will simply remove the variable, and from now on act as if the variable always had the value it had when it was deleted.

7.4 The Project Explorer

The project explorer, as mentioned in the general description of the GPS window, is one of the two explorers found by default on the left of the window. It shows in a tree structure the project hierarchy, along with all the source files belonging to the project, and the entities declared in the source files.

It is worth noting that the explorer provides a tree representation of the project hierarchy. If a project is imported by multiple other projects in the hierarchy, then this project will appear multiple times in the explorer.

Likewise, if you have edited the project manually and have used the `limited with` construct to have cycles in the project dependencies, the cycle will expand infinitely. For instance, if project 'a' imports project 'b', which in turns imports project 'a' through a `limited with` clause, then expanding the node for 'a' will show 'b'. In turn, expanding the node for 'b' will show a node for 'a', and so on.

The contextual menu in this explorer provides a number of items to modify the project hierarchy (what each project imports), as well as to visualize and modify the attributes for each projects (compilation switches, naming scheme, . . .)

The following entries are available in the contextual menu:

`Show Projects Imported by...`
: This item will open a new window in GPS, the project browser, which displays graphically the relationships between each project in the hierarchy.

`Save The Project...`
: This item can be selected to save a single project in the hierarchy after it was modified. Modified but unsaved projects in the hierarchy have a special icon (a red exclamation mark is drawn on top of the standard icon). If you would rather save all the modified projects in a single step, use the menu bar item `Project->Save All`.

`Edit Project Properties`
: This item will open a new dialog, and give access to all the attributes of the project: tool switches, naming schemes, source directories, . . . See Section 7.7 [The Project Properties Editor], page 62.

`Add Dependency...`
: This menu and its two sub-menus are the primary way to change the relationship between projects in the hierarchy. You can either add a dependency on an already existing project, or a dependency on a newly created project.

`Remove Dependency...`
: This menu item is the opposite of the previous one, and will remove a dependency between two projects

`Add Configuration Variable`
: This menu item should be used to add new configuration variables, as described in Section 7.3 [Scenarios and Configuration Variables], page 50.

`Edit Project Source File`
: This menu will load the project file into an editor, so that you can manually edit it. This should be used if you need to access some features of the project files that are not accessible graphically (renames statements, variables, . . .)

Any time one or several projects are modified, the contents of the explorer is automatically refreshed. No project is automatically saved. This provides a simple way to temporarily test new values for the project attributes. Unsaved modified projects are shown with a special icon in the project explorer, displaying a red exclamation mark on top of the standard icon:

7.5 The Project Menu

The menu bar item `Project` contains several commands that generally act on the whole project hierarchy. If you only want to act on a single project, use the contextual menu in the project explorer.

Some of these menus apply to the currently selected project. This notion depends on what window is currently active in GPS: if it is the project explorer, the selected project is either the selected node (if it is a project), or its parent project (for a file, directory, . . .). If the currently active window is an editor, the selected project is the one that contains the file.

In all cases, if there is no currently selected project, the menu will apply to the root project of the hierarchy.

These commands are:

`New`
: This menu will open the project wizard (Section 7.6 [The Project Wizard], page 55), so that you can create new project. On exit, the wizard asks whether the newly created project should be loaded. If you select `Yes`, the new project will replace the currently loaded project hierarchy.

`Open`
: This menu opens a file selection dialog, so that any existing project can be loaded into GPS. The newly loaded project replaces the currently loaded project hierarchy. GPS works on a single project hierarchy at a time.

`Recent` This menu can be used to easily switch between the last projects that were loaded in GPS.

`Edit Project Properties`
This menu applies to the currently selected project, and will open the project properties dialog for this project.

`Save All` This will save all the modified projects in the hierarchy.

`Edit File Switches`
This menu applies to the currently selected project. This will open a new window in GPS, listing all the source files for this project, along with the switches that will be used to compile them, See Section 7.8 [The Switches Editor], page 64.

`Recompute Project`
Recompute the contents of the project after modifications outside of GPS. In particular, it will take into account new files added externally to the source directories. This isn't needed for modifications made through GPS. Note also that this doesn't re-parse the physical project file on disk. Instead, you can reopen the project if you have done manual modifications to it.

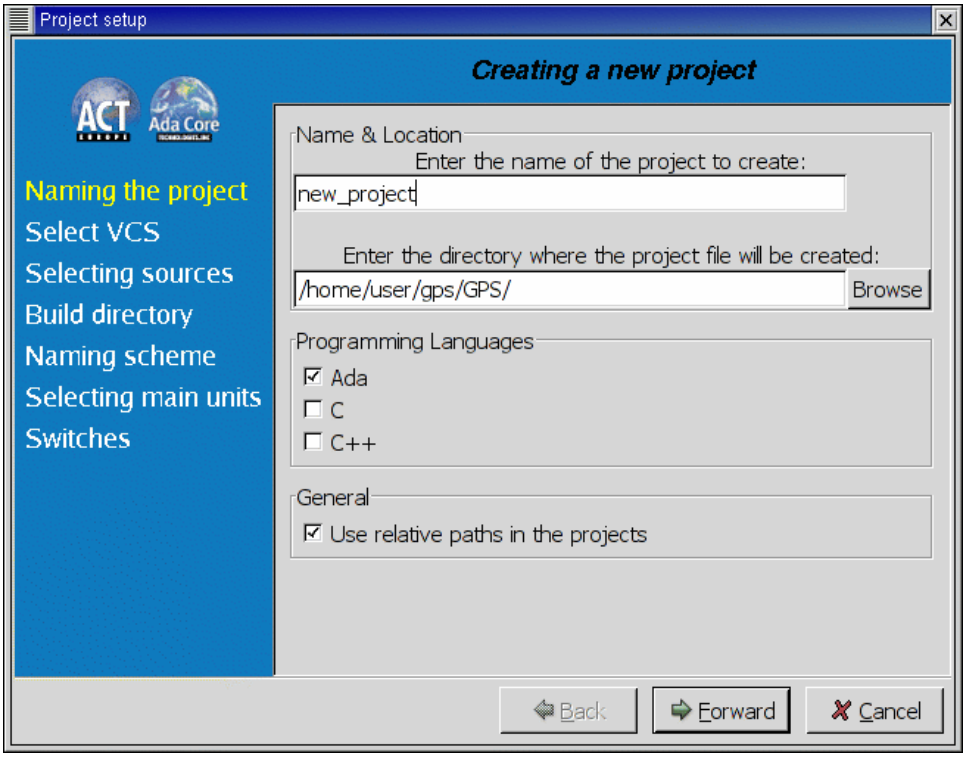
`File View` and `Project View`
These two menus will open (or raise if they are already open) the explorers on the left side of the GPS window.

7.6 The Project Wizard

The project wizard allows you to create in a few steps a new project file. It has a number of pages, each dedicated to editing a specific set of attributes for the project.

The typical way to access this wizard is through the `Project->New...` menu. On exit, the wizard will ask whether the newly created project should replace the currently loaded ones.

The project wizard is also launched when a new dependency is created between two projects, through the contextual menu in the project explorer.



The wizard gives access to the following list of pages:

- Project Naming
- Languages Selection
- Version Control System Selection
- Source Directories Selection
- Build Directory
- Main Units
- Naming Scheme
- Switches

7.6.1 Project Naming

This is the first page displayed by the wizard.

You must enter the name and location of the project to create. This name must be a valid Ada identifier (i.e. start with a letter, optionally followed by a series of digits, letters or underscores). Spaces are not allowed. Likewise, reserved Ada keywords must be avoided. If the name is invalid, GPS will display an error message when you press the `Forward` button.

Child projects can be created from this dialog. These are project whose name is of the form `Parent.Child`. However, the generated project is invalid, since one of the restrictions for these projects, which is currently not enforced by GPS, is that the project must import or extend its parent project. Therefore, you will not be able to load this project in GPS until you have manually edited it.

In this page, you should also select what languages the source files in this project are written in. Currently supported languages are `Ada`, `C` and `C++`. Multiple languages can be used for a single project.

The last part of this page is used to indicate how the path should be stored in the generated project file. Most of the time, this setting will have no impact on your work. However, if you wish to edit the project files by hand, or be able to duplicate a project hierarchy to another location on your disk, it might be useful to indicate that paths should be stored as relative paths (they will be relative to the location of the project file).

7.6.2 Languages Selection

This page is used to select the programming languages used for the sources of this project. By default, only `Ada` is selected. New languages can be added to this list by using XML files, see the section on customizing GPS (see Section 15.4.11 [Adding support for new languages], page 161).

7.6.3 VCS Selection

The second page in the project wizard allows you to select which Version Control system is to be used for the source files of this project.

GPS doesn't attempt to automatically guess what it should use, so you must specify it if you want the VCS operations to be available to you.

The two actions `Log checker` and `File checker` are the name and location of programs to be run just prior an actual commit of the files in the Version Control System. These should be used for instance if you wish to enforce style checks before a file is actually made available to other developers in your team.

If left blank, no program will be run.

7.6.4 Source Directories Selection

This page lists and edits the list of source directories for the project. Any number of source directory can be used (the default is to use the directory which contains the project file, as specified in the first page of the wizard).

If you do not specify any source directory, no source file will be associated with the project, since GPS wouldn't know where to look for them.

To add source directories to the project, select a directory in the top frame, and click on the down arrow. This will add the directory to the bottom frame, which contains the current list of source directories.

You can also add a directory and all its subdirectories recursively by using the contextual menu in the top frame. This contextual menu also provides an entry to create new directories, if needed.

To remove source directories from the project, select the directory in the bottom frame, and click on the up arrow, or use the contextual menu.

All the files in these directories that match one of the language supported by the project are automatically associated with that project.

The relative sizes of the top and bottom frame can be changed by clicking on the separation line between the two frames and dragging the line up or down.

7.6.5 Build Directory

The object directory is the location where the files resulting from the compilation of sources (e.g. '`.o`' files) are placed. One object directory is associated for each project.

The exec directory is the location where the executables are put. By default, this is the same directory as the object directory.

7.6.6 Main Units

The main units of a project are the files that should be compiled and linked to obtain executables.

Typically, for C applications, these are the files that contain the `main()` function. For Ada applications, these are the files that contain the main subprogram each partition in the project.

These files are treated specially by GPS. Some sub-menus of `Build` and `Debug` will have predefined entries for the main units, which make it more convenient to compile and link your executables.

To add main units click on the Add button. This opens a file selection dialog. No check is currently done that the selected file belongs to the project, but GPS will complain later if it doesn't.

When compiled, each main unit will generate an executable, whose name is visible in the second column in this page. If you are using a recent enough version of GNAT (3.16 or more recent), you can change the name of this executable by clicking in the second column and changing the name interactively.

7.6.7 Naming Scheme

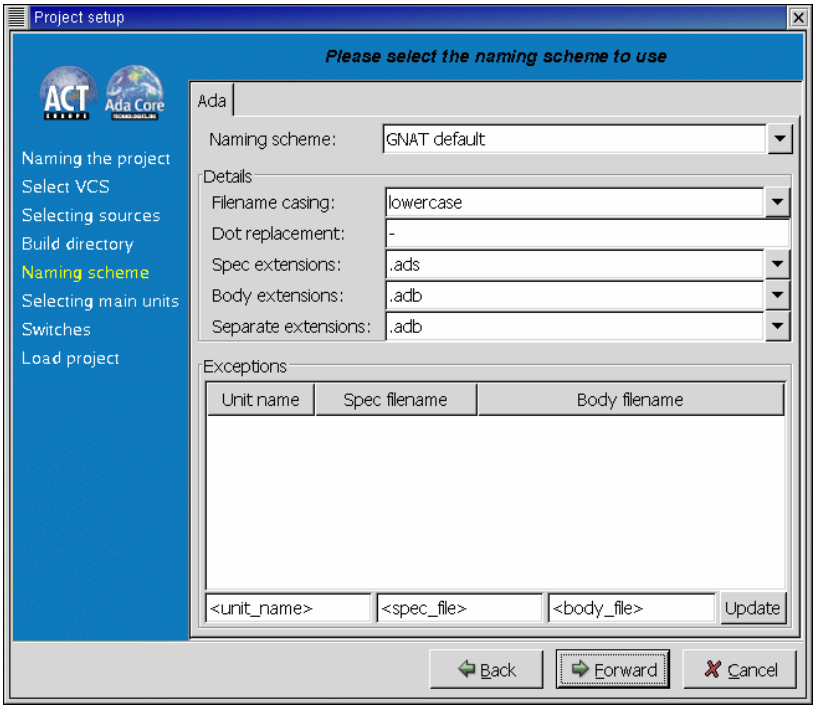
A naming scheme indicates the file naming conventions used in the different languages supported by a given project. For example, all '.adb' files are Ada files, all '.c' files are C files.

GPS is very flexible in this respect, and allows you to specify the default extension for the files in a given programming language. GPS makes a distinction between spec (or header) files, which generally contain no executable code, only declarations, and body files which contain the actual code. For languages other than Ada, this header file is used rather than the body file when you select Go To Declaration in the contextual menu of editors.

In a language like Ada, the distinction between spec and body is part of the definition of the language itself, and you should be sure to specify the appropriate extensions.

The default naming scheme for Ada is GNAT's naming scheme ('.ads' for specs and '.adb' for bodies). In addition, a number of predefined naming schemes for other compilers are available in the first combo

box on the page. You can also create your own customized scheme by entering a free text in the text entries.



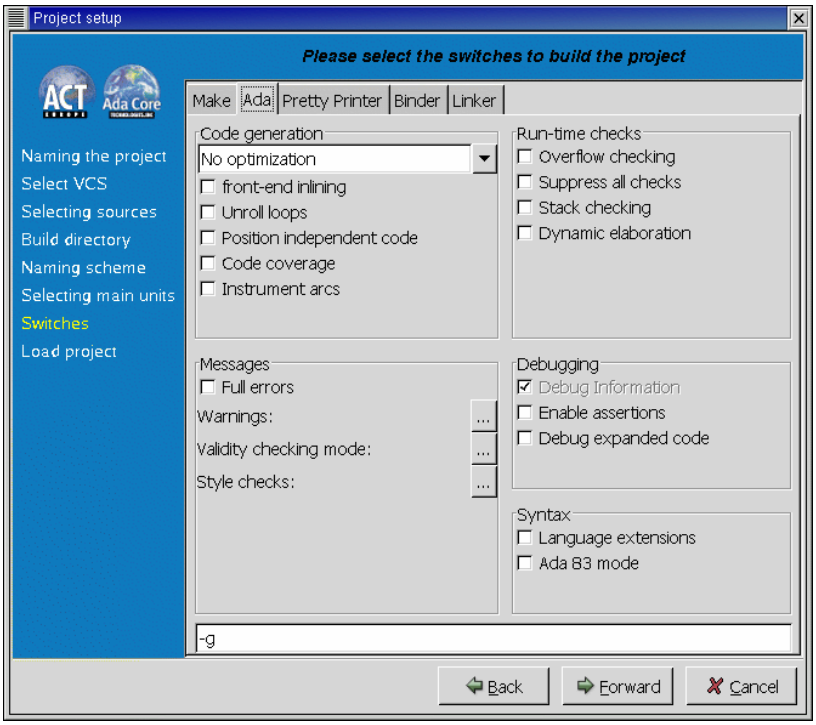
For all languages, GPS accepts exceptions to this standard naming scheme. For instance, this let you specify that in addition to using '`.adb`' for Ada body files, the file '`foo.ada`' should also be considered as an Ada file.

The list of exceptions is displayed in the bottom list of the naming scheme editor. To remove entries from this list, select the line you want to remove, and then press the ⟨Del⟩ key. The contents of the lines can be edited interactively, by double-clicking on the line and column you want to edit.

To add new entries to this list, use the fields at the bottom of the window, and press the update button.

7.6.8 Switches

The last page of the project wizard is used to select the default switches to be used by the various tools that GPS calls (compiler, linker, binder, pretty printer, . . .).



This page appears as a notebook, where each page is associated with a specific tool. All these pages have the same structure:

Graphical selection of switches
: The top part of each page contains a set of buttons, combo boxes, entry fields, . . . which give fast and intuitive access to the most commonly used switches for that tool.

Textual selection of switches
: The bottom part is an editable entry field, where you can directly type the switches. This makes it easier to move from an older setup (e.g. Makefile, script) to GPS, by copy-pasting switches.

The two parts of the pages are kept synchronized at any time: clicking on a button will edit the entry field to show the new switch; adding a new switch by hand in the entry field will activate the corresponding button if there is one.

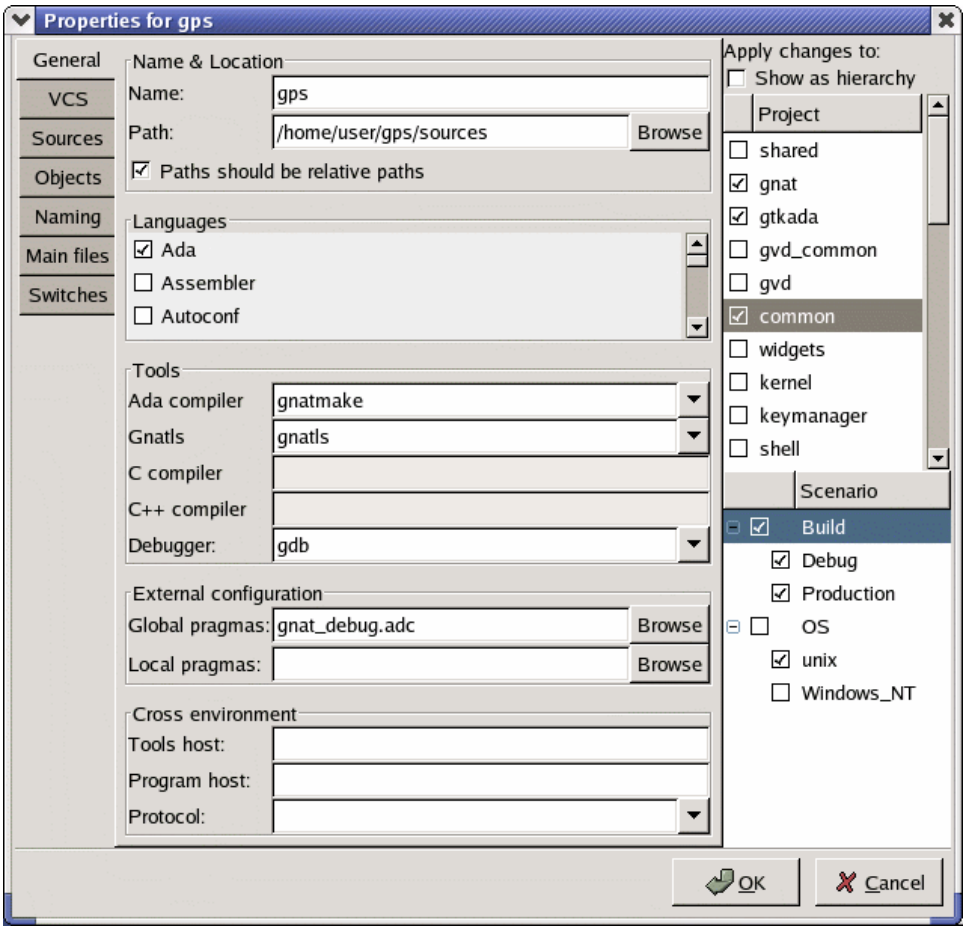
Any switch can be added to the entry field, even if there is no corresponding button. In this case, GPS will simply forward it to the tool when it is called, without trying to represent it graphically.

7.7 The Project Properties Editor

The project properties editor gives you access at any time to the properties of your project. It is accessible through the menu `Project->Edit Project Properties`, and through the contextual menu `Edit project properties` on any project item, e.g. from the Project View or the Project Browser.

If there was an error loading the project (invalid syntax, non-existing directories, . . .), a warning dialog is displayed when you select the menu. This reminds you that the project might be only partially loaded, and editing it might result in the loss of data. In such cases, it is recommended that you edit the project file manually, which you can do directly from the pop-up dialog.

Fix the project file as you would for any text file, and then reload it manually (through the `Project->Open...` or `Project->Recent` menus.



The project properties editor is divided in three parts:

The attributes editor

The contents of this editor are very similar to that of the project wizard (see Section 7.6 [The Project Wizard], page 55). In fact, all pages but the `General` page are exactly the same, and you should therefore read the description for these in the project wizard chapter.

The general page gives access to more attributes than the general page of the project wizard does. In addition, you can select the name of the external tools that GPS uses (such as compilers, debugger, . . .).

See also Chapter 14 [Working in a Cross Environment], page 121 for more info on the `Cross environment` attributes.

The project selector

This area, in the top-right corner of the properties editor, contains a list of all the projects in the hierarchy. The value in the attributes editor is applied to all the selected projects in this selector. You cannot unselect the project for which you activated the contextual menu.

Clicking on the right title bar (`Project`) of this selector will sort the projects in ascending or descending order.

Clicking on the left title bar (untitled) will select or unselect all the projects.

This selector has two different possible presentations, chosen by the toggle button on top: you can either get a sorted list of all the projects, each one appearing only once. Or you can have the same project hierarchy as displayed in the project explorer.

The scenario selector

This area, in the bottom-right corner of the properties editor, lists all the scenario variables declared for the project hierarchy. By selecting some or all of their values, you can chose to which scenario the modifications in the attributes editor apply.

Clicking on the left title bar (untitled, on the left of the `Scenario` label) will select or unselect all values of all variables.

To select all values of a given variable, click on the corresponding check button.

7.8 The Switches Editor

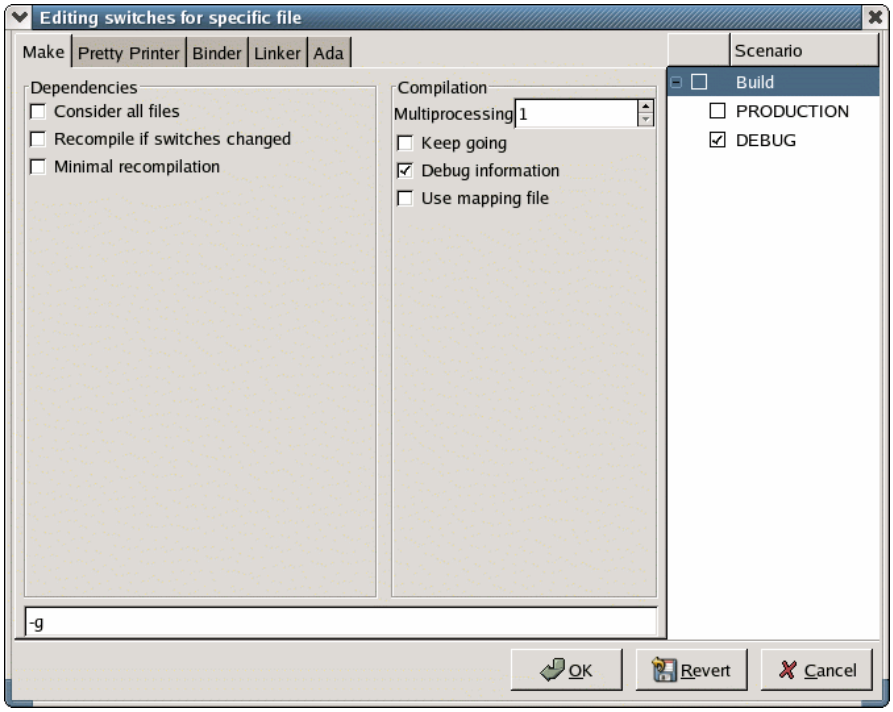
The switches editor, available through the menu `Project->Edit Switches`, lists all the source files associated with the selected project.

For each file, the compiler switches are listed. These switches are displayed in gray if they are the default switches defined at the project level (see Section 7.7 [The Project Properties Editor], page 62). They are defined in black if they are specific to a given file.

Double-clicking in the switches column allows you to edit the switches for a specific file. It is possible to edit the switches for multiple files at the same time by selecting them before displaying the contextual menu (`Edit switches for all selected files`).

When you double-click in one of the columns that contain the switches, a new dialog is opened that allows you to edit the switches specific to the selected files.

This dialog has a button titled `Revert`. Clicking on this button will cancel any file-specific switch, and revert to the default switches defined at the project level.



7.9 The Project Browser

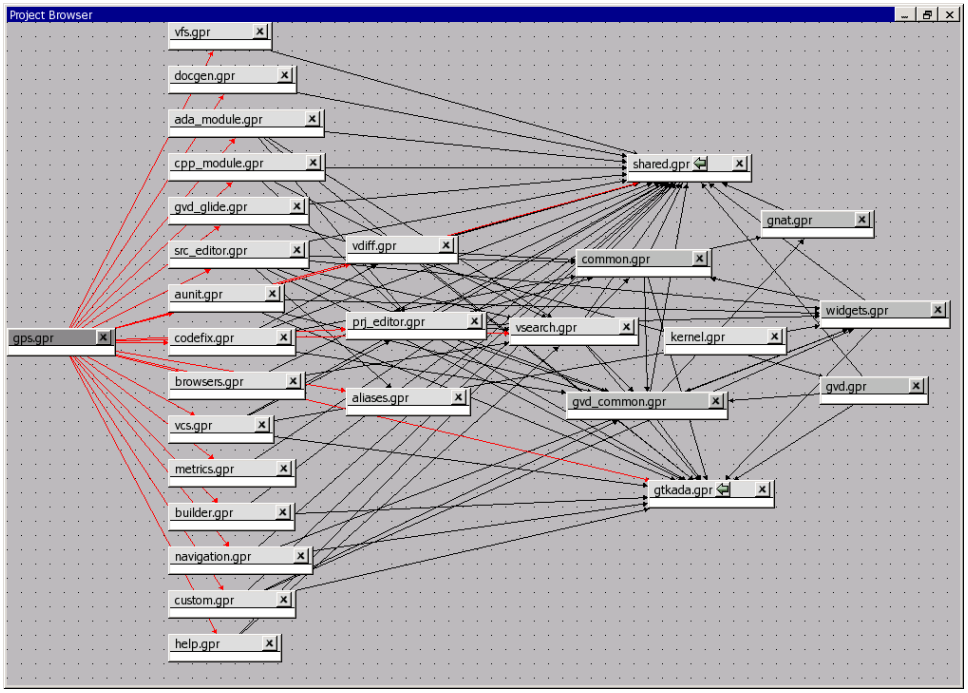
The project graph is a special kind of browser (see Chapter 10 [Source Browsing], page 77). It shows the dependencies between all the project in the project hierarchy. Two items in this browser will be linked if one of them imports the other.

It is accessed through the contextual menu in the project explorer, by selecting the `Show projects imported by...` item, when right-clicking on a project node.

Clicking on the left arrow in the title bar of the items will display all the projects that import that project. Similarly, clicking on the right arrow will display all the projects that are imported by that project.

The contextual menu obtained by right-clicking on a project item contains several items. Most of them are added by the project ed-

itor, and gives direct access to editing the properties of the project, adding dependencies... See Section 7.4 [The Project Explorer (Editing Projects)], page 52.



Some new items are added to the menu:

`Locate in explorer`
: Selecting this item will switch the focus to the project explorer, and highlight the first project node found that matches the project in the browser item. This is a convenient way to get information like the list of directories or source files for that project.

`Show dependencies`
: This item plays the same role as the right arrow in the title bar, and display all the projects in the hierarchy that are imported directly by the selected project

`Show recursive dependencies`
: This item will display all the dependencies recursively for the project (i.e. the projects it imports directly, the projects that are imported by them, and so on).

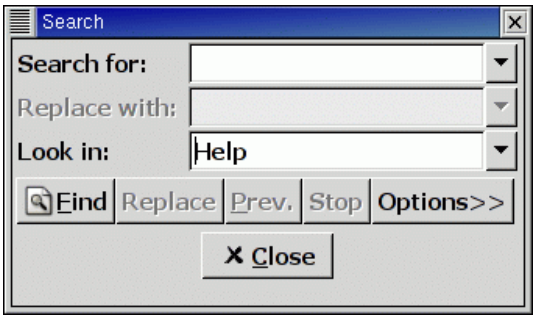
`Show projects depending on`
: This item plays the same role as the left arrow in the title bar, and displays all the projects that directly import the selected project.

8 Searching and Replacing

GPS provides extensive search capabilities among its different elements. For instance, it is possible to search in the currently edited source file, or in all the source files belonging to the project, even those that are not currently open. It is also possible to search in the project explorer (on the left side of the main GPS window), or the help modules,. . .

All these search contexts are grouped into a single graphical window, that you can open either through the menu `Navigate->Find/Replace...`, or the shortcut ⟨Ctrl-F⟩.

Selecting either of these two options will pop up a dialog on the screen, similar to the following:



On this screen shot, you can see three entry fields:

`Search for`
: This is the location where you type the string or pattern you are looking for. The search widget supports two modes, either fixed strings or regular expressions. You can commute between the two modes by either clicking on the `Options` button and selecting the appropriate check box, or by opening the combo box (click on the arrow on the right of the entry field).

  In this combo box, a number of predefined patterns are provided. The top two ones are empty patterns, that automatically set up the appropriate fixed strings/regular expression mode. The other regular expressions are language-specific, and will match patterns like Ada type definition, C++ method declaration,. . .

`Replace with`
: This field should contain the string that will replace the occurrences of the pattern defined above. The combo box provides a history of previously used replacement strings.

`Look in` This field defines the context in which the search should occur. GPS will automatically select the most appropriate context when you open the search dialog, depending on which component currently has the focus. You can of course change the context to another one if needed.

Clicking on the arrow on the right will display the list of all possible contexts. This list includes:

`Project Explorer`
: Search in the project explorer. An extra *Scope* box will be displayed where you can specify the scope of your search, which can be a set of: `Projects`, `Directories`, `Files`, `Entities`. The search in entities may take a long time, search each file is parsed during the search.

`Open Files`
: Search in all the files that are currently open in the source editor. The *Scope* entry is described in the `Files...` section below.

`Files...`
: Search in a given set of files. An extra *Files* box will be displayed where you can specify the files by using standard shell (Unix or Windows) regular expression, e.g. `*.ad?` for all files ending with .ad and any trailing character. The directory specified where the search starts, and the *Recursive search* button whether sub directories will be searched as well.

  The *Scope* entry is used to restrict the search to a set of language constructs, e.g. to avoid matching on comments when you are only interested in actual code, or to only search strings and comments, and ignore the code.

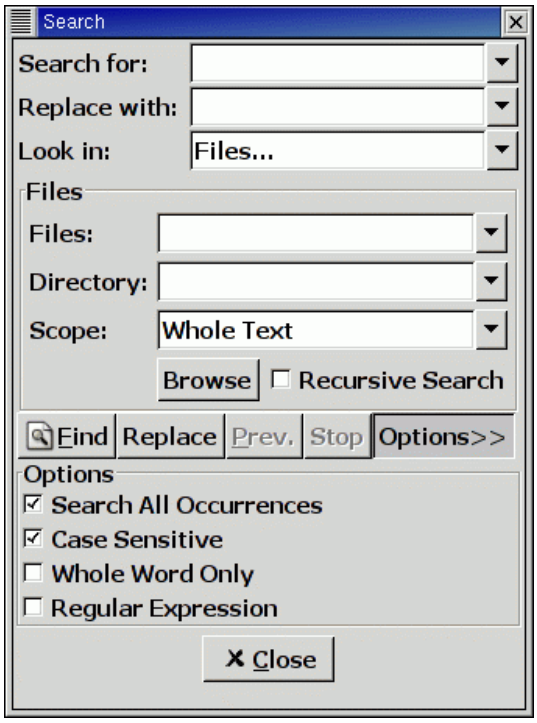
`Files From Project`
: Search in all the files from the project, including files from project dependencies. The *Scope* entry is described in the `Files...` section above.

`Current File`
: Search in the current source editor. The *Scope* entry is described in the `Files...` section above.

`Project Browser`
: Search in the project browser (see Section 7.9 [The Project Browser], page 65).

`Help`
: Search in the help window.

The second part of the window is a row of buttons, to start the search (or continue to the next occurrence), to stop the current search when it is taking too long, or to display the options.



There are four check boxes in this options box.

`"Search All Occurrences"`

The default mode for the search widget is interactive searching: its stops as soon as one occurrence of the pattern is found. You then have to press the `Next` button (or the equivalent shortcut ⟨Ctrl-N⟩) to go to the next occurrence.

However, if you enable this check box, the search widget will start searching for all occurrences right away, and put the results in a new window called `Locations` (initially found in the bottom dock of the GPS window). You can interrupt the search at any time by pressing the `Stop` button: this will stop when the next occurrence is found.

This button is reset to its default value whenever you modify the searched pattern or the replacement text.

"Case Sensitive"
: By default, patterns are case insensitive (upper-case letters and lower-case letters are considered as equivalent). You can change this behavior by clicking on this check box.

"Whole Word Only"
: If activated, this check box will force the search engine to ignore substrings. "sensitive" will no longer match "insensitive".

"Regular Expression"
: This button commutes between fixed string patterns and regular expressions. You can also commute between these two modes by selecting the arrow on the right of the Search for: field. The grammar followed by the regular expressions is similar to the Perl and Python regular expressions grammar, and is documented in the GNAT run time file 'g-regpat.ads'. To open it from GPS, you can use the open from project dialog (File->Open From Project...) and type g-regpat.ads. See [Open From Project], page 31 for more information on this dialog.

As most GPS components, the search window is under control of the multiple document interface, and can thus be integrated into the main GPS window instead of being an external window.

To force this behavior, open the menu Window, select Search in the list at the bottom of the menu, and then select either Floating or Docked.

If you save the desktop (File->Save More->Desktop, GPS will automatically reopen the search dialog in its new place when it is started next time.

9 Compilation/Build

This chapter describes how to compile files, build executables and run them. Most capabilities can be accessed through the `Build` menu item, or through the `Build` and `Run` contextual menu items, as described in the following section.

When compiler messages are detected by GPS, an entry is added in the *Locations tree*, allowing you to easily navigate through the compiler messages (see Section 2.8 [The Locations Tree], page 10), or even to automatically correct some errors or warnings (see Section 13.3 [Code Fixing], page 118).

9.1 The Build Menu

The build menu gives access to capabilities related to checking, parsing and compiling files, as well as creating and running executables.

Check Syntax
: Check the syntax of the current source file. Display an error message in the *Messages* window if no file is currently selected.

Compile File
: Compile the current file. Display an error message in the *Messages* window if no file is selected.

  If errors or warnings occur during the compilation, the corresponding locations will appear in the Locations Tree. If the corresponding Preference is set, the source lines will be highlighted in the editors (see Section 15.1 [The Preferences Dialog], page 123). To remove the highlighting on these lines, remove the files from the Locations Tree.

Make

main
: For each main source file defined in your top level project, an entry is listed to build (compile, bind, link) this source file. Similarly the `Build` contextual menu accessible from a project entity contains the same entries.

Compile all sources
: Compile all source files defined in the currently selected project, or by default the top level project.

All
: Build and link all main units defined in your project. If no main unit is specified in your project, build all files defined in your project and

subprojects recursively. For a library project file, compile sources and recreate the library when needed.

<current file>
Consider the currently selected file as a main file, and build it.

Custom... Display a text entry where you can enter any external command. This menu is very useful when you already have existing build scripts, make files, . . . and want to invoke them from GPS.

Recompute C/C++ Xref info
Recompute the cross-reference information for C and C++ source files. See Section 6.1 [Support for Cross-References], page 43.

Run

main For each main source file defined in your top level project, an entry is listed to run the executable associated with this main file. Running an application will first open a dialog where you can specify command line arguments to your application, if needed. You can also specify whether the application should be run within GPS (the default), or using an external terminal.

When running an application from GPS, a new execution window is added in the bottom area where input and output of the application is handled. This window is never closed automatically, even when the application terminates, so that you can still have access to the application's output. If you explicitly close an execution window while an application is still running, a dialog window will be displayed to confirm whether the application should be terminated.

When using an external terminal, GPS launches an external terminal utility that will take care of the execution and input/output of your application. This external utility can be configured in the preferences dialog (*Helpers->Execute command*).

Similarly, the `Run` contextual menu accessible from a project entity contains the same entries.

Custom... Similar to the entry above, except that you can run any arbitrary executable.

Interrupt
Interrupt the current compilation or build.

10 Source Browsing

10.1 General Issues

GPS contains several kinds of browsers, that have a common set of basic functionalities. There are currently four such browsers: the project browser (see Section 7.9 [The Project Browser], page 65), the call graph (see Section 10.2 [Call Graph], page 79), the dependency browser (see Section 10.3 [Dependency Browser], page 81) and the entity browser (see Section 10.4 [Entity Browser], page 84).

All these browsers are interactive viewers. They contain a number of items, whose visual representation depends on the type of information displayed in the browser (they can be projects, files, entities, . . .).

In addition, the following capabilities are provided in all browsers:

Scrolling
: When a lot of items are displayed in the canvas, the currently visible area might be too small to display all of them. In this case, scrollbars will be added on the sides, so that you can make other items visible. Scrolling can also be done with the arrow keys.

Layout
: A basic layout algorithm is used to organize the items. This algorithm is layer oriented: items with no parents are put in the first layer, then their direct children are put in the second layer, and so on. Depending on the type of browser, these layers are organized either vertically or horizontally. This algorithm tries to preserve as much as possible the positions of the items that were moved interactively.

  The `refresh layout` menu item in the background contextual menu can be used to recompute the layout of items at any time, even for items that were previously moved interactively.

Interactive moving of items
: Items can be moved interactively with the mouse. Click and drag the item by clicking on its title bar. The links will still be displayed during the move, so that you can check whether it overlaps any other item. If you are trying to move the item outside of the visible part of the browser, the latter will be scrolled.

Links
: Items can be linked together, and will remain connected when items are moved. Different types of links exist, see the description of the various browsers.

By default, links are displayed as straight lines. You can choose to use orthogonal links instead, which are displayed only with vertical or horizontal lines. Select the entry `orthogonal links` in the background contextual menu.

Exporting

The entire contents of a browser can be exported as a `png` image using the entry `Export...` in the background contextual menu.

Zooming Several different zoom levels are available. The contextual menu in the background of the browser contains three entries: `zoom in`, `zoom out` and `zoom`. The latter is used to select directly the zoom level you want.

This zooming capability is generally useful when lots of items are displayed in the browser, to get a more general view of the layout and the relationships between the items.

Selecting items

Items can be selected by clicking inside them. Multiple items can be selected by holding the ⟨control⟩ key while clicking in the item. Alternatively, you can click and drag the mouse inside the background of the browser. All the items found in the selection rectangle when the mouse is released will be selected.

Selected items are drawn with a different title bar color. All items linked to them also use a different title bar color, as well as the links. This is the most convenient way to understand the relationships between items when lots of them are present in the browser.

Hyper-links

Some of the items will contain hyper links, displayed in blue by default, and underlined. Clicking on these will generally display new items.

Two types of contextual menus are available in the browsers: the background contextual menu is available by right-clicking in the background area (i.e. outside of any item). As described above, it contains entries for the zooming, selecting of orthogonal links, and refresh; the second kind of contextual menu is available by right-clicking in items.

The latter menu contains various entries. Most of the entries are added by various modules in GPS (VCS module, source editor, ...). In addition, each kind of browser also has some specific entries, which is described in the corresponding browser's section.

There are two common items in all item contextual menus:

`Hide Links`

Browsers can become confusing if there are many items and many links. You can lighten them by selecting this menu entry. As a result, the item will remain in the canvas, but none of the links to or from it will be visible. Selecting the item will still highlight linked items, so that this information remains available.

`Remove all other items`

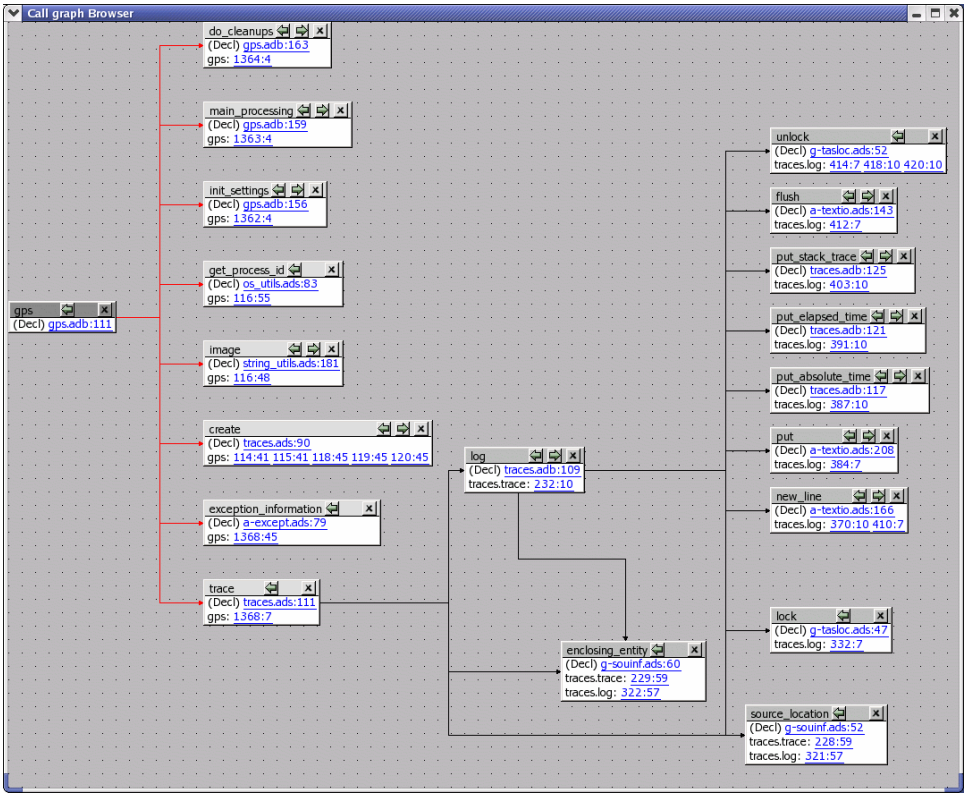
Selecting this menu item will remove all items but the selected one.

10.2 Call Graph

The call graph shows graphically the relationship between subprogram callers and callees. A link between two items indicate that one of them is calling the other.

A special handling is provided for renaming entities (in Ada): if a subprogram is a renaming of another one, both items will be displayed in the browser, with a special hashed link between the two. Since the

renaming subprogram doesn't have a proper body, you will then need to ask for the subprograms called by the renamed to get the list.



In this browser, clicking on the right arrow in the title bar will display all the entities that are called by the selected item.

Clicking on the left arrow will display all the entities that call the selected item (i.e. its callers).

This browser is accessible through the contextual menu in the project explorer and source editor, by selecting one of the items:

All boxes in this browser list several information: the location of their declaration, and the list of all their references in the other entities currently displayed in the browser. If you close the box for an entity that calls them, the matching references are also hidden, to keep the contents of the browser simpler.

`References->`*Entity* `calls`

Display all the entities called by the selected entity. This has the same effect as clicking on the right title bar arrow if the item is already present in the call graph.

`References->`*Entity* `is called by`
: Display all the entities called by the selected entity. This has the same effect as clicking on the left title bar arrow if the item is already present in the call graph.

The contextual menu available by right-clicking on the entities in the browser has the following new entries, in addition to the ones added by other modules of GPS.

Entity `calls`
: Same as described above.

Entity `is called by`
: Same as described above.

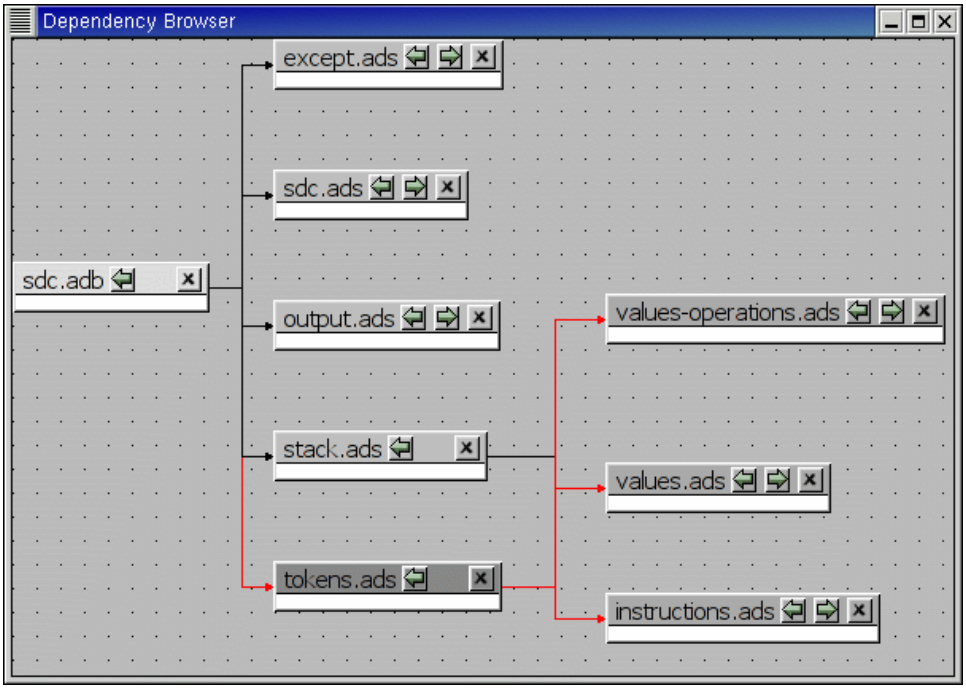
`Go To Spec`
: Selecting this item will open a source editor that displays the declaration of the entity.

`Go To Body`
: Selecting this item will open a source editor that displays the body of the entity.

`Locate in explorer`
: Selecting this menu entry will move the focus to the project explorer, and select the first node representing the file in which the entity is declared. This makes it easier to see which other entities are declared in the same file.

10.3 Dependency Browser

The dependency browser shows the dependencies between source files. Each item in the browser represents one source file.



In this browser, clicking on the right arrow in the title bar will display the list of files that the selected file depends on. A file depend on another one if it explicitly imports it (`with` statement in Ada, or `#include` in C/C++). Implicit dependencies are currently not displayed in this browser, since the information is accessible by opening the other direct dependencies.

Clicking on the left arrow in the title bar will display the list of files that depend on the selected file.

This browser is accessible through the contextual menu in the explorer and the source editor, by selecting one of the following items:

`Show dependencies for` *file*
: This has the same effect as clicking on the right arrow for a file already in the browser, and will display the direct dependencies for that file.

`Show files depending on` *file*
: This has the same effect as clicking on the left arrow for a file already in the browser, and will display the list of files that directly depend on that file.

The background contextual menu in the browser adds a few entries to the standard menu:

`Open file...`
: This menu entry will display an external dialog in which you can select the name of a file to analyze.

`Refresh`
: This menu entry will check that all links displays in the dependency browser are still valid. If not, they are removed. The arrows in the title bar are also reset if necessary, in case new dependencies were added for the files.

  The browser is not refreshed automatically, since there are lots of cases where the dependencies might change (editing source files, changing the project hierarchy or the value of the scenario variables,...)

`Show system files`
: This menu entry indicates whether standard system files (runtime files for instance in the case of Ada) are displayed in the browser. By default, these files will only be displayed if you explicitly select them through the `Open file` menu, or the contextual menu in the project explorer.

`Show implicit dependencies`
: This menu entry indicates whether implicit dependencies should also be displayed for the files. Implicit dependencies are files that are required to compile the selected file, but that are not explicitly imported through a `with` or `#include` statement. For instance, the body of generics in Ada is an implicit dependency. Any time one of the implicit dependencies is modified, the selected file should be recompiled as well.

The contextual menu available by right clicking on an item also adds a number of entries:

`Analyze other file`
: This will open a new item in the browser, displaying the complement file for the selected one. In Ada, this would be the body if you clicked on a spec file, or the opposite. In C, it depends on the naming conventions you specified in the project properties, but you would generally go from a '`.h`' file to a '`.c`' file and back.

`Show dependencies for` *file*
: These play the same role as in the project explorer contextual menu

10.4 Entity Browser

The entity browser displays static information about any source entity.

The exact content of the items depend on the type of the item. For instance:

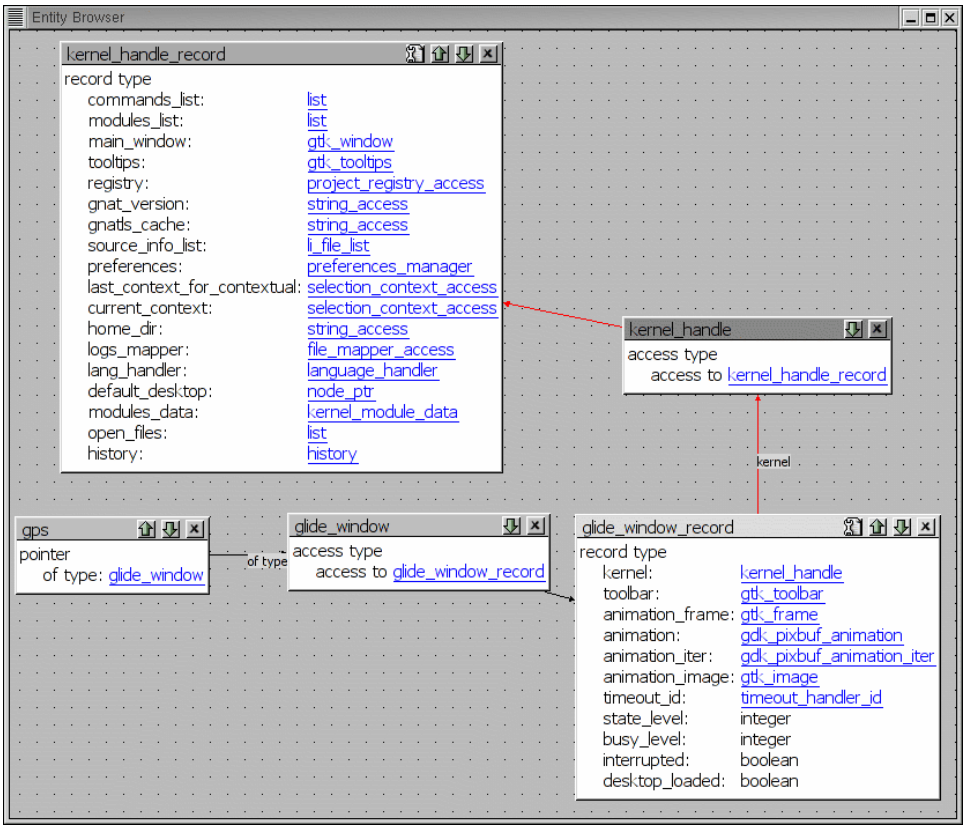
`Ada record / C struct`
: The list of fields, each as an hyper link, is displayed. Clicking on one of the fields will open a new item for the type.

`Ada tagged type / C++ class`
: The list of attributes and methods is displayed. They are also click-able hyper-links.

`Subprograms`
: The list of parameters is displayed

`Packages` The list of all the entities declared in that package is displayed

and `more ...`



This browser is accessible through the contextual menu in the explorer and source editor, when clicking on an entity:

`Examine entity` *entity*
: Open a new item in the entity browser that displays information for the selected entity.

Most information in the items are click-able (by default, they appear as underlined blue text). Clicking on one of these hyper links will open a new item in the entity browser for the selected entity.

This browser can display the parent entities for an item. For instance, for a C++ class or Ada tagged type, this would be the types it derives from. This is accessible by clicking on the up arrow in the title bar of the item.

Likewise, children entities (for instance types that derive from the item) can be displayed by clicking on the down arrow in the title bar.

An extra button appear in the title bar for the C++ class or Ada tagged types, which toggles whether the inherited methods (or primitive oper-

ations in Ada) should be displayed. By default, only the new methods, or the ones that override an inherited one, are displayed. The parent's methods are not shown, unless you click on this title bar button.

11 Debugging

GPS is also a graphical front-end for text-based debuggers such as GDB. A knowledge of the basics of the underlying debugger used by GPS will help understanding how GPS works and what kind of functionalities it provides.

Please refer to the debugger-specific documentation - e.g. the GDB documentation - for more details.

The integrated debugger provided by GPS is using an improved version of the GVD engine, so the functionalities between GVD and GPS are very similar. If you are familiar with GVD, you may be interested in reading Section 11.9 [Upgrading from GVD to GPS], page 105 which explains the differences between the two environments.

Debugging is tightly integrated with the other components of GPS. For example, it is possible to edit files and navigate through your sources while debugging.

To start a debug session, go to the menu `Debug->Initialize`, and choose either the name of your executable, if you have specified the name of your main program(s) in the project properties, or start an empty debug session using the `<no main file>` item. It is then possible to load any file to debug, by using the menu `Debug->Debug->Load File...`

Note that you can create multiple debuggers by using the `Initialize` menu several times: this will create a new debugger each time. All the debugger-related actions (e.g. stepping, running) are performed on the current debugger, which is represented by the current debugger console. To switch between debuggers, simply select its corresponding console.

After the debugger has been initialized, you have access to two new windows: the data window (in the top of the working area), and the debugger console (in a new page, after the Messages and Shell windows). All the menus under `Debugger` are now also accessible, and you also have access to additional contextual menus, in particular in the source editor where it is possible to easily display variables, set breakpoints, and get automatic display (via *tool tips*) of object values.

When you want to quit the debugger without quitting GPS, go to the menu `Debug->Terminate Current`, that will terminate your current debug session, or the menu `Debug->Terminate` that will terminate all your debug sessions at once.

11.1 The Debug Menu

The `Debug` entry in the menu bar provides operations that act at a global level. Key shortcuts are available for the most common operations, and

are displayed in the menus themselves. Here is a detailed list of the menu items that can be found in the menu bar:

Run... Opens a dialog window allowing you to specify the arguments to pass to the program to be debugged, and whether this program should be stopped at the beginning of the main subprogram. If you confirm by clicking on the *OK* button, the program will be launched according to the arguments entered.

Step Execute the program until it reaches a different source line.

Step Instruction
Execute the program for one machine instruction only.

Next Execute the program until it reaches the next source line, stepping over subroutine calls.

Next Instruction
Execute the program until it reaches the next machine instruction, stepping over subroutine calls.

Finish Continue execution until selected stack frame returns.

Continue
Continue execution of the program being debugged.

Interrupt
Asynchronously interrupt the program being debugged. Note that depending on the state of the program, you may stop it in low-level system code that does not have debug information, or in some cases, not even a coherent state. Use of breakpoints is preferable to interrupting programs. Interrupting programs is nevertheless indispensable in some situations, for example when the program appears to be in an infinite (or at least very time-consuming) loop.

Terminate Current
Terminate the current debug session, by closing the data window and the debugger console, as well as terminating the underlying debugger (e.g `gdb`) used to handle the low level debugging.

Terminate
Terminate all your debug sessions. Same as `Terminate Current` if there is only one debugger open.

11.1.1 Debug

Connect to Board...
Opens a simple dialog to connect to a remote board. This option is only relevant to cross debuggers.

Load File...
Opens a file selection dialog that allows you to choose a program to debug. The program to debug is either an executable for native debugging, or a partially linked module for cross environments (e.g VxWorks).

Add Symbols...
Add the symbols from a given file/module. This corresponds to the gdb command *add-symbol-file*. This menu is particularly useful under VxWorks targets, where the modules can be loaded independently of the debugger. For instance, if a module is independently loaded on the target (e.g. using windshell), it is absolutely required to use this functionality, otherwise the debugger won't work properly.

Attach... Instead of starting a program to debug, you can instead attach to an already running process. To do so, you need to specify the process id of the process you want to debug. The process might be busy in an infinite loop, or waiting for event processing. Note that as for [core files], page 89, you need to specify an executable before attaching to a process.

Detach Detaches the currently debugged process from the underlying debugger. This means that the executable will continue to run independently. You can use the *Attach To Process* menu later to re-attach to this process.

Debug Core File...
This will open a file selection dialog that allows you to debug a core file instead of debugging a running process. Note that you must first specify an executable to debug before loading a core file.

Kill Kills the process being debugged.

11.1.2 Data

Note that most items in this menu need to access the underlying debugger when the process is stopped, not when it is running. This means that you first need to stop the process on a breakpoint or interrupt it, before using the following commands. Failing to do so will result in blank windows.

Call Stack
Displays the Call Stack window. See Section 11.2 [The Call Stack Window], page 91 for more details.

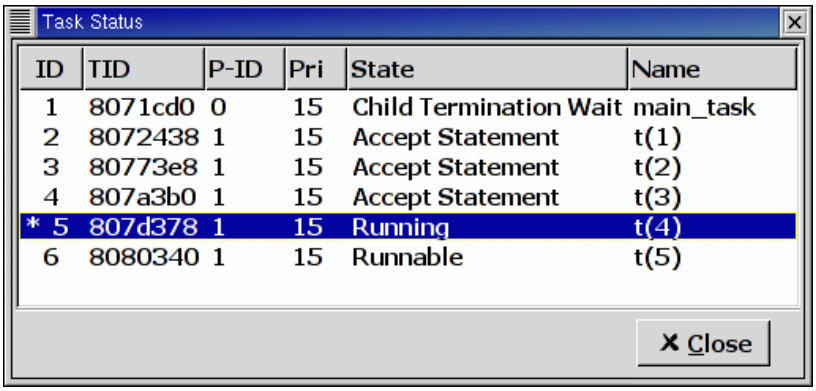
Threads Opens a new window containing the list of threads currently present in the executable as reported by the underlying debugger. For each thread, it will give information such as

internal identifier, name and status. This information is language- and debugger-dependent. You should refer to the underlying debugger's documentation for more details. As indicated above, the process being debugged needs to be stopped before using this command, otherwise a blank list will be displayed.

When supported by the underlying debugger, clicking on a thread will change the context (variables, call stack, source file) displayed, allowing you to inspect the stack of the selected thread.

Tasks For GDB only, this will open a new window containing the list of Ada tasks currently present in the executable. Similarly to the thread window, you can switch to a selected task context by clicking on it, if supported by GDB. See the GDB documentation for the list of items displayed for each task.

As for the thread window, the process being debugged needs to be stopped before using this window.



Protection Domains

For VxWorks AE only, this will open a new window containing the list of available protection domains in the target. To change to a different protection domain, simply click on it. A indicates the current protection domain.

Assembly

Opens a new window displaying an assembly dump of the current code being executed. See Section 11.7 [The Assembly Window], page 102 for more details.

Edit Breakpoints

Opens an advanced window to create and modify any kind of breakpoint (see Section 11.4 [The Breakpoint Editor],

page 97). For simple breakpoint creation, see the description of the source window.

Examine Memory
Opens a memory viewer/editor. See Section 11.5 [The Memory Window], page 99 for more details.

Command History
Opens a dialog with the list of commands executed in the current session. You can select any number of items in this list and replay the selection automatically.

Display Local Variables
Opens an item in the Data Window containing all the local variables for the current frame.

Display Arguments
Opens an item in the Data Window containing the arguments for the current frame.

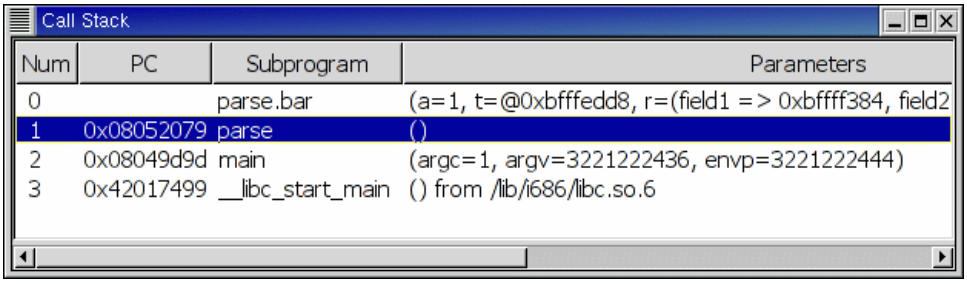
Display Registers
Opens an item in the Data Window containing the machine registers for the current frame.

Display Any Expression...
Opens a small dialog letting you specify an arbitrary expression in the Data Window. This expression can be a variable name, or a more complex expression, following the syntax of the underlying debugger. See the documentation of e.g gdb for more details on the syntax. The check button *Expression is a subprogram call* should be enabled if the expression is actually a debugger command (e.g `p/x var`) or a procedure call in the program being debugged (e.g `call my_proc`).

Refresh Refreshes all the items displayed in the Data Window.

11.2 The Call Stack Window

The call stack window gives a list of frames corresponding to the current execution stack for the current thread/task.



The bottom frame corresponds to the outermost frame where the thread is currently stopped. This frame corresponds to the first function executed by the current thread (e.g main if the main thread is in C). You can click on any frame to switch to the caller's context, this will update the display in the source window. See also the up and down buttons in the tool bar to go up and down one frame in the call stack.

The contextual menu (right mouse button) allows you to choose which information you want to display in the call stack window (via check buttons):

- Frame number: the debugger frame number (usually starts at 0 or 1)
- Program Counter: the low level address corresponding to the function's entry point.
- Subprogram Name: the name of the subprogram in a given frame
- Parameters: the parameters of the subprogram
- File Location: the filename and line number information.

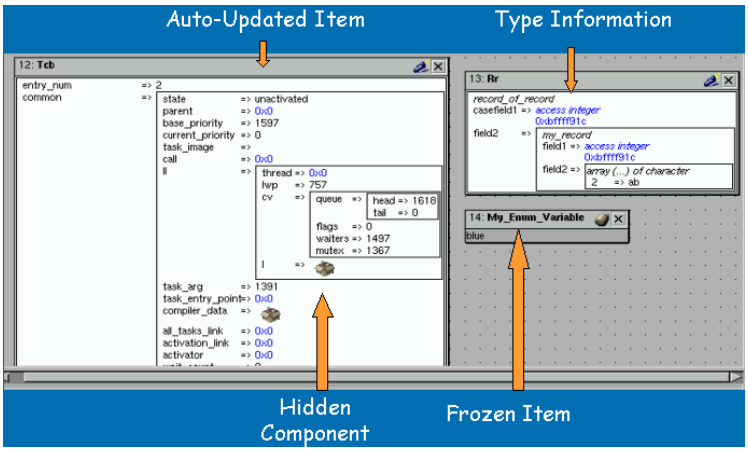
By default, only the subprogram name is displayed. You can hide the call stack window by closing it, as for other windows, and show it again using the menu `Data->Call Stack`.

11.3 The Data Window

11.3.1 Description

The data window contains all the graphic boxes that can be accessed using the *Data->Display* menu items, or the data window *Display Expression...* contextual menu, or the source window *Display* contextual menu items, or finally the *graph* command in the debugger console.

For each of these commands, a box is displayed in the data window with the following information:



- A title bar containing:
  - The number of this expression: this is a positive number starting from 1 and incremented for each new box displayed. It represents the internal identifier of the box.
  - The name of the expression: this is the expression or variable specified when creating the box.
  - An icon representing either a flash light, or a lock. This is a click-able icon that will change the state of the box from automatically updated (the flash light icon) to frozen (the lock icon). When frozen, the value is grayed, and will not change until you change the state. When updated, the value of the box will be recomputed each time an execution command is sent to the debugger (e.g step, next).
  - An icon representing an 'X'. You can click on this icon to close/delete any box.
- A main area. The main area will display the data value hierarchically in a language-sensitive manner. The canvas knows about data structures of various languages (e.g `C`, `Ada`, `C++`) and will organize them accordingly. For example, each field of a record/struct/class, or each item of an array will be displayed separately. For each subcomponent, a thin box is displayed to distinguish it from the other components.

A contextual menu, that takes into account the current component selected by the mouse, gives access to the following capabilities:

Close *component*
: Closes the selected item.

Hide all *component*
: Hides all subcomponents of the selected item. To select a particular field or item in a record/array, move your mouse over the name of this component, not over the box containing the values for this item.

Show all *component*
: Shows all subcomponents of the selected item.

Clone *component*
: Clones the selected component into a new, independent item.

View memory at address of *component*
: Brings up the memory view dialog and explore memory at the address of the component.

Set value of *component*
: Sets the value of a selected component. This will open an entry box where you can enter the new value of a variable/component. Note that GDB does not perform any type or range checking on the value entered.

Update Value
: Refreshes the value displayed in the selected item.

Show Value
: Shows only the value of the item.

Show Type
: Shows only the type of each field for the item.

Show Value+Type
: Shows both the value and the type of the item.

Auto refresh
: Enables or disables the automatic refreshing of the item upon program execution (e.g step, next).

A contextual menu can be accessed in the canvas itself (point the mouse to an empty area in the canvas, and click on the right mouse button) with the following entries:

Display Expression...
: Open a small dialog letting you specify an arbitrary expression in the Data Window. This expression can be a variable name, or a more complex expression, following the syntax of the current language and underlying debugger. See the documentation of e.g gdb for more details on the syntax. The check button *Expression is a subprogram call* should be enabled if the expression is actually not an expression but rather a debugger command (e.g `p/x var`) or a procedure call in the program being debugged (e.g `call my_proc`).

Align On Grid
Enables or disables alignment of items on the grid.

Detect Aliases
Enables or disables the automatic detection of shared data structures. Each time you display an item or dereference a pointer, all the items already displayed on the canvas are considered and their addresses are compared with the address of the new item to display. If they match, (for example if you tried to dereference a pointer to an object already displayed) instead of creating a new item a link will be displayed.

Zoom in Redisplays the items in the data window with a bigger font

Zoom out
Displays the items in the data window with smaller fonts and pixmaps. This can be used when you have several items in the window and you can't see all of them at the same time (for instance if you are displaying a tree and want to clearly see its structure).

Zoom Allows you to choose the zoom level directly from a menu.

11.3.2 Manipulating items

11.3.2.1 Moving items

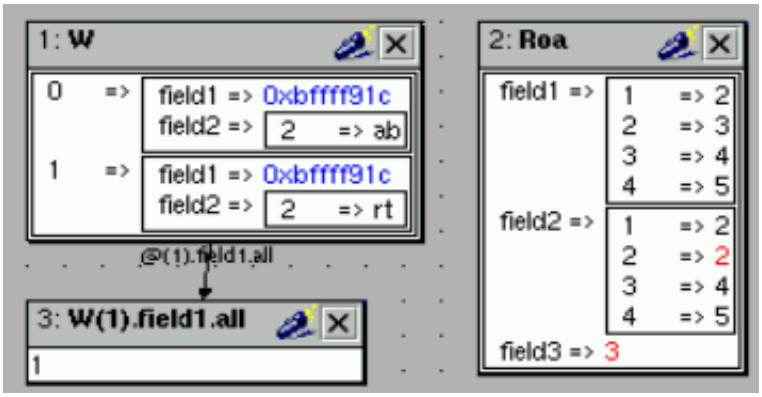
All the items on the canvas have some common behavior and can be fully manipulated with the mouse. They can be moved freely anywhere on the canvas, simply by clicking on them and then dragging the mouse. Note that if you are trying to move an item outside of the visible area of the data window, the latter will be scrolled so as to make the new position visible.

Automatic scrolling is also provided if you move the mouse while dragging an item near the borders of the data window. As long as the mouse remains close to the border and the button is pressed on the item, the data window is scrolled and the item is moved. This provides an easy way to move an item a long distance from its initial position.

11.3.2.2 Colors

Most of the items are displayed using several colors, each conveying a special meaning. Here is the meaning assigned to all colors (note that

the exact color can be changed through the preferences dialog; these are the default colors):



black This is the default color used to print the value of variables or expressions.

blue This color is used for C pointers (or Ada access values), i.e. all the variables and fields that are memory addresses that denote some other value in memory.

You can easily dereference these (that is to say see the value pointed to) by double-clicking on the blue text itself.

red This color is used for variables and fields whose value has changed since the data window was last displayed. For instance, if you display an array in the data window and then select the *Next* button in the tool bar, then the elements of the array whose value has just changed will appear in red.

As another example, if you choose to display the value of local variables in the data window (*Display->Display Local Variables*), then only the variables whose value has changed are highlighted, the others are left in black.

11.3.2.3 Icons

Several different icons can be used in the display of items. They also convey special meanings.

trash bin icon

This icon indicates that the debugger could not get the value of the variable or expression. There might be several reasons, for instance the variable is currently not in scope (and thus does not exist), or it might have been optimized away by the

compiler. In all cases, the display will be updated as soon as the variable becomes visible again.

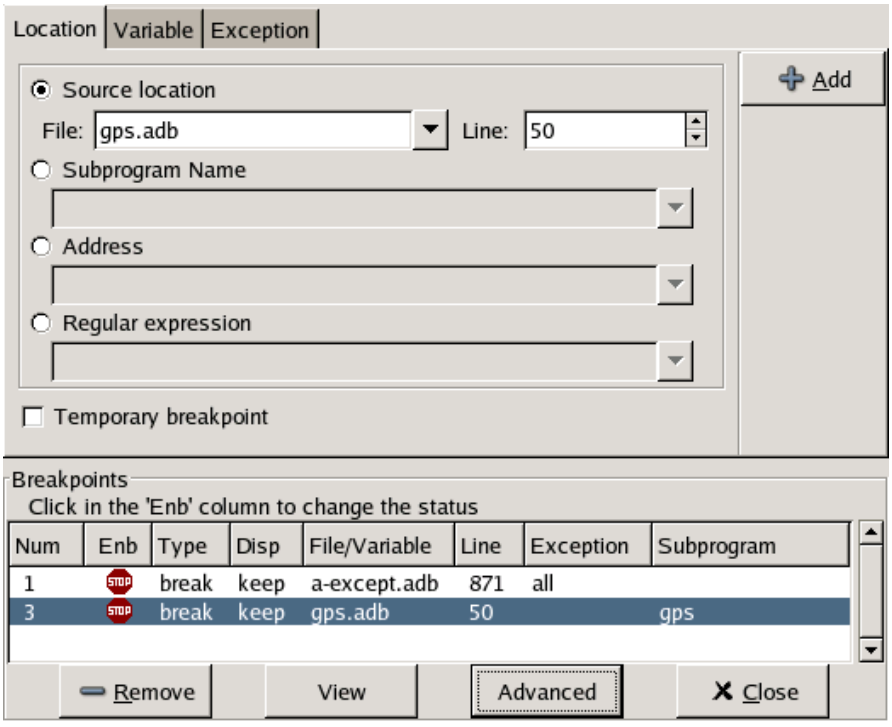
package icon

This icon indicates that part of a complex structure is currently hidden. Manipulating huge items in the data window (for instance if the variable is an array of hundreds of complex elements) might not be very helpful. As a result, you can shrink part of the value to save some screen space and make it easier to visualize the interesting parts of these variables.

Double-clicking on this icon will expand the hidden part, and clicking on any sub-rectangle in the display of the variable will hide that part and replace it with that icon.

See also the description of the contextual menu to automatically show or hide all the contents of an item. Note also that one alternative to hiding subcomponents is to clone them in a separate item (see the contextual menu again).

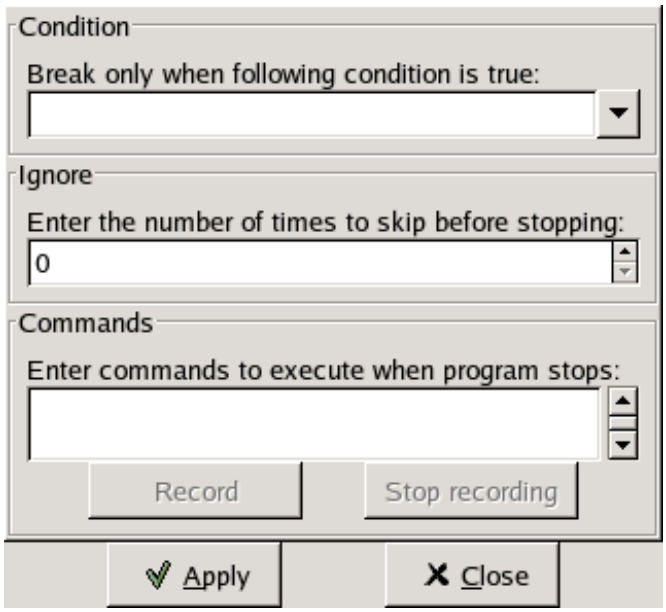
11.4 The Breakpoint Editor



The breakpoint editor can be accessed from the menu *Data->Edit Breakpoints*. It gives access to the different kind of breakpoints: on source location, subprogram, address and Ada exceptions.

The top area provides an interface to easily create the different kinds of breakpoints, while the bottom area lists the existing breakpoints and their characteristics.

It is possible to access to advanced breakpoint characteristics for a given breakpoint, by first selecting a breakpoint in the list, and then by clicking on the *Advanced* button, which will display a new dialog window where you can specify commands to run automatically after a breakpoint is hit, or specify how many times a selected breakpoint will be ignored. If running VxWorks AE, you can also change the Scope and Action of breakpoints.



11.4.1 Scope/Action Settings for VxWorks AE

In VxWorks AE breakpoints have two extra properties:

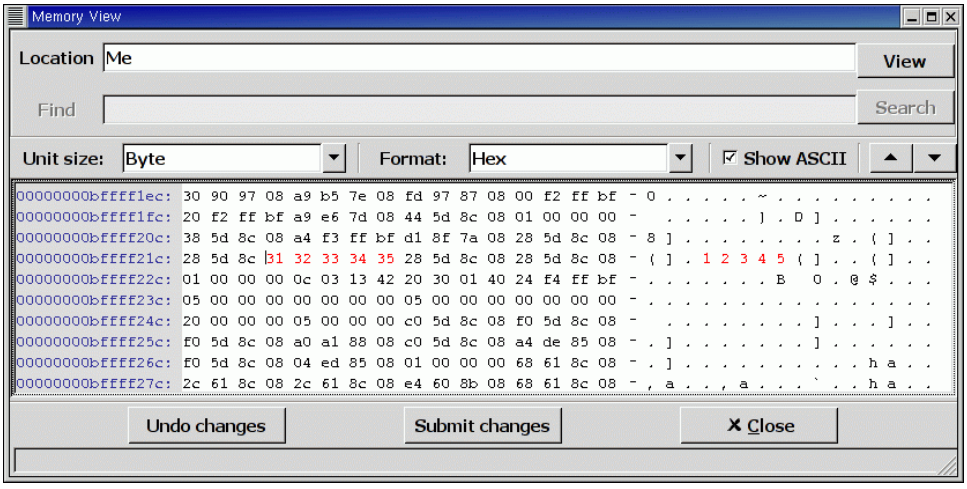
- Scope: which task(s) can hit a given breakpoint. Possible Scope values are:
  - task: the breakpoint can only be hit by the task that was active when the breakpoint was set. If the breakpoint is set before the program is run, the breakpoint will affect the environment task
  - pd: any task in the current protection domain can hit that breakpoint

  - any: any task in any protection domain can hit that breakpoint. This setting is only allowed for tasks in the Kernel domain.
- Action: when a task hits a breakpoints, which tasks are stopped:
  - task: stop only the task that hit the breakpoint.
  - pd: stop all tasks in the current protection domain
  - all: stop all breakable tasks in the system

These two properties can be set/changed through the advanced breakpoints characteristics by clicking on the *Advanced* button. There are two ways of setting these properties:

- Per breakpoint settings: after setting a breakpoint (the default Scope/Action values will be task/task), select the *Scope/Action* tab in the *Advanced* settings. To change these settings on a given breakpoint, select it from the breakpoints list, select the desired values of Scope and Action and click on the *Update* button.
- Default session settings: select the *Scope/Action* tab in the *Advanced* settings. Select the desired Scope and Action settings, check the *Set as session defaults* check box below and click the *Close* button. From now on, every new breakpoint will have the selected values for Scope and Action.

11.5 The Memory Window



The memory window allows you to display the contents of memory by specifying either an address, or a variable name.

To display memory contents, enter the address using the C hexadecimal notation: 0xabcd, or the name of a variable, e.g foo, in the *Location*

text entry. In the latter case, its address is computed automatically. Then either press *Enter* or click on the *View* button. This will display the memory with the corresponding addresses in the bottom text area.

You can also specify the unit size (*Byte*, *Halfword* or *Word*), the format (*Hexadecimal*, *Decimal*, *Octal* or *ASCII*), and you can display the corresponding ASCII value at the same time.

The *up* and *down* arrows as well as the ⟨Page up⟩ and ⟨Page down⟩ keys in the memory text area allows you to walk through the memory in order of ascending/descending addresses respectively.

Finally, you can modify a memory area by simply clicking on the location you want to modify, and by entering the new values. Modified values will appear in a different color (red by default) and will only be taken into account (i.e written to the target) when you click on the *Submit changes* button. Clicking on the *Undo changes* or going up/down in the memory will undo your editing.

Clicking on *Close* will close the memory window, canceling your last pending changes, if any.

11.6 Using the Source Editor when Debugging

When debugging, the left area of each source editor provides the following information:

Lines with code

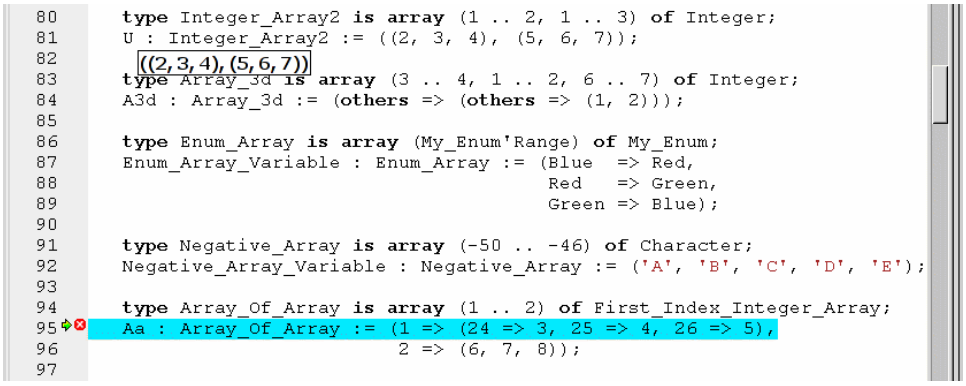
In this area, blue dots are present next to lines for which the debugger has debug information, in other words, lines that have been compiled with debug information and for which the compiler has generated some code. Currently, there is no check when you try to set a breakpoint on a non dotted line: this will simply send the breakpoint command to the underlying debugger, and usually (e.g in the case of gdb) result in setting a breakpoint at the closest location that matches the file and line that you specified.

Current line executed

This is a green arrow showing the line about to be executed.

Lines with breakpoints

For lines where breakpoints have been set, a red mark is displayed on top of the blue dot for the line. You can add and delete breakpoints by clicking on this area (the first click will set a breakpoint, the second click will remove it).



The second area in the source window is a text window on the right that displays the source files, with syntax highlighting. If you leave the cursor over a variable, a tooltip will appear showing the value of this variable. Automatic tooltips can be disabled in the preferences menu. See [preferences dialog], page 123.

When the debugger is active, the contextual menu of the source window contains a sub menu called `Debug` providing the following entries.

Note that these entries are dynamic: they will apply to the entity found under the cursor when the menu is displayed (depending on the current language). In addition, if a selection has been made in the source window the text of the selection will be used instead. This allows you to display more complex expressions easily (for example by adding some comments to your code with the complex expressions you want to be able to display in the debugger).

Print *selection*
: Prints the selection (or by default the name under the cursor) in the debugger console.

Display *selection*
: Displays the selection (or by default the name under the cursor) in the data window. The value will be automatically refreshed each time the process state changes (e.g after a step or a next command). To freeze the display in the canvas, you can either click on the corresponding icon in the data window, or use the contextual menu for the specific item (see Section 11.3 [The Data Window], page 92 for more information).

Print *selection*.**all**
: Dereferences the selection (or by default the name under the cursor) and prints the value in the debugger console.

Display *selection*.**all**
: Dereferences the selection (or by default the name under the cursor) and displays the value in the data window.

View memory at address of *selection*
: Brings up the memory view dialog and explores memory at the address of the selection.

Set Breakpoint on Line *xx*
: Sets a breakpoint on the line under the cursor, in the current file.

Set Breakpoint on *selection*
: Sets a breakpoint at the beginning of the subprogram named *selection*

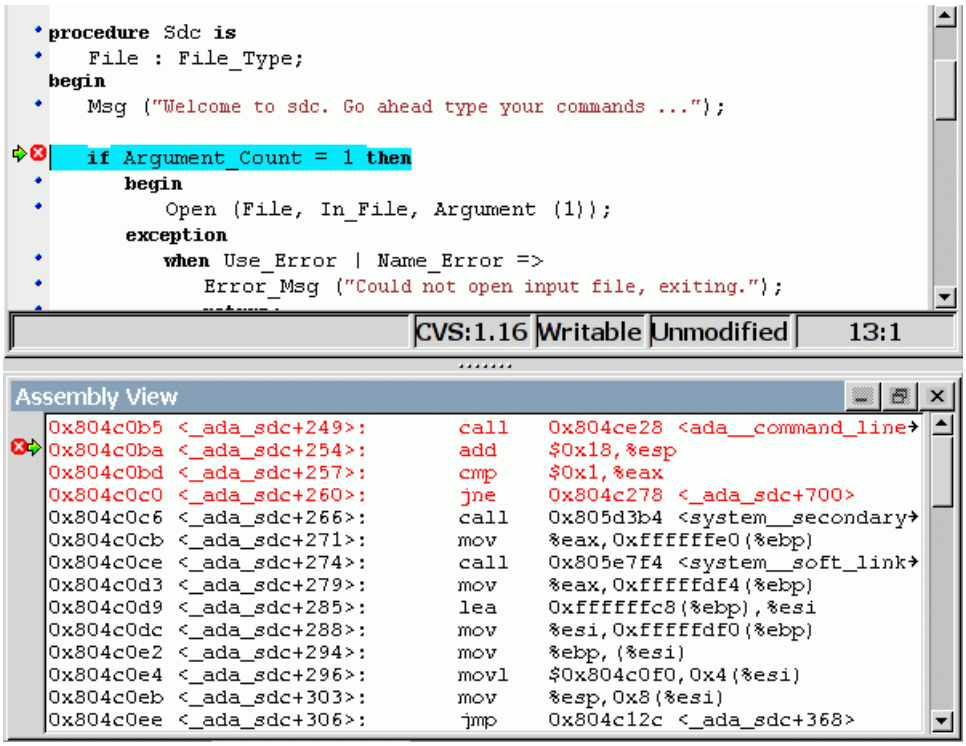
Continue Until Line *xx*
: Continues execution (the program must have been started previously) until it reaches the specified line.

Show Current Location
: Jumps to the current line of execution. This is particularly useful after navigating through your source code.

11.7 The Assembly Window

It is sometimes convenient to look at the assembly code for the subprogram or source line you are currently debugging.

You can open the assembly window by using the menu `Debug->Data->Assembly`.



The current assembly instruction is highlighted with a green arrow on its left. The instructions corresponding to the current source line are highlighted in red by default. This allows you to easily see where the program counter will point to, once you have pressed the "Next" button on the tool bar.

Moving to the next assembly instruction is done through the "Nexti" (next instruction) button in the tool bar. If you choose "Stepi" instead (step instruction), this will also jump to the subprogram being called.

For efficiency reasons, only a small part of the assembly code around the current instruction is displayed. You can specify in the [preferences dialog], page 123 how many instructions are displayed by default. Also, you can easily display the instructions immediately preceding or following the currently displayed instructions by pressing one of the ⟨Page up⟩ or ⟨Page down⟩ keys, or by using the contextual menu in the assembly window.

A convenient complement when debugging at the assembly level is the ability of displaying the contents of machine registers. When the debugger supports it (as gdb does), you can select the `Data->Display`

`Registers` menu to get an item in the canvas that will show the current contents of each machine register, and that will be updated every time one of them changes.

You might also choose to look at a single register. With gdb, select the `Data->Display Any Expression`, entering something like

```
output /x $eax
```

in the field, and selecting the toggle button "Expression is a subprogram call". This will create a new canvas item that will be refreshed every time the value of the register (in this case eax) changes.

11.8 The Debugger Console

This is the text window located at the bottom of the main window. In this console, you have direct access to the underlying debugger, and can send commands (you need to refer to the underlying debugger's documentation, but usually typing *help* will give you an overview of the commands available).

If the underlying debugger allows it, pressing ⟨Tab⟩ in this window will provide completion for the command that is being typed (or for its arguments).

There are also additional commands defined to provide a simple text interface to some graphical features.

Here is the complete list of such commands. The arguments between square brackets are optional and can be omitted.

`graph (print|display) expression [dependent on display_num] [link_name name]`

> This command creates a new item in the canvas, that shows the value of *`Expression`*. *`Expression`* should be the name of a variable, or one of its fields, that is in the current scope for the debugger.
>
> The command `graph print` will create a frozen item, that is not automatically refreshed when the debugger stops, whereas `graph display` displays an automatically refreshed item.
>
> The new item is associated with a number, that is visible in its title bar. These numbers can be used to create links between the items, using the second argument to the command, *`dependent on`*. The link itself (i.e. the line) can be given a name that is automatically displayed, using the third argument.

`graph (print|display) ‘command‘`
: This command is similar to the one above, except it should be used to display the result of a debugger command in the canvas.

  For instance, if you want to display the value of a variable in hexadecimal rather than the default decimal with gdb, you should use a command like:

  ```
  graph display ‘print /x my_variable‘
  ```

  This will evaluate the command between back-quotes every time the debugger stops, and display this in the canvas. The lines that have changed will be automatically highlighted (in red by default).

  This command is the one used by default to display the value of registers for instance.

`graph (enable|disable) display display_num [display_num ...]`
: This command will change the refresh status of items in the canvas. As explained above, items are associated with a number visible in their title bar.

  Using the `graph enable` command will force the item to be automatically refreshed every time the debugger stops, whereas the `graph disable` command will freeze the item.

`graph undisplay display_num`
: This command will remove an item from the canvas

`view (source|asm|source_asm)`
: This command indicates what should be displayed in the source window. The first option indicates that only the source code should be visible, the second one specifies that only the assembly code should be visible, and the last one indicates that both should be displayed.

11.9 Upgrading from GVD to GPS

This section is intended for users already familiar with GVD, in order to help them transitioning to GPS. If you have not used GVD, you may want to skip this section.

This section outlines the differences between GVD and GPS, and also lists some of the advantages of GPS compared to GVD.

11.9.1 Command Line Switches

The following command line switches related to debugging are available in GPS:

`--debug` Automatically start a debug session, as done by GVD. You can also specify a program name and its arguments, so this option replaces the `--pargs` and `executable-file` arguments in GVD.

`--debugger`
Equivalent to the same GVD option, with the difference that arguments can be specified as well, replacing the `--dargs` option.

`--target` Same as in GVD.

For example, the equivalent of the following command line using a sh-like shell would be:

```
$ gvd --debugger=gdb-5 executable --pargs 1 2 3
```

would be

```
$ gps --debug="executable 1 2 3" --debugger=gdb-5
```

`--traceon=GVD.OUT`
This switch replaces the –log-level=4 option that was used to get the full log of the communications between GVD and the underlying debugger.

11.9.2 Menu Items

All the debugger-related menus in GVD can be found under the 'Debug' menu in GPS, with the following mapping:

`File->xxx`
available under `Debug->Debug->xxx`

`Program->xxx`
available under `Debug->xxx`

`Data->xxx`
available under `Debug->Data->xxx`

The menu `File->New Debugger...` is replaced by the combination of the menu `Debug->Initialize` and the project properties, available under `Project->Edit Project Properties` where you can similarly specify your *Debugger Host* (called *Tools Host*), your *Program Host*, the *Protocol* used by the underlying debugger to communicate with the target, and the name of the debugger. To conveniently switch between multiple debugger configurations, we recommend to use a scenario variable and set different properties based on the value of this variable. See Section 7.3 [Scenarios and Configuration Variables], page 50 and Chapter 14 [Working in a Cross Environment], page 121 for more details.

11.9.3 Tool Bar Buttons

GPS provides by default fewer debugger buttons than GVD, because some buttons are actually not used very often, and others have been merged. In addition, it will be possible in the future to completely configure the GPS tool bar.

`Run` Menu `Debug->Run...` (⟨F2⟩)

`Start` Start/Continue button

`Step` Step button

`Stepi` Menu `Debug->Step Instruction` (⟨Shift-F5⟩)

`Next` Next button

`Nexti` Menu `Debug->Next Instruction` (⟨Shift-F6⟩)

`Finish` Finish button

`Cont` Start/Continue button

`Up` Up button

`Down` Down button

`Interrupt`
Menu `Debug->Interrupt` (⟨Control-Backslash⟩)

11.9.4 Key Short Cuts

The same key shortcuts have been kept by default between GVD and GPS except for the Interrupt menu, which is now ⟨Control-Backslash⟩ instead of ⟨Esc⟩.

11.9.5 Contextual Menus

All the debugger-related contextual menus can now be found under the `Debug` sub-menu.

The only difference is the contextual menu `Show` used to display the assembly dump of the current code. It is replaced by the menu `Debug->Data->Assembly`, see Section 11.7 [The Assembly Window], page 102 for more details.

11.9.6 File Explorer

The file explorer provided in GVD is replaced by the `Project View` and the `File View` in GPS.

When using the `--debug` command line switch and no explicit project file, GPS will automatically create a project file in a way very similar

to what GVD does to display its file explorer, and available under the `Project View`.

In addition, the `File View` gives access to any file in your file system, even if it is not available as part of the debug information.

11.9.7 Advantages of GPS

The advantages when using GPS instead of GVD can be classified in two main categories: when not using project files, and when using them.

When not using project files, you get access to the following advantages in GPS:

- Complete source editor including indentation, shortcuts, multiple views, . . . See Chapter 5 [Editing Files], page 23 for more details.
- A more stable and robust debugger engine. The debugger engine included in GPS corresponds to GVD version 2.0. In effect, GPS *is* the new version of GVD.
- Integrated help, see Chapter 3 [Integrated Help], page 13 for more details.
- Better look and feel. GPS uses the new version of the graphical toolkit used by GVD, which provides a modern look and feel and a more stable interface under Windows (with additions such as support for the mouse wheel).
- Support for version control systems which is integrated and available through a few mouse clicks or key bindings. See Chapter 12 [Version Control System], page 109 for more details.
- A more flexible window handling, see Chapter 4 [Multiple Document Interface], page 15 for more details.

When using project files, you will get, in addition to the advantages listed above:

- Source navigation, see Chapter 6 [Source Navigation], page 43 for more details.
- Source Browsers, in particular the entity browser, a nice complement of the debugger data window. See Chapter 10 [Source Browsing], page 77 for more details.
- Builds, see Chapter 9 [Compilation/Build], page 73 for more details.
- Semantic support. In particular, GPS is be able to e.g. differentiate variables from types when displaying a contextual menu, which is not possible in GVD.
- Flexibility of project files, see Chapter 7 [Project Handling], page 47 for more details.

12 Version Control System

GPS offers the possibility for multiple developers to work on the same project, through the integration of version control systems (VCS). Each project can be associated to a VCS, through the `VCS` tab in the Project property editor. See Section 7.7 [The Project Properties Editor], page 62.

GPS does not come with any version control system: it will use an underlying command-line system such as CVS or ClearCase to perform the low level operations, and provides a high level user iterface on top of them. Be sure to have a properly installed version control system before enabling it under GPS.

The systems that are supported out of the box in GPS are CVS and ClearCase. There are two interfaces to ClearCase: the standard ClearCase interface, which is built-in and uses a generic GPS terminology for VCS operations, and the Native ClearCase interface, which is fully customizable and uses by default the terminology specific to ClearCase.

Note that, at the moment, only Snapshot Views are supported in the ClearCase integration; Dynamic Views are not supported.

It is also possible to add your own support for other version control systems, or modify the existing CVS and ClearCase interfaces, see Section 15.8 [Adding support for new Version Control Systems], page 212 for more information.

When using CVS, GPS will also need a corresponding `patch` command that usually comes with it. If you are under Windows, be sure to install a set of CVS and patch executables that are compatible.

It is recommended that you first get familiar with the version control system that you intend to use in GPS first, since many concepts used in GPS assume basic knowledge of the underlying system.

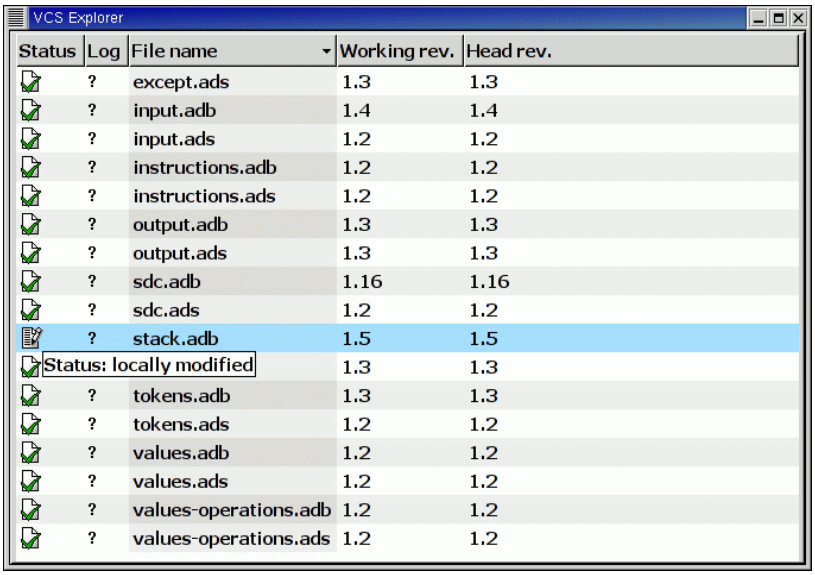
Associating a VCS to a project enables the use of basic VCS features on the source files contained in the project. Those basic features typically include the checking in and out of files, the querying of file status, file revision history, comparison between various revisions, and so on.

Administration of VCS systems is not handled by GPS at this stage. Therefore, before working on a project using version control system, make sure that the system is properly set-up before launching GPS.

Note: the set-up must make sure that the VCS commands can be launched without entering a password.

12.1 The VCS Explorer

The VCS Explorer provides an overview of source files and their status.



The easiest way to bring up the VCS Explorer is through the menu `VCS->Explorer`. The Explorer can also be brought up using the contextual menu `Version Control->Query status` on files, directories and projects in the file and project views, and on file editors. See Section 12.3 [The Version Control Contextual Menu], page 112.

The VCS Explorer contains the following columns:

Status Shows the status of the file. This column can be sorted by clicking on the header. The different possible status for files are the following:

`Unknown`  The status is not yet determined or the VCS repository is not able to give this information (for example if it is unavailable, or locked).

`Not registered`

The file is not known to the VCS repository.

`Up-to-date`

The file corresponds to the latest version in the corresponding branch on the repository.

`Added`  The file has been added remotely but is not yet updated in the local view.

`Removed`  The file still exists locally but is known to have been removed from the VCS repository.

`Modified`  The file has been modified by the user or has been explicitly opened for editing.

`Needs merge`

The file has been modified locally and on the repository.

`Needs update`

The file has been modified in the repository but not locally.

`Contains merge conflicts`

The file contains conflicts from a previous update operation.

Log This column indicates whether a revision log exists for this file.

File The name of the file. This column can be sorted by clicking on the header.

Working rev.
Indicates the version of the local file.

Head rev.
Indicates the most recent version of the file in the repository.

The VCS Explorer supports multiple selections. To select a single line, simply left-click on it. To select a range of lines, select the first line in the range, then hold down the ⟨Shift⟩ key and select the last line in the range. To add or remove single columns from the selection, hold down the ⟨Control⟩ key and left-click on the columns that you want to select/unselect.

The explorer also provides an interactive search capability allowing you to quickly look for a given file name. The default key to start an interactive search is ⟨Ctrl-i⟩. See [Interactive Search], page 6 for more details.

The VCS contextual menu can be brought up from the VCS explorer by left-clicking on a selection or on a single line. See Section 12.3 [The Version Control Contextual Menu], page 112.

12.2 The VCS Menu

Basic VCS operations can be accessed through the VCS menu. Most of these functions act on the current selection, i.e. on the selected items in the VCS Explorer if it is present, or on the currently selected file editor, or on the currently selected item in the Project/File View. In most cases, the VCS contextual menu offers more control on VCS operations. See Section 12.3 [The Version Control Contextual Menu], page 112.

Explorer Open or raise the VCS Explorer. See Section 12.1 [The VCS Explorer], page 109.

Update all projects
Update the source files in the current project, and all imported sub-projects, recursively.

Query status for all projects
Query the status of all files in the project and all imported sub-projects.

For a description of the other entries in the VCS menu, see Section 12.3 [The Version Control Contextual Menu], page 112

12.3 The Version Control Contextual Menu

This section describes the version control contextual menu displayed when you right-click on an entity (e.g. a file, a directory, a project) from

various parts of GPS, including the project explorer, the source editor and the VCS Explorer.

Depending on the context, some of the items described in this section won't be shown, which means that they are not relevant to the current context.

Query status
: Query the status of the selected item. Brings up the VCS Explorer.

Update
: Update the currently selected item (file, directory or project).

Commit
: Submits the changes made to the file to the repository, and queries the status for the file once the change is made.

  It is possible to tell GPS to check the file before the actual commit happens. This is done by specifying a `File checker` in the `VCS` tab of the project properties dialog. This `File checker` is in fact a script or executable that takes an absolute file name as argument, and displays any error message on the standard output. The VCS commit operation will actually occur only if nothing was written on the standard output.

  It is also possible to check the change-log of a file before commit, by specifying a `Log checker` in the project properties dialog. This works on change-log files in the same way as the `File checker` works on source files.

Open
: Open the currently selected file for writing. On some VCS systems, this is a necessary operation, and on other systems it is not.

View entire revision history
: Show the revision logs for all previous revisions of this file.

View specific revision history
: Show the revision logs for one previous revision of this file.

Compare against head revision
: Show a visual comparison between the local file and the most recent version of that file in the repository.

Compare against other revision
: Show a visual comparison between the local file and one specific version of that file in the repository.

Compare between two revisions
: Show a visual comparison between two specific revisions of the file in the repository.

Compare base against head
: Show a visual comparison between the corresponding version of the file in the repository and the most recent version of that file.

Annotate
: Display the annotations for the file, i.e. the information for each line of the file showing the revision corresponding to that file, and additional information depending on the VCS system.

  When using CVS, the annotations are clickable. Left-clicking on an annotation line will query and display the changelog associated to the specific revision for this line.

Remove Annotate
: Remove the annotations from the selected file.

Edit revision log
: Edit the current revision log for the selected file.

Edit global ChangeLog
: Edit the global ChangeLog entry for the selected file. see Section 12.4 [Working with global ChangeLog file], page 115.

Remove revision log
: Clear the current revision associated to the selected file.

Add Add a file to the repository, using the current revision log for this file. If no revision log exists, activating this menu will create one.

Remove Remove a file from the repository, using the current revision log for this file. If no revision log exists, activating this menu will create one.

Revert Revert a locale file to the repository revision, discarding all local changes.

Directory
: Only available when the current context contains directory information

  Query status for directory
  : Query status for the files contained in the selected directory.

  Update directory
  : Update the files in the selected directory.

  Query status for directory recursively
  : Query status for the files in the selected directory and all subdirectories recursively, links not included.

Update directory recursively
: Update the files in the selected directory and all subdirectories recursively, links not included..

Project Only available when the current context contains project information

List all files in project
: Brings up the VCS Explorer with all the source files contained in the project.

Query status for project
: Queries the status for all the source files contained in the project.

Update project
: Updates all the source files in the project.

List all files in project and sub-projects
: Brings up the VCS Explorer with all the source files contained in the project and all imported sub-projects.

Query status for project and sub-projects
: Queries the status for all the source files contained in the project and all imported sub-projects.

Update project and sub-projects
: Updates all the source files in the project and all imported sub-projects.

Hide up-to-date files
: Only available from the VCS Explorer. Filter out up-to-date files, that is files that have not been modified locally and that do not need to be updated.

Hide non registered files
: Only available from the VCS Explorer. Filter out non registered files, that is files unknown to the version control system, or whose information could not be retrieved (e.g. the version control server is temporarily unavailable).

12.4 Working with global ChangeLog file

A global ChangeLog file contains revision logs for all files in a directory and is named '`ChangeLog`'. The format for such a file is:

ISO-DATE *name* <*e-mail*>

```
<HT>* filename[, filename]:
<HT>revision history
```

where:

ISO-DATE
: A date with the ISO format YYYY-MM-DD

name
: A name, generally the developer name

<**e-mail**>
: The e-mail address of the developer surrounded with '<' and '>' characters.

HT
: Horizontal tabulation (or 8 spaces)

The *name* and <*e-mail*> items can be entered automatically by setting the *GPS_CHANGELOG_USER* environment variable. Note that there is two spaces between the *name* and the <*e-mail*>.

```
On sh shell:

   export GPS_CHANGELOG_USER="John Doe  <john.doe@home.com>"

On Windows shell:
   set GPS_CHANGELOG_USER="John Doe  <john.doe@home.com>"
```

Using the menu entry **Edit global ChangeLog** will open the file 'ChangeLog' in the directory where the current selected file is and create the corresponding 'ChangeLog' entry. This means that the ISO date and filename headers will be created if not yet present. You will have to enter your name and e-mail address.

This 'ChangeLog' file serve as a repository for revision logs, when ready to check-in a file use the standard **Edit revision log** menu command. This will open the standard revision log buffer with the content filled from the global 'ChangeLog' file.

13 Tools

13.1 The Tools Menu

The `Tools` menu gives access to additional tools. Some items are currently disabled, meaning that these are planned tools not yet available.

The list of active items includes:

Shell Console
: Open a shell console at the bottom are of GPS. See Section 2.7 [The Shell and Python Windows], page 9.

Call Graph
: See Section 10.2 [Call Graph], page 79.

Dependency Browser
: See Section 10.3 [Dependency Browser], page 81.

Entity Browser
: See Section 10.4 [Entity Browser], page 84.

Compare
: See Section 13.2 [Visual Comparison], page 117.

Task Manager
: See Section 2.11 [The Task Manager], page 12.

13.2 Visual Comparison

Note that this tool is in a preliminary stage. More capabilities will be added in the future such as comparison of multiple files, interactive merge, ...

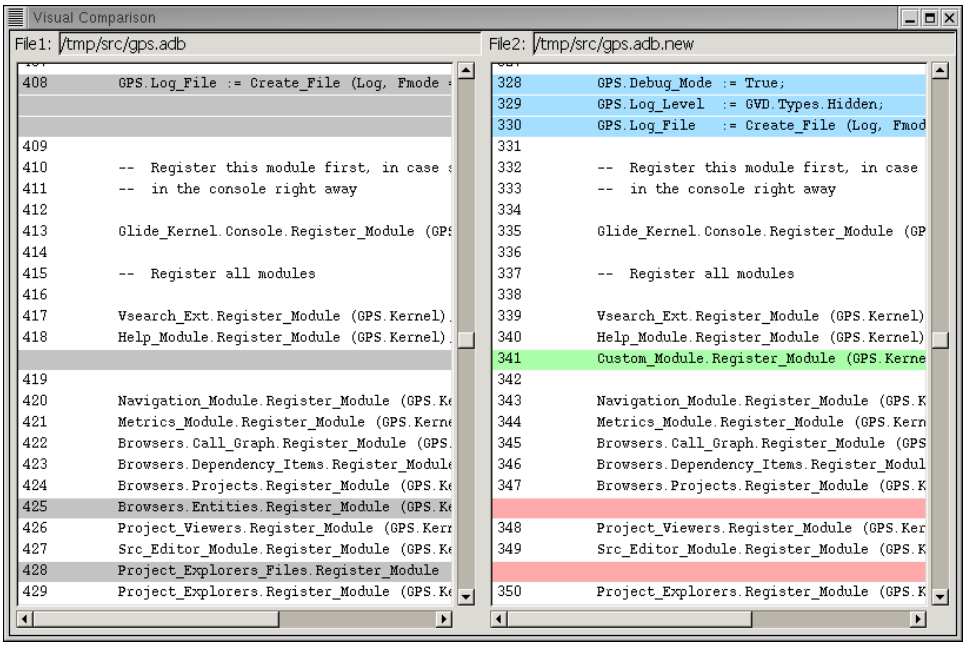
The visual comparison, available either from the VCS menus or from the Tools menu, provide a way to display graphically differences between two files, or two different versions of the same file.

This tool is based on the standard text command `diff`, available on all Unix systems. Under Windows, a default implementation is provided with GPS, called `gnudiff.exe`. You may want to provide an alternate implementation by e.g. installing a set of Unix tools such as cygwin (`http://www.cygwin.com`).

The dialog is composed of two main areas: on the left side, the reference file is displayed; on the right side, the modified file.

By default, only chunks of differences are displayed, with a number of lines of context around, that can be parametrized in the preferences dialog.

Vertical and horizontal scroll bars are available for each file that allow you to scroll both files at the same time. In addition, empty lines are added when needed so that the two files can always be displayed side by side and stay synchronized.



Colors are used to display the different kinds of chunks:

gray This color is used for all the chunks on the reference (left) file. Only the modified (right) file is displayed with different colors.

blue This color is used to display lines that have been modified compared to the reference file.

green Used to display lines added compared to the reference file; in other words, lines that are not present in the reference file.

red Used to display lines removed from the reference file; in other words, lines that are present only in the reference file.

13.3 Code Fixing

GPS provides an interactive way to fix or improve your source code, based on messages (errors and warnings) generated by the GNAT compiler.

This capability is integrated with the *Locations tree* (see Section 2.8 [The Locations Tree], page 10): when GPS can take advantage of a compiler message, an icon is added on the left side of the line.

For a simple fix, a wrench icon is displayed. If you click with the left button on this icon, the code will be fixed automatically, and you will see the change in the corresponding source editor. An example of a simple fix, is the addition of a missing semicolon.

You can also check what action will be performed by clicking on the right button which will display a contextual menu with a text explaining the action that will be performed. Similarly, if you display the contextual menu anywhere else on the message line, a sub menu called *Code Fixing* gives you access to the same information. In the previous example of a missing semicolon, the menu will contain an entry labeled *Add expected string* ";".

Once the code change has been performed, the tool icon is no longer displayed.

For more complex fixes, where more than one change is possible, the icon will display in additional of the tool, a red question mark. In this case, clicking on the icon will display the contextual menu directly, giving you access to the possible choices. For example, this will be the case when an ambiguity is reported by the compiler for resolving an entity.

14 Working in a Cross Environment

This chapter explains how to adapt your project and configure GPS when working in a cross environment.

14.1 Customizing your Projects

This section describes some possible ways to customize your projects when working in a cross environment. For more details on the project capabilities, see Chapter 7 [Project Handling], page 47.

When using the project editor to modify the project's properties, two areas are particularly relevant to cross environments: `Tools` and `Cross environment`, part of the `General` page.

In the `Tools` section, you will typically need to change the name of the compiler(s) and the debugger, as well as gnatls' name if you are using Ada.

For example, assuming you have an Ada project, and using a powerpc VxWorks configuration. You will set the *Ada compiler* to `powerpc-wrs-vxworks-gnatmake`; *Gnatls* to `powerpc-wrs-vxworks-gnatls` and *Debugger* to `powerpc-wrs-vxworks-gdb`.

If you are using an alternative run time, e.g. a *soft float* run time, you need to add the option `--RTS=soft-float` to the *Gnatls* property, e.g: `powerpc-wrs-vxworks-gnatls --RTS=soft-float`, and add this same option to the *Make* switches in the switch editor. See [Switches], page 60 for more details on the switch editor.

To modify your project to support configurations such as multiple targets, or multiple hosts, you can create scenario variables, and modify the setting of the Tools parameters based on the value of these variables. See Section 7.3 [Scenarios and Configuration Variables], page 50 for more information on these variables.

For example, you may want to create a variable called `Target` to handle the different kind of targets handled in your project:

Target Native, Embedded

Target Native, PowerPC, M68K

Similarly, you may define a `Board` variable listing the different boards used in your environment and change the *Program host* and *Protocol* settings accordingly.

In some cases, it is useful to provide a different body file for a given package (e.g. to handle target specific differences). A possible approach in this case is to use a configuration variable (e.g. called `TARGET`), and specify a different naming scheme for this body file (in the project properties, `Naming` tab), based on the value of `TARGET`.

14.2 Debugger Issues

This section describes some debugger issues that are specific to cross environments. You will find more information on debugging by reading Chapter 11 [Debugging], page 87.

To connect automatically to the right remote debug agent when starting a debugging session (using the menu `Debug->Initialize`), be sure to specify the `Program host` and `Protocol` project properties, as described in the previous section.

For example, if you are using the *Tornado* environment, with a target server called `target_ppc`, set the `Protocol` to `wtx` and the `Program host` to `target_ppc`.

Once the debugger is initialized, you can also connect to a remote agent by using the menu `Debug->Debug->Connect to Board...`. This will open a dialog where you can specify the target name (e.g. the name of your board or debug agent) and the communication protocol.

In order to load a new module on the target, you can select the menu `Debug->Debug->Load File...`.

If a module has been loaded on the target and is not known to the current debug session, use the menu `Debug->Debug->Add Symbols...` to load the symbol tables in the current debugger.

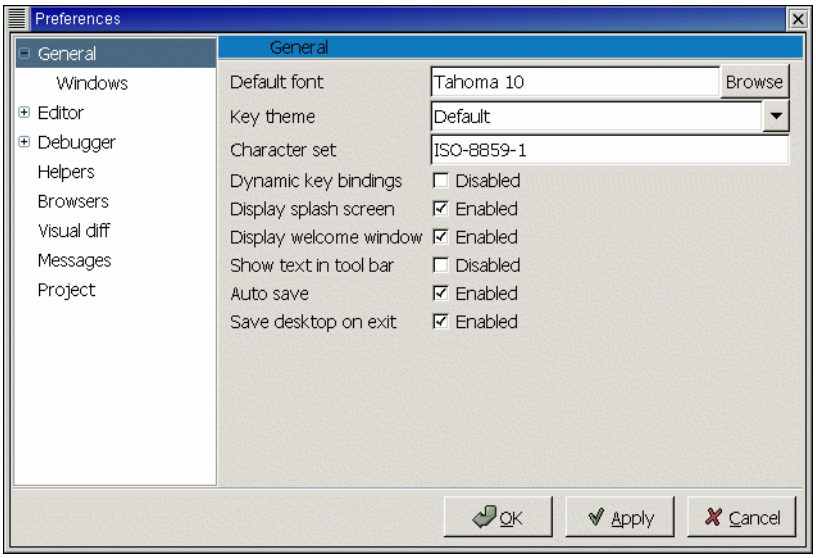
Similarly, if you are running the underlying debugger (gdb) on a remote machine, you can specify the name of this machine by setting the `Tools host` field of the project properties.

15 Customizing and Extending GPS

GPS provides several levels of customization, from simple preferences dialog to powerful scripting capability through the `python` language. This chapters describes each of these capabilities.

15.1 The Preferences Dialog

This dialog, available through the menu `Edit->Preferences`, allows you to modify the global preferences of GPS. To enable the new preferences, you simply need to confirm by pressing the `OK` button. To test your changes, you can use the `Apply` button. Pressing the `Cancel` button will undo all your changes.



Each preference is composed of a label displaying the name of the preference, and an editing area to modify its value. If you leave to mouse over the label, a tool tip will be displayed giving an on-line help on the preference.

The preferences dialog is composed of several areas, accessible through the tabs at the left of the dialog. Each page corresponds to a set of preferences.

- **Themes**

  This page allows you to quickly change the current settings for GPS, including preferences, key bindings, menus.... See Section 15.2

[GPS Themes], page 137 for more information on themes. It is only displayed when there are themes registered.

- **General**

Default font
: The default font used in GPS

Character set
: Name of character set to use for displaying text. The default value is ISO-8859-1, which corresponds to Latin-1 (Western European) characters.

Dynamic key bindings
: Whether the menu key bindings can be changed interactively.

  When this preference is enabled, you can navigate through the menus, and type the key binding you want to associate to a particular item. To remove a key binding, use the ⟨Backspace⟩ key. Your changes will be saved when GPS exits, in a file called '`$HOME/.gps/custom_keys`'. In particular, this means that if for some reason you need to edit the file manually, you need to do it outside of GPS, or save the file under a different name, and rename it after exiting GPS.

Display splash screen
: Whether a splash screen should be displayed when starting GPS.

Display welcome window
: Whether GPS should display the welcome window for the selection of the project to use.

Tool bar style
: How the tool bar should be displayed: not at all, with small icons or with large icons

Show text in tool bar
: Whether the tool bar should show both text and icons, or only icons.

Auto save
: Whether unsaved files and projects should be saved automatically before calling external tools (e.g. before a build).

Save desktop on exit
: Whether the desktop (size and positions of all windows) should be saved when exiting.

Multi language build
: Whether GPS should build (using gprmake) more than just Ada sources for projects containing Ada and other (e.g. C) languages.

  By default, GPS will call gnatmake to build projects containing Ada sources, meaning that non Ada sources won't be built. By enabling this preference, a multi-language build tool, called `gprmake` will be called. Note that this tool is still under development, so this option should only be activated with caution.

Jump to first location
: Whether the first entry of the location window should be selected automatically, and thus whether the corresponding editor should be immediately open.

- **Windows**

  This section specifies preferences that apply to the *Multiple Document Interface* described in Chapter 4 [Multiple Document Interface], page 15.

  Opaque If True, items will be resized or moved opaquely when not maximized.

  Destroy floats
  : If False, closing the window associated with a floating item will put the item back in the main GPS window, but will not destroy it. If True, the item is destroyed.

  All floating
  : If True, then all the windows will be floating by default, i.e. be under the control of your system (Windows) or your window manager (Unix machines). This replaces the MDI.

  Background color
  : Color to use for the background of the MDI.

  Title bar color
  : Color to use for the title bar of unselected items.

  Selected title bar color
  : Color to use for the title bar of selected items.

  Show title bars
  : If True, each window in GPS will have its own title bars, showing some particular information (like the name of the file edited for editors), and some buttons to iconify, maximize or close the window. This title bar is highlighted when the window is the one currently selected.

If False, the title bar is not displayed, to save space on the screen. The tabs of the notebooks will then be highlighted.

Notebook tabs policy
Indicates when the notebook tabs should be displayed. If set to "Never", you will have to select the window in the Window menu, or through the keyboard. If set to "Automatic", then the tabs will be shown when two or more windows are stacked.

Notebook tabs position
Indicates where the notebook tabs should be displayed

- **Editor**

  General

  Strip blanks
  Whether the editor should remove trailing blanks when saving a file.

  Line terminator
  Choose between *Unix*, *Windows* and *Unchanged* line terminators when saving files. Choosing *Unchanged* will use the original line terminator when saving the file; *Unix* will use LF line terminators; *Windows* will use CRLF line terminators.

  Display line numbers
  Whether the line numbers should be displayed in file editors.

  Display subprogram names
  Whether the subprogram name should be displayed in the editor's status bar.

  Tooltips Whether tool tips should be displayed automatically.

  Highlight delimiters
  Determine whether the delimiter matching the character following the cursor should be highlighted. The list of delimiters includes: `{}[]()`

  Autosave delay
  The period (in seconds) after which an editor is automatically saved, 0 if none.

Each modified file is saved under a file called `.#filename#`, which is removed on the next explicit save operation.

Column highlight
The column number to highlight and draw in the editors. 0 if none.

Block highlighting
Whether the editor should highlight the current block. The current block depends on the programming language, and will include e.g. procedures, loops, if statements, . . .

Block folding
Whether the editor should provide the ability to fold/unfold blocks.

Automatic syntax check
Whether GPS should automatically check syntax in background for the source files that are being edited.

Speed Column Policy
When the Speed Column should be shown on the side of the editors:

`Never` The Speed Column is never displayed.

`Automatic` The Speed Column is shown whenever lines are highlighted in the editor, for example to show the current execution point, or lines containing compilation errors, . . . It disappears when no lines are highlighted.

`Always` The Speed Column is always displayed.

External editor
The default external editor to use.

Custom editor command
Specify the command line for launching a custom editor. It is assumed that the command will create a new window/terminal as needed. If the editor itself does not provide this capability (such as vi or pico under Unix

systems), you can use an external terminal command, e.g:

```
xterm -geo 80x50 -exe vi +%l %f
```

The following substitutions are provided:

`%l`	line to display
`%c`	column to display
`%f`	full pathname of file to edit
`%e`	extended lisp inline command
`%p`	top level project file name
`%%`	percent sign ('%')

Always use external editor
True if all editions should be done with the external editor. This will deactivate completely the internal editor. False if the external editor needs to be explicitly called by the user.

Fonts & Colors

Default The default font, default foreground and default background colors used in the source editor.

Keywords
Font and colors used to highlight keywords.

Comments
Font and colors used to highlight comments. Setting the color to white will set a transparent color.

Strings Font and colors used to highlight strings. Setting the color to white will set a transparent color.

Current line color
Color for highlighting the current line. Leave it to blank for no highlighting. Setting the color to white will set a transparent color.

Current block color
Color for highlighting the current source block.

Delimiter highlighting color
Color for highlighting delimiters.

Search results highlighting
: Color for highlighting the search results in the text of source editors.

Cursor color
: Color used for the cursor in editors and interactive consoles

Cursor aspect ratio
: Defines the size of the cursor, relatively to characters. 100 means the cursor will occupy the same size as a character, 10 means it will only occupy 10% of the size occupies by a character.

Ada

Auto indentation
: How the editor should indent Ada sources. None means no indentation; Simple means that indentation from the previous line is used for the next line; Extended means that a language specific parser is used for indenting sources.

Use tabulations
: Whether the editor should use tabulations when indenting.

Default indentation
: The number of spaces for the default Ada indentation.

Continuation lines
: The number of extra spaces for continuation lines.

Declaration lines
: The number of extra spaces for multiple line declarations. For example, using a value of 4, here is how the following code would be indented:

```
variable1,
    variable2,
    variable3 : Integer;
```

Case indentation
: Whether GPS should indent case statements with an extra level, as used in the Ada Reference Manual, e.g:

```
case Value is
   when others =>
      null;
end case;
```

If this preference is set to `Non_Rm_Style`, this would be indented as:

```
case Value is
when others =>
   null;
end case;
```

By default (`Automatic`), GPS will choose to indent with an extra level or not based on the first `when` construct: if the first `when` is indented by an extra level, the whole case statement will be indented following the RM style.

Reserved word casing

How the editor should handle reserved words casing. `Unchanged` will keep the casing as-is; `Upper` will change the casing of all reserved words to upper case; `Lower` will change the casing to lower case; `Mixed` will change the casing to mixed case (all characters to lower case except first character and characters after an underscore which are set to upper case); `Smart_Mixed` As above but do not force upper case characters to lower case.

Identifier casing

How the editor should handle identifiers casing. The values are the same as for the *Reserved word casing* preference.

Format operators/delimiters

Whether the editor should add extra spaces around operators and delimiters if needed. If enabled, an extra space will be added when needed in the following cases: before an opening parenthesis; after a closing parenthesis, comma, semicolon; around all Ada operators (e.g. `<=`, `:=`, `=>`, . . .)

Align colons in declarations

Whether the editor should automatically align colons in declarations and parameter lists. Note that the alignment is computed by taking into account the current buffer up

to the current line (or end of the current selection), so if declarations continue after the current line, you can select the declarations lines and hit the reformat key.

Align associations on arrows
Whether the editor should automatically align arrows in associations (e.g. aggregates or function calls). See also previous preference.

Align declarations after colon
Whether the editor should align continuation lines in variable declarations based on the colon character.

Consider the following code:

```
Variable : constant String :=
  "a string";
```

If this preference is enabled, it will be indented as follows:

```
Variable : constant String :=
             "a string";
```

C/C++

Auto indentation
How the editor should indent C/C++ sources. None means no indentation; Simple means that indentation from the previous line is used for the next line; Extended means that a language specific parser is used for indenting sources.

Use tabulations
Whether the editor should use tabulations when indenting. If True, the editor will replace each occurrence of eight characters by a tabulation character.

Default indentation
The number of spaces for the default indentation.

- **Debugger**

  General

  Color highlighting
  Color used for highlighting in the debugger console.

Break on exceptions

Specifies whether a breakpoint on all exceptions should be set by default when loading a program. This setup is only taken into account when a new debugger is initialized, and will not modify a running debugger (use the breakpoint editor for running debuggers).

Execution window

Specifies whether the debugger should create a separate execution window for the program being debugged. If true, a separate console will be created. Under Unix systems, this console is another window in the bottom part of the main window; under Windows, this is a separate window created by the underlying gdb, since Windows does not have the notion of separate terminals (aka ttys).

Note that in this mode under Windows, the `Debug->Interrupt` menu will not interrupt the debugged program. Instead, you need to hit ⟨Ctrl-C⟩ in the separate execution window to interrupt it while it is running. On Windows this separate execution window uses the default system-wide console properties (the size of the window, the colors...). It is possible to change those properties using the default console menu (top-left of the console) on Windows XP or using the control panel on Windows NT.

If false, no execution window will be created. The debugger assumes that the program being debugged does not require input, or that if it does, input is handled outside GPS. For example, when you attach to a running process, this process already has a separate associated terminal.

Show lines with code

Specifies whether the source editor should display blue dots for lines that contain code. If set to *False*, gray dots will be displayed instead on each line, allowing breakpoint on any line. Disabling this option provides a faster feedback, since GPS does not need to

query the debugger about which lines contain code.

Assembly

Current assembly line
Color used to highlight the assembly code for the current line.

Range size
Number of assembly lines to display in the initial display of the assembly window. If the size is 0, then the whole subprogram is displayed, but this can take a very long time on slow machines.

Data

Lets you change the preferences of the *Data Window*, in particular the fonts and colors used to display the data graphically.

Click-able item
Indicates color to be used for the items that are click-able (e.g pointers).

Changed data
Indicates color to be used to highlight fields that have changed since the last update.

Item name
Indicates font to be used for the name of the item.

Item type
Indicates font to be used to display the type of the item.

Detect aliases
If enabled, do not create new items when an item with the same address is already present on the canvas.

Memory

Default color
Color used by default in the memory view window.

Color highlighting
Color used for highlighted items.

Selection
Color used for selected items.

- **Helpers**

  List processes
  : Command used to list processes running on the machine.

  Remote shell
  : Program used to run a process on a remote machine. You can specify arguments, e.g. `rsh -l user`

  Remote copy
  : Program used to copy a file from a remote machine. You can specify arguments, e.g. `rcp -l user`

  Execute command
  : Program used to execute commands externally.

  Print command
  : External program used to print files.

    This program is required under Unix systems in order to print, and is set to `a2ps` by default. If `a2ps` is not installed on your system, you can download it from `www.inf.enst.fr/~demaille/a2ps`

    Under Windows systems, this program is optional and is empty by default, since a built-in printing is provided. An external tool will be used if specified, such as the PrintFile freeware utility available from `www.lerup.com/printfile/descr.html`

- **Browsers**

  General

  Selected item color
  : Color to use to draw the selected item.

  Background color
  : Color used to draw the background of the browsers.

  Hyper link color
  : Color used to draw the hyper links in the items.

  Selected link color
  : Color to use for links between selected items.

  Default link color
  : Color used to draw the links between unselected items.

  Ancestor items color
  : Color to use for the background of the items linked to the selected item.

Offspring items color
Color to use for the background of the items linked from the selected item.

Vertical layout
Whether the layout of the graph should be vertical (*True*) or horizontal (*False*).

File Dependencies

Show system files
Whether the system files (Ada runtime or standard C include files) should be visible in the browser.

Show implicit dependencies
If False, then only the explicit dependencies are shown in the browser. Otherwise, all dependencies, even implicit, are displayed.

- **Visual diff**

Note that in order to perform visual comparison between files, GPS needs to call external tool (not distributed with GPS) such as `diff` or `patch`. These tools are usually found on most unix systems, and may not be available by default on other OSes. Under Windows, you can download them from one of the unix toolsets available, such as msys (`http://www.mingw.org/msys.shtml`) or cygwin (`http://www.cygwin.com`).

Context length
The number of lines displayed before and after each chunk of differences. Specifying -1 will display the whole file.

Diff command
Command used to compute differences between two files. Arguments can also be specified. The visual diff expects a standard diff output with no context (that is, no `-c` nor `-u` switch). Arguments of interest may include (this will depend on the version of diff used):

-b Ignore changes in amount of white space.

-B Ignore changes that just insert or delete blank lines.

-i Ignore changes in case; consider upper and lower case letters equivalent.

-w Ignore white space when comparing lines.

Patch command
: Command used to apply a patch. Arguments can also be specified. This command is used internally by GPS to perform the visual comparison on versioned files (e.g. when performing a comparison with a version control system).

  This command should be compatible with the `GNU patch` utility.

- **Messages**

Color highlighting
: Color used to highlight text in the messages window.

Color highlighting
: Color used to highlight lines causing compilation errors/warnings in the source editors. When this color is set to white, the errors/warnings are not highlighted. (Chapter 9 [Compilation/Build], page 73)

File pattern
: Pattern used to detect file locations and the type of the output from the messages window. This is particularly useful when using an external tool such as a compiler or a search tool, so that GPS will highlight and allow navigation through source locations. This is a standard system V regular expression containing from two to five parenthesized subexpressions corresponding to the file, line, column, warnings or style error patterns.

File index Index of filename in the file pattern.

Line index
: Index of the line number in the file pattern.

Column index
: Index of the column number in the file pattern.

Warning index
: Index of the warning identifier in the file pattern.

Style index
: Index of the style error identifier in the file pattern.

- **Project**

Relative project paths
: Whether paths should be absolute or relative when the projects are modified.

Fast Project Loading
: If the project respects a number of restrictions, activating the preference will provide major speed up when

GPS parses the project. This is especially noticeable if the source files are on a network drive.

GPS assumes that the following restricitions are true when the preference is activated. If this isn't the case, no error is reported, and only minor drawacks will be visible in GPS (no detection that two files are the same if one of them is a symbolic link for instance, although GPS will still warn you if you are trying to overwrite a file modified on the disk).

The restrictions are the following:

- Symbolic links shouldn't be used in the project. More precisely, you can only have symbolic links that point to files outside of the project, but not to another file in the project
- Directories can't have source names. No directory name should match the naming scheme defined in the project. For instance, if you are using the default GNAT naming scheme, you cannot have directories with names ending with ".ads" or ".adb"

15.2 GPS Themes

GPS provides an extensive support for themes. Themes are predefined set of value for the preferences, for the key bindings, or any other configurable aspect of GPS.

For instance, color themes are a convenient way to change all colors in GPS at once, according to predefined choices (strongly contrasted colors, monochrome,...). It is also possible to have key themes, defining a set of key bindings to emulate e.g. other editors.

Any number of themes can be activated at the same time through the preferences dialog (`Edit->Preferences`). This dialog contains a list of all themes that GPS knows about, organized into categories for convenient handling. Just click on the buttons on the left of each theme name to activate that theme.

Note that this will immediately change the current preferences settings. For instance, if the theme you just selected changes the colors in the editor, these are changed immediately in the `Editor->Fonts & Colors`. You can of course still press `Cancel` to keep your previous settings

If multiple themes are active at the same time and try to override the same preferences, the last theme which is loaded by GPS will override all previously loaded themes. However, there is no predefined order in which the themes are loaded.

15.2.1 The Emacs Theme

The Emacs Theme, which is provided by default with GPS, defines a number of key bindings similar to Emacs.

`control-c n`
: Create a title box above the current Ada subprogram

`control-k`
: Remove text from the cursor to the end of line

`control-d`
: Remove the character after the cursor

`control-t`
: Transpose the characters before and after the cursor

`control-x control-s`
: Save the current editor

`control-a`
: Go to the beginning of the line

`control-e`
: Go to the end of the line

`alt-less` Go to the beginning of the buffer

`control-c control-d`
: Navigate to the declaration or the body of the current entity

`control-c o`
: Goto from the specification to the body, and vice-versa

`control-y`
: Paste the current clipboard

`alt-w` Copy the current selection to the clipboard

`control-w`
: Cut the current selection to the clipboard

`shift-control-underscore`
: Undo the previous edition

`control-x k`
: Close the current window

`control-x control-c`
: Exit GPS

`control-s`
: Bring up the "Find/Replace" dialog

`control-x 3`
: Split the window horizontally

`control-x 2`
: Split the window vertically

`control-x o`
: Select the other window

`control-l`
: Center the cursor on the screen

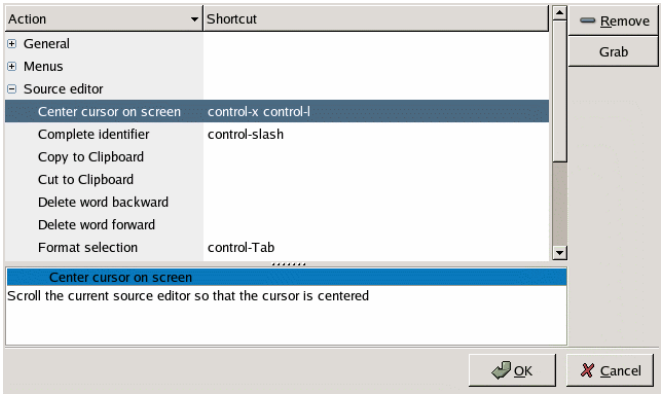
`alt-backspace`
: Delete the previous word

`alt-right`
: Go to the next word

`alt-left` Go to the previous word

15.3 The Key Manager Dialog

The key manager is accessible through the menu `Edit->Key Shortcuts`. This dialog provides an easy way to associate key shortcuts with actions. These actions are either predefined in GPS, or defined in your own customization files, as documented in Section 15.4 [Customizing through XML files], page 140. It also provides an easy way to redefine the menu shortcuts.



Actions are referenced by their name, and are grouped into categories. These categories indicate when the action applies. For instance, the indentation command only applies in source editors, whereas the command to change the current window applies anywhere in GPS. The categories correspond in fact to filters that indicate when the action can be executed. You can create your own new categories by using the `<filter>` tag in the customization files (see Section 15.4 [Customizing through XML files], page 140).

Through the key manager, you can define key bindings similar to what Emacs uses (⟨control-x⟩ followed by ⟨control-k⟩ for instance). To register such key bindings, you need to press the `Grab` button as usual, and then type the shortcut. The recording of the key binding will stop a short while after the last key stroke.

If you define complex shortcuts for menus, they will not appear next to the menu name when you select it with the mouse. This is expected, and is due to technical limitations in the graphical toolkit that GPS uses.

15.4 Customizing through XML files

You can customize lots of capabilities in GPS using XML files that are loaded by GPS at start up.

For example, you can add items in the menu and tool bars, as well as defining new key bindings, new languages, new tools, . . .

XML files are found through three mechanisms, described here in the order in which they are searched. Files with the '`.xml`' extension found through `GPS_CUSTOM_PATH` or the user's directory can override any setup found in the system directory. Likewise, files found in the user's directory can override any file found in the `GPS_CUSTOM_PATH` directories.

Note that only files with the '`.xml`' extension are considered, other files are ignored.

- System wide customization

  The '`INSTALL/share/gps/customize`' directory, where '`INSTALL`' is the name of the GPS installation directory, should contain the files that will always be loaded whenever GPS is started, by any user on the system.

- `GPS_CUSTOM_PATH`

  This environment variable can be set before launching GPS. It should contain a list of directories, separated by semicolons (';') on Windows systems and colons (':') on Unix systems. All the files found in these directories will be searched for customization files.

  This is a convenient way to have project-specific customization files. You can for instance create scripts, or icons, that set the appropriate value for the variable and then start GPS. Depending on your project, this allows you to load specific aliases which do not make sense for other projects.

- User directory

  The directory '`$HOME/.gps/customize`' on Unix systems, and '`%HOME%\.gps\customize`' on Windows systems, can also contain customization files which are parsed at startup. This is a convenient way for users to define their own customization, that they

want to load no matter which project they are working on. Note that you can use the environment variable `GPS_HOME` to override the value of the `HOME` variable.

Alternatively, if none of `HOME` and `GPS_HOME` are defined, `USERPROFILE` is also considered.

XML files must be utf8-encoded by default. In addition, you can specify any specific encoding through the standard `<?xml encoding="..." ?>` declaration, as in the following example:

```
<?xml version="1.0" encoding="iso-8859-1"?>
<submenu>
  <title>encoded text/title>
</submenu>
```

Any given XML file can contain customization for various aspects of GPS, mixing aliases, new languages or menus,. . . in a single file. This is a convenient way to distribute your customization to other users.

These files must be valid XML files, i.e. must start with the `<?xml?>` tag, and contain a single root XML node, the name of which is left to your consideration. The general format is therefore

```
<?xml version="1.0" ?>
<root_node>
   ...
</root_node>
```

The list of valid XML child nodes that can be specified under <root> is described in later sections. It includes:

`<action>` (see Section 15.4.1 [Defining Actions], page 142)

`<key>` (see Section 15.4.7 [Binding actions to keys], page 156)

`<submenu>`
(see Section 15.4.4 [Adding new menus], page 151)

`<pref>` (see Section 15.4.8 [Preferences support in custom files], page 156)

`<preference>`
(see Section 15.4.8 [Preferences support in custom files], page 156)

`<alias>` (see Section 15.4.12 [Defining text aliases], page 165)

`<language>`
(see Section 15.4.11 [Adding support for new languages], page 161)

`<button>` (see Section 15.4.6 [Adding tool bar buttons], page 154)

`<entry>` (see Section 15.4.6 [Adding tool bar buttons], page 154)

`<vsearch-pattern>`
(see Section 15.4.10 [Defining new search patterns], page 160)

`<tool>` (see Section 15.5 [Adding support for new tools], page 179)

`<filter>` (see Section 15.4.3 [Filtering actions], page 148)

`<contextual>`
(see Section 15.4.5 [Adding contextual menus], page 154)

`<case_exceptions>`
(see Section 15.4.15 [Adding casing exceptions], page 176)

`<documentation_file>`
(see Section 15.4.16 [Adding documentation], page 177)

`<stock>` (see Section 15.4.17 [Adding stock icons], page 178)

`<project_attribute>`
(see Section 15.4.14 [Defining project attributes], page 169)

15.4.1 Defining Actions

This facility distinguishes the actions from their associated menus or key bindings. Actions can take several forms: external commands, shell commands and predefined commands, as will be explained in more details below.

The general form to define new actions is to use the `<action>` tag. This tag accepts the following attributes:

`name (mandatory)`
This tag must be specified. It provides the name by which the action is referenced in other parts of the customization files, for instance when it is associated with a menu or a toolbar button. The name can contain any character, although it is recommended to avoid XML special characters. It mustn't start with a '/'.

`output (optional)`
If specified, this attribute indicates where the output of the commands will be sent by default. This can be overridden by each command, using the same attribute for `<shell>` and `<external>` tags, See Section 15.5.4.5 [Redirecting the command output], page 190.

`show-command (optional)`
If specified, this attribute indicates whether the text of the command itself should be displayed at the same location as its output. Neither will be displayed if the output is hidden. The default is to show the command along with its output.

This attribute can be overridden for each command.

If you are defining the same action multiple times, the last definition will be kept. However, existing menus, buttons,... that already reference that action will keep their existing semantic. The new definition will only be used for all new menus created from that point on.

The <action> can have one or several children, all of which define a particular command to execute. All of these commands are executed one after the other, unless one of them fails in which case the following commands are not executed.

The following XML tags are valid children for <action>.

<external>

This defines a command to execute through the system (i.e. a standard Unix or Windows command)

Note for Windows users: like under UNIX, scripts can be called from custom menu. In order to do that, you must write your script in a '.bat' or '.cmd' file, and call this file using cmd /c. Thus, the external tag would look like:

```
<?xml version="1.0" ?>
<external_example>
  <action name="my_command">
    <external>cmd /c c:\.gps\my_scripts\my_cmd.cmd</external>
  </action>
</external_example>
```

This tag accepts the following attributes:

show-command (optional)

This attribute can be used to override the homonym attribute specified for the <action> tag.

output (optional)

This attribute can be used to override the homonym attribute specified for the <action> tag.

progress-regexp (optional)

This attribute specifies a regular expression that the output of the command will be checked against. Every time the regular expression matches, it should provide two numeric values that are used to display the usual progress indicators at the bottom-right corner of the GPS window, as happens during regular compilations.

The name of the action is printed in the progress bar while the action is executing.

```
<?xml version="1.0" ?>
<progress_action>
  <action name="progress" >
    <external
      progress-regexp="(\d+) out of (\d+).*$"
      progress-current="1"
      progress-final="2"
      progress-hide="true">gnatmake foo.adb
    </external>
  </action>
</progress_action>
```

`progress-current (optional)`
: This is the opening parenthesis count index in `progress-regexp` that contains the current step.

`progress-final (optional)`
: This is the opening parenthesis count index in `progress-regexp` that contains the current last step. This last index can grow as needed. For example, gnatmake will output the number of the file it is currently examining, and the total number of files to be examined. However, that last number may grow up, since parsing a new file might generate a list of additional files to parse later on.

`progress-hide (optional)`
: If this attribute is set to the value "true", then all the lines that match `progress-regexp` and are used to compute the progress will not be displayed in the output console. For any other value of this attribute, these lines are displayed along will the rest of the output.

`<on-failure>`
: This tag specifies a group of command to be executed if the previous external command fails. Typically, this is used to parse the output of the command and fill the location window appropriately (see Section 15.5.4.6 [Processing the tool output], page 190).

  For instance, the following action spawn an external tool, and parses its output to the location window and the automatic fixing tool if the external tool happens to fail.

  In this group of commands the %... and $... macros can be used.

```
<?xml version="1.0" ?>
<action_launch_to_location>
```

```
  <action name="launch tool to location" >
    <external>tool-path</external>
    <on-failure>
      <shell>Locations.parse "%1" category<shell>
      <external>echo the error message is "%2"</external>
    </on-failure>
    <external>echo the tool succeeded with message %1</external>
  </action>
</action_launch_to_location>
```

`<shell>` As well as external commands, you can use custom menu items to invoke GPS commands using the `shell` tag. These are command written in one of the shell scripts supported by GPS.

This tag supports the same `show-command` and `output` attributes as the `<action>` tag.

The following example shows how to create two actions to invoke the `help` interactive command and to open the file 'main.c'.

```
<?xml version="1.0" ?>
<help>
  <action name="help">
    <shell>help</shell>
  </action>
  <action name="edit">
    <shell>edit main.c</shell>
  </action>
</help>
```

By default, commands are expected to be written in the GPS shell language. However, you can specify the language through the `lang` attribute. Its default value is `"shell"`.

The value of this attribute could also be "python".

When programming with the GPS shell, you can execute multiple commands by separating them with semicolons. Therefore, the following example adds a menu which lists all the files used by the current file, in a project browser.

```
<?xml version="1.0" ?>
<current_file_uses>
  <action name="current file uses">
    <shell lang="shell">File %f</shell>
    <shell lang="shell">File.uses %1</shell>
  </action>
</current_file_uses>
```

`<description>`

This tag contains a description for the command, which is used in the graphical editor for the key manager. See Section 15.3 [The Key Manager Dialog], page 139.

`<filter>`, `<filter_and>`, `<filter_or>`
: This is the context in which the action can be executed, See Section 15.4.3 [Filtering actions], page 148.

It is possible to mix both shell commands and external commands. For instance, the following command opens an xterm (on Unix systems only) in the current directory, which depends on the context.

```
<?xml version="1.0" ?>
<xterm_directory>
  <action "xterm in current directory">
    <shell lang="shell">cd %d</shell>
    <external>xterm</external>
  </action>
</xterm_directory>
```

As seen in some of the examples above, some special strings are expanded by GPS just prior to executing the command. These are the "%f", "%d",.. See below for a full list.

More information on chaining commands is provided in See Section 15.5.4.1 [Chaining commands], page 187.

Some actions are also predefined in GPS itself. This include for instance aliases expansion, manipulating MDI windows,... All known actions (predefined and the ones you have defined in your own customization files) can be discovered by opening the key shortcut editor (`Edit->Key shortcuts` menu).

15.4.2 Macro arguments

When an action is defined, you can use macro arguments to pass to your shell or external commands. Macro arguments are special parameters that are transformed every time the command is executed. The following macro arguments are provided.

The equivalent python command is given for all tests. These commands are useful when you are writing a full python script, and want to test for yourself whether the context is properly defined.

`%f`
: Base name of the currently opened file.
Python equivalent:

```
import os.path
os.path.basename (GPS.current_context().file().name())
```

`%F`
: Absolute name of the currently opened file.
Python equivalent:

```
GPS.current_context().file().name()
```

`%d`
: The currently directory.
Python equivalent:

```
GPS.current_context().directory()
```

`%p` The current project. This is the name of the project, not the project file.
Python equivalent:

```
GPS.current_context().project().name()
```

`%P` The root project. This is the name of the project, not the project file.
Python equivalent:

```
GPS.Project.root().name()
```

`%pp` The current project file pathname. If a file is selected, this is the project file to which the source file belongs.
Python equivalent:

```
GPS.current_context().project().file().name()
```

`%PP` The root project pathname.
Python equivalent:

```
GPS.Project.root().file().name()
```

`%pps` This is similar to `%pp`, except it returns the project name prepended with `-P`, or an empty string if there is no project file selected and the current source file doesn't belong to any project. This is mostly for use with the GNAT command line tools.
Python equivalent:

```
if GPS.current_context().project():
   return "-P" & GP.current_context().project().path()
```

`%PPs` This is similar to `%PP`, except it returns the project name prepended with `-P`, or an empty string if the root project is the default project. This is mostly for use with the GNAT command line tools.

`%(p|P)[r](d|s)[f]`
Substituted by the list of sources or directories of a given project. This list is a list of space-separated, quoted names (all names are surrounded by double quotes, for proper handling of spaces in directories or file names).

- `P` the root project.
- `p` the selected project, or the root project if there is no project selected.
- `r` recurse through the projects: sub projects will be listed as well as their sub projects, etc. . .
- `d` list the source directories.
  Python equivalent:

```
GPS.current_context().project().source_dirs()
```

`s` list the source files.
Python equivalent:

```
GPS.current_context().project().sources()
```

`f` output the list into a file and substitute the parameter with the name of that file. This file is never deleted by GPS, it is your responsibility to do so.

Examples:

`%Ps` Replaced by a list of source files in the root project.

`%prs` Replaced by a list of files in the current project, and all imported sub projects, recursively.

`%prdf` Replaced by the name of a file that contains a list of source directories in the current project, and all imported sub projects, recursively.

15.4.3 Filtering actions

By default, an action will execute in any context in GPS. The user just selects the menu or key, and GPS tries to execute the action.

It is possible to restrict when an action should be considered as valid. If the current context is incorrect for the action, GPS will not attempt to run anything, and will display an error message for the user.

Actions can be restricted in several ways:

1. Using macro arguments (see Section 15.4.2 [Macro arguments], page 146). If you are using one of the macro arguments defined in the previous section, anywhere in the chain of commands for that action, GPS will first check that the information is available, and if not will not start running any of the shell commands or external commands for that action.

   For instance, if you have specified `%F` as a parameter to one of the commands, GPS will check prior to running the action that there is a current file. This can be either a currently selected file editor, or for instance that the project explorer is selected, and a file node inside it is also selected.

   You do not have to specify anything else, this filtering is automatic

2. Defining explicit filters Explicit restrictions can be specified in the customization files. These are specified through the `<filter>`, `<filter_and>` and `<filter_or>` tags, see below.

   These tags can be used to further restrict when the command is valid. For instance, you can use them to specify that the command

only applies to Ada files, or only if a source editor is currently selected.

15.4.3.1 The filters tags

Such filters can be defined in one of two places in the customization files:

1. At the toplevel At the same level as other tags such as <action>, <menu> or <button> tags, you can define named filters. These are general filters, that can be referenced elsewhere without requiring code duplication. They also appear explicitly in the key shortcuts editor if at least one action is depending on them.
2. As a child of the <action> tag Such filters are anonymous, although they provide exactly the same capabilities as the ones above. These are mostly meant for simple filters, or filters that you use only once, or don't want to appear in the key shortcuts manager.

There are three different kinds of tags:

<filter> This defines a simple filter. This tag takes no child tag.

<filter_and>
: All the children of this tag are composed together to form a compound filter. They are evaluated in turn, and as soon as one of them fails, the whole filter fails. Children of this tag can be of type <filter>, <filter_and> and <filter_or>.

<filter_or>
: All the children of this tag are composed together to form a compound filter. They are evaluated in turn, and as soon as one of them succeeds, the whole filter succeeds. Children of this tag can be of type <filter>, <filter_and> and <filter_or>.

If several such tags are found following one another under an <action> tag, they are combined through "or", i.e. any of the filters may match for the action to be executed.

The <filter>, <filter_and> and <filter_or> tags accept the following set of common attributes:

name (optional)
: This attribute is used to create named filters, that can be reused elsewhere in actions or compound filters through the id attribute. The name can take any form. This is also the name that appears in the context of the key shortcuts editor.

error (optional)
: This is the error message printed in the GPS console if the filter doesn't match, and thus the action cannot be executed. If you are composing filters through <filter_and>

and <filter_or>, only the error message of the top-level filter will be printed.

In addition, the <filter> has the following specific attributes:

id (optional)
: If this attribute is specified, all other attributes are ignored. This is used to reference a named filter previously defined. Here is for instance how you can make an action depend on a named filter:

```
<?xml version="1.0" ?>
<test_filter>
  <filter name="Test filter" language="ada" />
  <action name="Test action" >
     <filter id="Test filter" />
     <shell>pwd</shell>
  </action>
</test_filter>
```

A number of filters are predefined by GPS itself. The full list appears in the key shortcut editor, and is listed here:

Source editor
: This filter will only match if the currently selected window in GPS is an editor.

language (optional)
: This attribute specifies the name of the language that must be associated with the current file to match. For instance, if you specify ada, you must have an Ada file selected, or the action won't execute. The language for a file is found by GPS following several algorithms (file extensions, and via the naming scheme defined in the project files).

shell_cmd (optional)
: This attribute specifies a shell command to execute. The output value of this command is used to find whether the filter matches: if it returns "1" or "true", the filter matches. In any other case, the filter fails.

Note that currently no expansion of macro arguments (%f, %p,. . .) is done in this command.

shell_lang (optional)
: This attribute specifies in which language the shell command above is written. Its default value indicates that the command is written using the GPS shell.

module (optional)
: This attribute specifies that the filter only matches if the current window was setup by this specific GPS module. For

instance, if you specify "Source_Editor", this filter will only match when the active window is a source editor.

The list of module names can be obtained by typing `lsmod` in the shell console at the bottom of the GPS window.

This attribute is mostly useful when creating new contextual menus.

When several attributes are specified for a `<filter>` node (which is not possible with `id`), they must all match for the action to be executed.

```
<?xml version="1.0" ?>
<!-- The following filter will only match if the currently selected
     window is a text editor editing an Ada source file -->
<ada_editor>
  <filter_and name="Source editor in Ada" >
    <filter language="ada" />
    <filter id="Source editor" />
  </filter_and>

  <!-- The following action will only be executed for such an editor -->

  <action name="Test Ada action" >
     <filter id="Source editor in Ada" />
     <shell>pwd</shell>
  </action>

  <!--  An action with an anonymous filter. It will be executed if the
        selected file is in Ada, even if the file was selected through
        the project explorer  -->

  <action name="Test for Ada files" >
      <filter language="ada" />
      <shell>pwd</shell>
  </action>
</ada_editor>
```

15.4.4 Adding new menus

These commands can be associated with menus, tool bar buttons and keys. All of these use similar syntax.

Binding a menu to an action is done through the `<menu>` and `<submenu>` tags.

The `<menu>` tag takes the following attributes:

`action (mandatory)`
: This attribute specifies which action to execute when the menu is selected by the user. If no action by this name was defined, no new menu is added. The action name can start

with a '/', in which case it represents the absolute path to a menu to execute instead.

This attribute can be omitted only when no title is specified for the menu to make it a separator (see below).

`before (optional)`
: It specifies the name of another menu item before which the new menu should be inserted. The reference menu must have been created before, otherwise the new menu is inserted at the end. This attribute can be used to control where precisely the new menu should be made visible.

`after (optional)`
: This attribute is similar to `before`, but has a lower priority. If it is specified, and there is no `before` attribute, it specifies a reference menu after which the new menu should be inserted.

It should also have one XML child called `<title>` which specifies the label of the menu. This is really a path to a menu, and thus you can define submenus by specifying something like "/Parent1/Parent2/Menu" in the title to automatically create the parent menus if they don't exist yet.

You can define the accelerator keys for your menus, using underscores in the titles. Thus, if you want an accelerator on the first letter in a menu named `File`, set its title as `_File`.

The tag `<submenu>` accepts the following attributes:

`before (optional)`
: See description above, same as for `<menu>`

`after (optional)`
: See description above, same as for `<menu>`

It accepts several children, among `<title>` (which must be specified at most once), `<submenu>` (for nested menus), and `<menu>`.

Since `<submenu>` doesn't accept the `action` attribute, you should use `<menu>` for clickable items that should result in an action, and `<submenu>` if you want to define several menus with the same path.

You can specify which menu the new item is added to in one of two ways:

- Specify a path in the `title` attribute of `<menu>`
- Put the `<menu>` as a child of a `<submenu>` node This requires slightly more typing, but it allows you to specify the exact location, at each level, of the parent menu (before or after an existing menu).

For example, this adds an item named `mymenu` to the standard `Edit` menu.

```
<?xml version="1.0" ?>
<test>
  <submenu>
    <title>Edit</title>
    <menu action="current file uses">
       <title>mymenu</title>
    </menu>
  </submenu>
</test>
```

The following has exactly the same effect:

```
<?xml version="1.0" ?>
<test>
  <menu action="current file uses">
    <title>Edit/mymenu</title>
  </menu>
</test>
```

The following adds a new item "stats" to the "unit testing" submenu in "my_tools".

```
<?xml version="1.0" ?>
<test>
  <menu action="execute my stats">
     <title>/My_Tools/unit testing/stats</title>
  </menu>
</test>
```

The previous syntax is shorter, but less flexible than the following, where we also force the My_Tools menu, if it doesn't exist yet, to appear after the File menu. This is not doable by using only <menu> tags. We also insert several items in that new menu

```
<?xml version="1.0" ?>
<test>
  <submenu after="File">
    <title>My_Tools</title>
    <menu action="execute my stats">
       <title>unit testing/stats</title>
    </menu>
    <menu action="execute my stats2">
       <title>unit testing/stats2</title>
    </menu>
  </submenu>
</test>
```

Adding an item with an empty title or no title at all inserts a menu separator. For instance, the following example will insert a separator followed by a File/Custom menu:

```
<?xml version="1.0" ?>
<menus>
  <action name="execute my stats" />
  <submenu>
     <title>File</title>
```

```
        <menu><title/></menu>
        <menu action="execute my stats">
            <title>Custom</title>
        </menu>
      </submenu>
    </menus>
```

15.4.5 Adding contextual menus

The actions can also be used to contribute new entries in the contextual menus everywhere in GPS. These menus are displayed when the user presses the right mouse button, and should only show actions relevant to the current context.

Such contributions are done through the `<contextual>` tag, which takes one mandatory attribute `action`, which is the name of the action to execute, and must be defined elsewhere in one of the customization files.

It accepts one child tag, `<Title>` which specifies the name of the menu entry. If this child is not specified, the menu entry will use the name of the action itself. The title is in fact the full path to the new menu entry. Therefore, you can create submenus by using a title of the form "Parent1/Parent2/Menu".

The new contextual menu will only be shown if the filters associated with the action match the current context.

For instance, the following example inserts a new contextual menu which prints the name of the current file in the GPS console. This contextual menu is only displayed in source editors.

```
<?xml version="1.0" ?>
<print>
  <action name="print current file name" >
    <filter module="Source_Editor" />
    <shell>echo %f</shell>
  </action>

  <contextual action="print current file name" >
    <Title>Print Current File Name</Title>
  </contextual>
</print>
```

15.4.6 Adding tool bar buttons

As an alternative to creating new menu items, you can create new buttons on the tool bar, with a similar syntax, by using the `<button>` tag. As for the `<menu>` tag, it requires an `action` attribute which specifies what should be done when the button is pressed. The button is not created if no such action was created.

Within this tag, the tag <pixmap> can be used to indicate the location of an image file (of the type jpeg, png, gif or xpm) to be used as icon for the button. An empty <button> tag indicates a separator in the tool bar.

A title can also be specified with <title>. This will be visible only if the user choses to see both text and icons in the tool bar.

The following example defines a new button:

```
<?xml version="1.0" ?>
<stats>
  <button action="execute my stats">
    <title>stats</title>
    <pixmap>/my_pixmaps/button.jpg</pixmap>
  </button>
</stats>
```

The <button> tag allows you to create a simple button that the user can press to start an action. GPS also supports another type of button, a combo box, from which the user can choose among a list of choices. Such a combo box can be created with the <entry> tag.

This tag accepts the following arguments:

id (mandatory)
: This should be a unique id for this combo box, and will be used later on to refer it, in particular from the scripting languages. It can be any string

label (default is "")
: The text of a label to display on the left of the combo box. If this isn't specified, no text will be displayed

on-changed (default is "")
: The name of a GPS action to execute whenever the user selects a new value in the combo box. This action is called with two parameters, the unique id of the combo box and the newly selected text respectively.

It also accepts any number of <choice> tags, each of which defines one of the values the user can choose from. These tags accepts one optional attribute, "on-selected", which is the name of a GPS action to call when that particular value is selected.

```
<action name="animal_changed">
   <shell>echo A new animal was selected in combo $1: animal is $2"</shell>
</action>
<action name="gnu-selected">
   <shell>echo Congratulations on choosing a Gnu</shell>
</action>
<entry id="foo" label="Animal" on-changed="animal_changed">
   <choice>Elephant</choice>
   <choice on-selected="gnu-selected">Gnu</choice>
</entry>
```

A more convenient interface exists for Python, the GPS.Toolbar class, which gives you the same flexibility as above, but also gives you dynamic control over the entry. See the python documentation.

15.4.7 Binding actions to keys

All the actions defined above can be bound to specific key shortcuts through the `<key>` attribute. As usual, it requires one `<action>` attribute to specify what to do when the key is pressed. The name of the action can start with a '/' to indicate that a menu should be executed instead of a user-defined action.

This tag doesn't contain any child tag. Instead, its text contents specified the keyboard shortcut. The name of the key can be prefixed by `control-`, `alt-`, `shift-` or any combination of these to specify the key modifiers to apply.

You can also define multiple key bindings similar to Emacs's by separating them by a space. For instance, `control-x control-k` means that the user should press ⟨control-x⟩, followed by a ⟨control-k⟩ to activate the corresponding action.

Use an empty string to describe the key binding if you wish to deactivate a preexisting binding. The second example below deactivates the standard binding.

```
<?xml version="1.0" ?>
<keys>
  <key action="expand alias">control-o</key>
  <key action="Jump to matching delimiter" />

  <!--  Bind a key to a menu -->
  <key action="/Window/Close">control-x control-w</key>
</key>
```

Multiple actions can be bound to the same key binding. The first one with a filter valid for the current context is executed. If no action with a filter can be executed, then the first action with no filter will be executed.

15.4.8 Preferences support in custom files

15.4.8.1 Creating new preferences

GPS has a number of predefined preferences to configure its behavior and its appearance. They are all customizable through the Edit->Preferences menu.

However, you might wish to add your own kind of preferences for your extension modules. This can easily be done through the usual GPS customization files. Preferences are different from project attributes

(see Section 15.4.14 [Defining project attributes], page 169), in that the latter will vary depending on which project is loaded by the user, whereas preferences are always set to the same value no matter what project is loaded.

Such preferences are created with the `<preference>` tag, which takes a number of attributes.

`name (mandatory)`
: This is the name of the preference, used when the preference is saved by GPS in the '`$HOME/.gps/preferences`' file, and to query the value of a preference interactively through the `GPS.Preference` class in the GPS shell or python. There are a few limitation to the form of these names: they cannot contain space or underscore characters. You should replace the latter with minus signs for instance.

`page (optional, default is "General")`
: The name of the page in the preferences editor where the preference can be edited. If this is the name of a non-existing page, GPS will automatically create it. If this is the empty string (`""`), the preference will not be editable interactively. This could be used to save a value from one session of GPS to the next, without allowing the user to alter it.

  Subpages are references by separating pages name with colons (':').

`default (optional, default depends on the type of the preference)`
: The default value of the preference, when not set by the user. This is 0 for integer preferences, the empty string for string preferences, True for boolean values, and the first possible choice for choice preferences.

`tip (optional, default is "")`
: This is the text of the tooltip that appears in the preferences editor dialog.

`label (mandatory)`
: This is the name of the preference as it appears in the preferences editor dialog

`type (mandatory)`
: This is the type of the preference, and should be one of:

  - "boolean"

    The preference can be True or False.

  - "integer"

    The preference is an integer. Two optional attributes can be specified for `<preference>`, "minimum" and "maxi-

mum", which define the range of valid values for that integer. Default values are 0 and 10 respectively.

- "string"

  The preference is a string, which might contain any value
- "color"

  The preference is a color name, in the format of a named color such as "yellow", or a string similar to "#RRGGBB", where RR is the red component, GG is the green component, and BB is the blue component
- "font"

  The preference is a font
- "choices"

  The preference is a string, whose value is chosen among a static list of possible values. Each possible value is defined in a <choice> child of the <preference> node.

Here is an example that defines a few new preferences:

```
<?xml version="1.0"?>
<custom>
   <preference name="my-int"
               page="Editor"
               label="My Integer"
               default="30"
               minimum="20"
               maximum="35"
               page="Manu"
               type="integer" />

   <preference name="my-enum"
               page="Editor:Fonts &amp;amp; Colors"
               label="My Enum"
               default="1"
               type="choices" >
     <choice>Choice1</choice>
     <choice>Choice2</choice>  <!--  The default choice -->
     <choice>Choice3</choice>
   </preference>
</custom>
```

The values of the above preferences can be queries in the scripting languages:

- GPS shell

```
Preference "my-enum"
Preference.get %1
```

- Python

```
val = GPS.Preference ("my-enum").get ()
val2 = GPS.Preference ("my-int").get ()
```

15.4.8.2 Setting preferences values

You can force specific default values for the preferences in the customization files through the `<pref>` tag. This is the same tag that is used by GPS itself when it saves the preferences edited through the preferences dialog.

This tag requires on attribute:

`name` This is the name of the preference of which you are setting a default value. Such names are predefined when the preference is registered in GPS, and can be found by looking at the '`$HOME/.gps/preferences`' file for each user, or by looking at one of the predefined GPS themes.

It accepts no child tag, but the value of the `<pref>` tag defines the default value of the preference, which will be used unless the user has overridden it in his own preferences file.

Any setting that you have defined in the customization files will be overridden by the user's preferences file itself, unless the user was still using the default value of that preference.

This `<pref>` tag is mostly intended for use through the themes (see Section 15.4.9 [Creating themes], page 159).

15.4.9 Creating themes

In addition to the predefined themes that come with GPS, you can create your own themes and share them between users. You can then selectively chose which themes they want to activate through the preferences dialog (see Section 15.2 [GPS Themes], page 137).

Creating new themes is done in the customization files through the `<theme>` tag.

This tag accepts a number of attributes:

`name (mandatory)`
This is the name of the theme, as it will appear in the preferences dialog

`description (optional)`
This text should explain what the text does. It appears in the preferences dialog when the user selects that theme.

`category (optional, default is General)`
This is the name of the category in which the theme should be presented in the preferences dialog. Categories are currently only used to organize themes graphically. New categories are created automatically if you chose one that doesn't exist yet.

This tag accepts any other customization tag that can be put in the customization files. This includes setting preferences (<pref>, defining key bindings (<key), defining menus (<menu>),. . .

If the same theme is defined in multiple locations (multiple times in the same customization file or in different files), their effects will be cumulated. The first definition of the theme seen by GPS will set the description and category for this theme.

All the children tags of the theme will be executed when the theme is activated through the preferences dialog. Although there is no strict ordering in which order the children will be executed, the global order is the same as for the customization files themselves: first the predefined themes of GPS, then the ones defined in customization files found through the GPS_CUSTOM_PATH directories, and finally the ones defined in files found in the user's own GPS directory.

```
<?xml version="1.0" ?>
<customize>
   <theme name="my theme" description="Create a new menu">
       <menu action="my action"><title>/Edit/My Theme Menu</title></menu>
   </theme>
</customize>
```

15.4.10 Defining new search patterns

The search dialog contains a number of predefined search patterns for Ada, C and C++. These are generally complex regular expressions, presented in the dialog with a more descriptive name. This includes for instance "Ada assignment", which will match all such assignments.

You can define your own search patterns in the customization files. This is done through the <vsearch-pattern> tag. This tag can have a number of children tags:

<name>

This tag is the string that is displayed in the search dialog to represent the new pattern. This is the text that the user will effectively see, instead of the often hard to understand regular expression.

<regexp>

This tag provides the regular expression to use when the pattern has been selected by the user. Be careful that you must protect reserved XML characters such as '<' and replace them by their equivalent expansion ("<" for this character).

This accepts one optional attribute, named case-sensitive. This attribute accepts one of two possible values ("true" or "false") which indicates whether the search should distin-

guish lower case and upper case letters. Its default value is "false".

`<string>`

This tag provides a constant string that should be searched. Only one of `<regexp>` and `<string>` should be provided. If both exists, the first `<regexp>` child found is used. If there is none, the first `<string>` child is used.

The tag accepts the same optional attribute `case-sensitive` as above

Here is a small example on how the "Ada assignment" pattern was defined.

```
<?xml version="1.0" ?>
<search>
  <vsearch-pattern>
    <name>Ada: assignment</name>
    <regexp case-sensitive="false">\b(\w+)\s*:=</regexp>
  </vsearch-pattern>
</search>
```

15.4.11 Adding support for new languages

You can define new languages in a custom file by using the `Language` tag. Defining languages gives GPS the ability to highlight the syntax of a file, explore a file (using e.g. the project explorer), find files associated with a given language, . . .

As described previously for menu items, any file in the 'customize' directory will be loaded by GPS at start up. Therefore, you can either define new languages in a separate file, or reuse a file where you already define actions and menus.

The following tags are available in a `Language` section:

`Name` A short string describing the name of the language.

`Parent` If set to the name of an existing language (e.g. `Ada`, `C++`) or another custom language, this language will inherit by default all its properties from this language. Any field explicitly defined for this language will override the inherited settings.

`Spec_Suffix`
A string describing the suffix of spec/definition files for this language. If the language does not have the notion of spec or definition file, you can ignore this value, and consider using the `Extension` tag instead. This tag must be unique.

`Body_Suffix`
: A string describing the suffix of body/implementation files for this language. This tag works in coordination with the `Spec_Suffix`, so that the user can choose to easily go from one file to the other. This tag must be unique.

`Extension`
: A string describing one of the valid extensions for this language. There can be several such children. The extension must start with a '.' character

`Keywords`
: A V7 style regular expression for recognizing and highlighting keywords. Multiple `Keywords` tags can be specified, and will be concatenated into a single regular expression.

  The full grammar of the regular expression can be found in the spec of the file '`g-regpat.ads`' in the GNAT run time.

`Engine`
: The name of a dynamic library providing one or several of the functions described below.

  The name can be a full pathname, or a short name. E.g. under most Unix systems if you specify `custom`, GPS will look for `libcustom.so` in the `LD_LIBRARY_PATH` run time search path. You can also specify explicitly e.g. `libcustom.so` or `/usr/lib/libcustom.so`.

  For each of the following five items, GPS will look for the corresponding symbol in `Engine` and if found, will call this symbol when needed. Otherwise, it will default to the static behavior, as defined by the other language-related items describing a language.

  You will find the required specification for the C and Ada languages to implement the following functions in the directory '`<prefix>/share/gps/doc/examples/language`' of your GPS installation. '`language_custom.ads`' is the Ada spec file; '`language_custom.h`' is the C spec file; '`gpr_custom.ad?`' are example files showing a possible Ada implementation of the function `Comment_Line` for the GPS project files ('`.gpr`' files), or any other Ada-like language; '`gprcustom.c`' is the C version of gpr_custom.adb.

`Comment_Line`
: Name of a symbol in the specified shared library corresponding to a function that will comment or uncomment a line (used to implement the menu `Edit->Un/Comment Lines`).

`Parse_Constructs`
: Name of a symbol in the specified shared library corresponding to a function that will parse constructs of a given buffer.

This procedure is used by GPS to implement several capabilities such as listing constructs in the project explorer, highlighting the current block of code, going to the next or previous procedure, . . .

`Format_Buffer`
: Name of a symbol in the specified shared library corresponding to a function that will indent and format a given buffer.

  This procedure is used to implement the auto indentation when hitting the ⟨enter⟩ key, or when using the format key on the current selection or the current line.

`Parse_Entities`
: Name of a symbol in the specified shared library corresponding to a function that will parse entities (e.g. comments, keywords, . . .) of a given buffer. This procedure is used to highlight the syntax of a file, and overrides the `Context` node described below.

`Context` Describes the context used to highlight the syntax of a file.

  `Comment_Start`
  : A string defining the beginning of a multiple-line comment.

  `Comment_End`
  : A string defining the end of a multiple-line comment.

  `New_Line_Comment_Start`
  : A regular expression defining the beginning of a single line comment (ended at the next end of line). This regular expression may contain multiple possible line starts, such as `;|#` for comments starting after a semicolon or after the hash sign.

  `String_Delimiter`
  : A character defining the string delimiter.

  `Quote_Character`
  : A character defining the quote character, used for e.g. canceling the meaning of a string delimiter (\ in C).

  `Constant_Character`
  : A character defining the beginning of a character literal.

  `Can_Indent`
  : A boolean indicating whether indentation should be enabled for this language. The indentation

mechanism used will be the same for all languages: the number of spaces at the beginning of the current line is used when indenting the next line.

`Syntax_Highlighting`
: A boolean indicating whether the syntax should be highlighted/colorized.

`Case_Sensitive`
: A boolean indicating whether the language (and in particular the identifiers and keywords) is case sensitive.

`Categories`
: Optional node to describe the categories supported by the project explorer for the current language. This node contains a list of `Category` nodes, each describing the characteristics of a given category, with the following nodes:

  `Name` — Name of the category, which can be one of: package, namespace, procedure, function, task, method, constructor, destructor, protected, entry, class, structure, union, type, subtype, variable, local_variable, representation_clause, with, use, include, loop_statement, case_statement, if_statement, select_statement, accept_statement, declare_block, simple_block, exception_handler.

  `Pattern` — Regular expression used to detect a language category. As for the `Keywords` node, multiple `Pattern` tags can be specified and will be concatenated into a single regular expression.

  `Index` — Index in the pattern used to extract the name of the entity contained in this category.

Here is an example of a language definition for the GPS project files:

```
<?xml version="1.0"?>
<Custom>
  <Language>
    <Name>Project File</Name>
    <Spec_Suffix>.gpr</Spec_Suffix>
    <Keywords>^(case|e(nd|xte(nds|rnal))|for|is|</Keywords>
    <Keywords>limited|null|others|</Keywords>
    <Keywords>p(ackage|roject)|renames|type|use|w(hen|ith))\b</Keywords>

    <Context>
      <New_Line_Comment_Start>--</New_Line_Comment_Start>
```

```
      <String_Delimiter>"</String_Delimiter>
      <Constant_Character>'</Constant_Character>
      <Can_Indent>True</Can_Indent>
      <Syntax_Highlighting>True</Syntax_Highlighting>
      <Case_Sensitive>False</Case_Sensitive>
    </Context>

    <Categories>
      <Category>
        <Name>package</Name>
        <Pattern>^[ \t]*package[ \t]+((\w|\.)+)</Pattern>
        <Index>1</Index>
      </Category>
      <Category>
        <Name>type</Name>
        <Pattern>^[ \t]*type[ \t]+(\w+)</Pattern>
        <Index>1</Index>
      </Category>
    </Categories>

    <Engine>gpr</Engine>
    <Comment_Line>gpr_comment_line</Comment_Line>
  </Language>
</Custom>
```

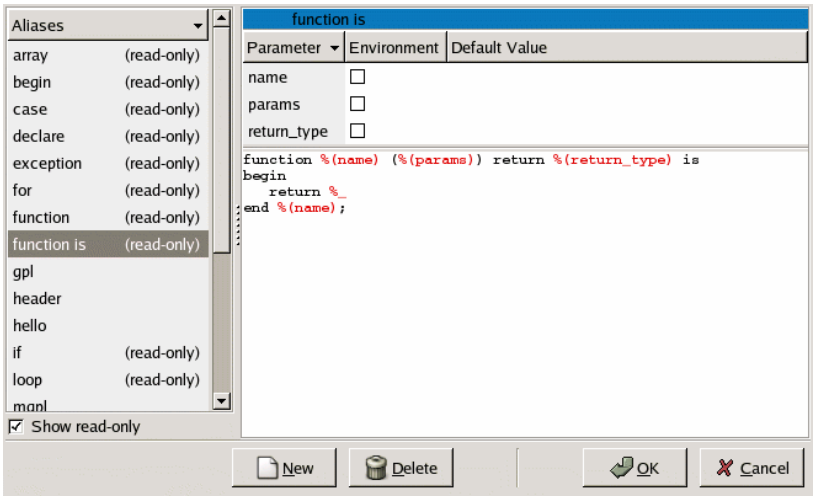
15.4.12 Defining text aliases

GPS provides a mechanism known as **aliases**. These are defined through the menu `Edit->Aliases`.

Each alias has a name, which is generally a short string of characters. When you type them in any textual entry in GPS (generally a source editor, but also entry fields for instance in the file selector), and then press the special activation key (by default ⟨control-o⟩, controlled by a preference), this name is removed from the source editor, and replaced by the text you have associated with it.

Alias names may be composed of any character except newlines, but must start with a letter. GPS will jump to the start of each word before

the current cursor position, and if the characters between this word start and the cursor position is an alias name, this alias is expanded.



The alias editor is divided into three main parts: on the left side, the list of currently defined aliases is shown. Clicking on any of them will display the replacement text for this alias. If you click again the selected alias, GPS displays a text entry which you can use to rename an existing alias. Alias names must start with a letter. A check button at the bottom selects whether the read-only aliases (i.e. system-wide aliases) should be displayed.

The second part is the expansion text for the alias, at the bottom right corner. This replacement text can used multiple lines, and contain some special text that act as a special replacement. These special texts are highlighted in a different color. You can insert these special entities either by typing them, or by right-clicking in the editor, and select the entity in the contextual menu.

The following special entities are currently defined:

`%_` This is the position where the cursor should be put once the replacement text has been inserted in the editor.

`%(name)` This is the name of a parameter. *name* can be any string you want, excluding closing parenthesis. See below for more information on parameters.

`%D` This is the current date, in ISO format. The year is displayed first, then the month and the day

`%H` This is the current time (hour, minutes and seconds)

`%l` If the expansion of the alias is done in a source editor, this is the line on which the cursor is when pressing ⟨control-o⟩.

`%c` This is similar to *%l*, except it returns the current column.

`%f` If the expansion is done in a source editor, this is the name of the current file (its base name only, this doesn't include the directory)

`%d` If the expansion is done in a source editor, this is the directory in which the current file is

`%p` If the expansion is done in a source editor, this is the base name of the project file to which the file belongs.

`%P` If the expansion is done in a source editor, this is the full path name to the project file (directory and base name).

`%O` Used for recursive aliases expansion. This special character will expand the text seen before it in the current alias, after replacement of the parameters and possibly other recursive expansions. This is similar to pressing ⟨control-o⟩ (or any key you have defined for alias expansion) in the expanded form of the alias.

You cannot expand an alias recursively when already expanding that alias. For instance, if the alias expansion for *procedure* contains *procedure%O*, the inner procedure will not be expanded.

The indentation as set in the expansion of the alias is preserved when the alias is expanded. All the lines will be indented the same amount to the right as the alias name. You can override this default behavior by selecting the check button `Indent source editor after expansion`. In this case, GPS will replace the name of the alias by its expansion, and then automatically recompute the position of each line with its internal indentation engine, as if the text had been inserted manually.

The third part of the aliases editor, at the top right corner, lists the parameters for the currently selected alias. Any time you insert a *%(name)* string in the expansion text, GPS automatically detects there is a new parameter reference (or an old reference has changed name or was removed); the list of parameters is automatically updated to show the current list.

Each parameters has three attributes:

name This is the name you use in the expansion text of the alias in the *%(name)* special entity.

Environment
: This specifies whether the default value of the parameter comes from the list of environment variables set before GPS was started.

default value
: Instead of getting the default value from the environment variable, you can also specify a fixed text. Clicking on the initial value of the currently selected variable opens a text entry which you can use to edit this default value.

When an alias that contains parameters is expanded, GPS will first display a dialog to ask for the value of the parameters. You can interactively enter this value, which replaces all the *%(name)* entities in the expansion text.

15.4.13 Aliases files

The customization files described earlier can also contain aliases definition. This can be used for instance to create project or system wide aliases. All the customization files will be parsed to look for aliases definition.

All these customization files are considered as read-only by GPS, and therefore cannot be edited through the graphical interface. It is possible to override some of the aliases in your own custom files.

There is one specific files, which must contain only aliases definition. This is the file '`$HOME/.gps/aliases`'. Whenever you edit aliases graphically, or create new ones, they are stored in this file, which is the only one that GPS will ever modify automatically.

The system files are loaded first, and aliases defined there can be overridden by the user-defined file.

These files are standard XML customization files. The specific XML tag to use is <*alias*>, one per new alias. The following example contains a standalone customization file, but you might wish to merge the <*alias*> tag in any other customization file.

The following tags are available:

`alias`
: This indicates the start of a new alias. It has one mandatory attribute, `name`, which the text to type in the source editor before pressing ⟨control-o⟩. It has one optional attribute, `indent`, which, if set to *true*, indicate that GPS should recompute the indentation of the newly inserted paragraph after the expansion.

`param`
: These are children of the `alias` node. There is one per parameter of the alias. They have one mandatory attribute,

`name`, which is the name to type between *%(name)* in the alias expansion text.

They have one optional attribute, `environment`, which indicates the default value must be read from the environment variables if it is set to true.

These tags contain text, which is the default value for the parameter.

`text` This is a child of the `alias` node, whose value is the replacement text for the alias.

Here is an example of an alias file:

```
<?xml version="1.0"?>
<Aliases>
  <alias name="proc" >
    <param name="p" >Proc1</param>
    <param environment="true" name="env" />
    <text>procedure %(p) is
%(env)%_
end %(p);</text>
  </alias>
</Aliases>
```

15.4.14 Defining project attributes

The project files are required by GPS, and are used to store various pieces of information related to the current set of source files. This includes how to find the source files, how the files should be compiled, or manipulated through various tools,. . . .

However, the default set of attributes that are usable in a project file is limited to the attributes needed by the tool packaged with GPS or GNAT.

If you are delivering your own tools, you might want to store similar information in the project files themselves, since these are a very convenient place to associate some specific settings with a given set of source files.

GPS lets manipulate the contents of projects through XML customization files and script commands. You can therefore add you own typed attributes into the projects, so that they are saved automatically when the user saves the project, and reloaded automatically the next time GPS is started.

15.4.14.1 Declaring the new attributes

New project attributes can be declared in two ways: either using the advanced XML tags below, or using the `<tool>` tag (see Section 15.5.3 [Defining tool switches], page 181).

The customization files support the <project_attribute> tag, which is used to declare all the new attributes that GPS should expect in a project. Attributes that have not been declared explictly will not be accessible through the GPS scripting languagues, and will generate warnings in the Messages window.

Project attributes are typed: they can either have a single value, or have a set of such values (a list). The values can in turn be a free-form string, a file name, a directory name, or a value extracted from a list of preset values.

Attributes that have been declared in these customization files will also be graphically editable through the project properties dialog, or the project wizard. Therefore, you should specify when an attribute is defined how it should be presented to the GPS user.

The <project_attribute> tag accepts the following attributes:

- package (a string, default value: "")

  This is the package in the project file in which the attribute is stored. Common practice suggests that one such package should be used for each tool. These packages provide namespaces, so that attributes with the same name, but for different tools, do not conflict with each other.

- name (a string, mandatory)

  This is the name of the attribute. This should be a string with no space, and that represents a valid Ada identifier (typically, it should start with a letter and be followed by a set of letters, digits or underscore characters). This is an internal name that is used when saving the attribute in a project file.

- editor_page (a string, default value: "General")

  This is the name of the page in the Project Properties editor dialog in which the attribute is presented. If no such page already exists, a new one will be created as needed. If the page already exists, the attribute will be appended at its bottom.

- editor_section (a string, default value: "")

  This is the name of the section, inside editor page, in which the attribute is displayed. These sections are surrounded by frames, the title of which is given by the editor_section attribute. If this attribute is not specified, the attribute is put in an untitled section.

- label (a string, default value: the name of the attribute)

  If this attribute is set to a value other than the empty string "", a textual label is displayed to the left of the attribute in the graphical editor. This should be used to identify the attribute. However, it can be left to the empty string if the attribute is in a named section of its own, since the title of the section might be a good enough indication.

- `description` (a string, default value: `""`)

  This is the help message that describes the role of the attribute. It is displayed in a tooltip if the user leaves the mouse on top of the attribute for a while.

- `list` (a boolean, default value: `"false"`)

  If this is set to `"true"`, the project attribute will in fact contains a list of values, as opposed to a single value. This is used for instance for the list of source directories in standard projects.

- `ordered` (a boolean, default value: `"false"`)

  This is only relevant if the project attribute contains a list of values. This indicates whether the order of the values is relevant. In most cases, it will not matter. However, for instance, the order of source directories matters, since this also indicates where the source files will be searched, stopping at the first match.

- `omit_if_default` (a boolean, default value: `"true"`)

  This indicates whether the project attribute should be set explicitly in the project if the user has left it to its default value. This can be used to keep the project files a simple as possible, if all the tools that will use this project attribute know about the default value. If this isn't the case, set `omit_if_default` to `"false"` to force the generation of the project attribute.

- `base_name_only` (a boolean, default value: `"false"`)

  If the attribute contains a file name or a directory name, this indicates whether the full path should be stored, or only the base name. In most cases, the full path should be used. However, since GPS automatically looks for source files in the list of directories, for instance, the list of source files should only contain base names. This also increases the portability of project files.

- `case_sensitive_index` (a boolean, default value: `"false"`)

  This XML attribute is only relevant for project attributes that are indexed on another one (see below for more information on indexed attributes). It indicates whether two indexes that differ only by their casing should be considered the same. For instance, if the index is the name of one of the languages supported by GPS, the index is case insensitive since `"Ada"` is the same as `"C"`. However, if the index is the name of a file on Windows, the index is case-insensitive.

- `hide_in` (a string, default value: `""`)

  This XML attribute defines the various context in which this attribute should not be editable graphically. Currently, GPS provides two such contexts (`"wizard"` and `"properties"`, corresponding to the project creation wizard and the project properties editor). If any of those context is specified in hide_in, then the widget to edit this at-

tribute will not be shown. The goal is to keep the graphical interface simple.

15.4.14.2 Declaring the type of the new attributes

The type of the project attribute is specified through one or several child tags of `<project_attribute>`. The following tags are recognized.

- `<string>`

  This tag indicates that the attribute is made of one (or more if it is a list) strings. This tag accepts the following XML attributes:

  - `default` (a string, default value: `""`)

    This gives the default value to be used for the string (and therefore the project attribute), in case the user hasn't overridden it.

  - `type` (one of `""`, `"file"`, `"directory"`, default `""`)

    This indicates what the string represents. In the first case, any value can be used. In the second case, it should represent a file name, although no check is done to make sure the file actually exists on the disk. But GPS will be able to do some special marshalling with the file name. The third case indicates that GPS should expect a directory.

- `<choice>`

  This tag can be repeated several times. It indicates one of the valid values for the attribute, and can be used to provide a static list of such values. If it is combined with a `<string>` tag, this indicates that the attribute can be any string, although a set of possible values is provided to the user for ease of use. This tag accepts one optional attribute, `"default"`, which is a boolean. It indicates whether this value is the default to use for the project attribute.

  If several `<choice>` tags are used, it is possible that several of them are part of the default value if the project attribute is a list, as opposed to a single value.

- `<shell>`

  This tag is a GPS scripting command to execute to get a list of valid values for the attribute. The command should return a list. As for the `<choice>` tag, the `<shell>` tag can be combined with a `<string>` tag to indicate that the list of values returned by the scripting command is only a set of possible values, but that the project attribute can in fact take any value.

  The `<shell>` tag accepts two attributes:

  - `lang` (a string, default value: `"shell"`)

    The scripting language in which the command is written. Currently, the only other possible value is `"python"`.

- `default` (a string, default value: `""`)

  The default value that the project attribute takes if the user hasn't overridden it.

In some cases, the type of the project attribute, or at least its default value, depends on what the attribute applies to. The project file support this in the form of indexed project attribute. This is for instance used to specify what should be the name of the executable generated when compiling each of the main files in the project (ie the executable name for `gps.adb` should be `gps.exe`, the one for `main.c` should be `myapp.exe`, and so on).

Such attributes can also be declared through XML files. In such cases, the `<project_attribute>` tag should have one `<index>` child, and zero or more `<specialized_index>` children. Each of these two tags in turn take one of the already mentioned `<string>`, `<choice>` or `<shell>` tag.

The `<index>` tag indicates what other project attribute is used to index the current one. In the example given above for the executable names, the index is the attribute that contains the list of main files for the project.

It accepts the following XML attributes:

- `attribute` (a string, mandatory)

  The name of the other attribute. This other attribute must be declared elsewhere in the customization files, and must be a list of values, not a single value.

- `package` (a string, default value: `""`)

  The package in which the index project attribute is defined. This is used to uniquely identify homonym attributes.

The `<specialized_index>` is used to override the default type of the attribute for specific values of the index. For instance, the project files contains an attribute that specify what the name of the compiler is for each language. It is indexed on the project attribute that list the languages used for the source files of the project. Its default value depends on the language ("gnatmake" for Ada, "gcc" for C, and so on). This attribute accepts requires one XML attribute:

- `value` (a string, mandatory)

  This is the value of the attribute for which the type is overriden.

Note that almost all the standard project attributes are defined through an XML file, '`projects.xml`', which is part of the GPS installation. Check this file to get advanced examples on how to declare project attributes.

15.4.14.3 Examples

The following example declares three attributes, with a single string as their value. This string represents a file or a directory in the last two cases. You can simply copy this into a '`.xml`' file in your '`$HOME/.gps/customize`' directory, as usual.

```
<?xml version="1.0"?>
<custom>
  <project_attribute
      name="Single1"
      package="Test"
      editor_page="Tests single"
      editor_section="Single"
      description="Any string">

     <string default="Default value" />
  </project_attribute>

  <project_attribute
      name="File1"
      package="Test"
      editor_page="Tests single"
      editor_section="Single"
      description="Any file" >

      <string type="file" default="/my/file" />
  </project_attribute>

  <project_attribute
      name="Directory1"
      package="Test"
      editor_page="Tests single"
      editor_section="Single"
      description="Any directory" >

      <string type="directory" default="/my/directory/" />
  </project_attribute>
</custom>
```

The following example declares an attribute whose value is a string. However, a list of predefined possible values is also provided, as an help for interactive edition for the user. If the `<string>` tag wasn't given, the attribute's value would have two be one of the three possible choices.

```
<?xml version="1.0" ?>
<custom>
  <project_attribute
      name="Static2"
      package="Test"
      editor_page="Tests single"
      editor_section="Single"
      description="Choice from static list (or any string)" >
```

```
      <choice>Choice1</choice>
      <choice default="true" >Choice2</choice>
      <choice>Choice3</choice>
      <string />
  </project_attribute>
</custom>
```

The following example declares an attribute whose value is one of the languages currently supported by GPS. Since this list of languages is only know when GPS is executed, a script command is used to query this list.

```
<?xml version="1.0" ?>
<custom>
 <project_attribute
      name="Dynamic1"
      package="Test"
      editor_page="Tests single"
      editor_section="Single"
      description="Choice from dynamic list" >

      <shell default="C" >supported_languages</shell>
  </project_attribute>
</custom>
```

The following example declares an attribute whose value is a set of file names. The order of files in this list matters to the tools that are using this project attribute.

```
<?xml version="1.0" ?>
<custom>
 <project_attribute
      name="File_List1"
      package="Test"
      editor_page="Tests list"
      editor_section="Lists"
      list="true"
      ordered="true"
      description="List of any file" >

      <string type="file" default="Default file" />
  </project_attribute>
</custom>
```

The following example declares an attribute whose value is a set of predefined possible values. By default, two such values are selected, unless the user overrides this default setting.

```
<?xml version="1.0" ?>
<custom>
  <project_attribute
      name="Static_List1"
      package="Test"
```

```
      editor_page="Tests list"
      editor_section="Lists"
      list="true"
      description="Any set of values from a static list" >

      <choice>Choice1</choice>
      <choice default="true">Choice2</choice>
      <choice default="true">Choice3</choice>
  </project_attribute>
</custom>
```

The following example declares an attribute whose value is a string. However, the value is specific to each language (this could for instance be used for the name of the compiler to use for a given language). This is an indexed project attribute. It has two default values, one for Ada, one for C. All other languages have no default value.

```
<?xml version="1.0" ?>
<custom>
  <project_attribute
      name="Compiler_Name"
      package="Test"
      editor_page="Tests indexed"
      editor_section="Single"
      <index attribute="languages" package="">
         <string default="" />
      </index>
      <specialized_index value="Ada" >
         <string default="gnatmake" />
      </specialized_index>
      <specialized_index value="C" >
         <string default="gcc" />
      </specialized_index>
  </project_attribute>
</custom>
```

15.4.14.4 Accessing the project attributes

The new attributes that were defined are accessible from the GPS scripting languages, like all the standard attributes, see Section 15.5.4.3 [Querying project switches], page 188.

You can for instance access the Compiler_Name attribute we created above with a python command similar to:

```
GPS.Project.root().get_attribute_as_string ("Compiler_Name", "Test", "Ada")
```

You can also access the list of main files for the project, for instance, by calling

```
GPS.Project.root().get_attribute_as_list ("main")
```

15.4.15 Adding casing exceptions

A set of case exceptions can be declared in this file. Each case exception is put inside the tag `<word>` or `<substring>`. These exceptions are used by GPS to set identifiers or keywords case when editing case insensitive languages (except if corresponding case is set to Unchanged). see Section 15.1 [The Preferences Dialog], page 123.

```
<?xml version="1.0" ?>
<exceptions>
  <case_exceptions>
     <word>GNAT</word>
     <word>OS_Lib</word>
     <substring>IO</substring>
  </case_exceptions>
</exceptions>
```

15.4.16 Adding documentation

New documentation can be added in GPS in various ways. This is useful if you want to point to your own project documentation for instance.

The first possibility is to create a new menu, through a `<menu>` tag in an XML file, associated with an action that either spawn an external web browser or calls the internal `GPS.Help.browse()` shell command.

However, this will not show the documentation in the `Help->Contents` menu, which you also might want to do.

To have both results, you should use the `<documentation_file>` tag in an XML file. These tags are generally found in the '`gps_index.xml`' files, as documented in see Section 3.2 [Adding New Help Files], page 14, but you can in fact add them in any of your customization files.

The documentation files you display can contain the usual type of html links. In addition, GPS will treat specially links starting with '%', and consider them as script commands to execute instead of file to display. The following example show how to insert a link that will in effect open a file in GPS when clicked by the user

```
<a href="%shell:Editor.editor g-os_lib.ads">Open runtime file</a>
```

The first word after '%' is the name of the language, and the command to execute is found after the ':' character.

The `<documentation_file>` tag accepts two attributes.

before (optional, default="")
: The name of the menu before which the new entry should be inserted. If the new menu is inserted in some submenus, this tag controls the deeper nesting. Parent menus are created as needed, but if you wish to control their specific order, you should create them first with a `<menu>` tag.

after (optional, default="")
: The name of the menu after which the new entry should be inserted.

The <documentation_file> accepts a number of child nodes:

name This is the name of the file. It can be either an absolute file name, or a file name relative to one of the directories in GPS_DOC_PATH. If this child is omitted, you must specify a <shell> child.

This name can contain a reference to a specific anchor in the html file, using the standard HTML syntax.

```
<name>file#anchor</name>
```

shell This child specifies the name of a shell command to execute to get the name of the HTML file. This command can for instance create the HTML file dynamically, or download it locally using some special mechanism. This child accepts one attribute, "lang", which is the name of the language in which the command is written

descr This is the description for this help file. It appears in a tool tip for the menu item.

category This is used in the Help->Contents menu to organize all the documentation files.

menu This is the full path to the menu. It behaves like a UNIX path, except it reference the various menus, starting from the menu bar itself. The first character of this path must be "/". The last part of the path is the name of the new menu item. If not set, no menu is displayed for this file, although it will still appear in the Help->Contents menu

The following example shows how to create a new entry "item" in the Help menu, that will display 'file.html'. The latter is searched in the GPS_DOC_PATH list of directories.

```
<?xml version="1.0"?>
<index>
   <documentation_file>
      <name>file.html</name>
      <descr>Tooltip text</descr>
      <category>name</category>
      <menu>/Help/item</menu>
   </documentation_file>
</index>
```

15.4.17 Adding stock icons

XML files can be used to define "stock icons". Stock icons are pictures that are identified by their label, and which are used through GPS in various places, such as buttons, menus, toolbars, and so on.

The stock icons must be declared using the tag `<icon>`, within the global tag `<stock>`. The attribute `id` indicates the label used to identify the stock icon, and the attribute `file` points to the file which contains the actual picture, either in absolute format, or relative to the directory which contains the XML file.

For a better rendering, icons that are to be used in menus and buttons should have a size of 24x24 pixels, whereas icons used in toolbars should be 48x48 pixels.

Here is an example:

```
<?xml version="1.0"?>
<my_visual_preferences>
  <stock>
    <icon id="myproject-my-picture" file="icons/my-picture.png" />
  </stock>
</my_visual_preferences>
```

Note: as shown in the example above, it is a good practice to prefix the label by a unique name (e.g. `myproject-`), in order to make sure that predefined stock icons will not get overridden by your icons.

15.5 Adding support for new tools

GPS has built-in support for external tools. This feature can be used to support a wide variety of tools (in particular, to specify different compilers). Regular enhancements are done in this area, so if you are planning to use the external tool support in GPS, check for the latest GPS version available.

Typically, the following things need to be achieved to successfully use a tool:

- Specify its command line switches
- Pass it the appropriate arguments depending on the current context, or on user input
- Spawn the tool
- Optionally parse its result and act accordingly

Each of these points is discussed in further sections. In all these cases, most of the work can be done statically through XML customization files. These files have the same format as other XML customization files (see Section 15.4 [Customizing through XML files], page 140), and the tool descriptions are found in `<tool>` tags.

This tag accepts the following attributes:

`name (mandatory)`
: This is the name of the tool. This is purely descriptive, and will appear throughout the GPS interface whenever this tool is referenced. This includes for instances the tabs of the switches editor.

`package (Default value is ide)`
: This optional attribute specifies which package should be used in the project to store information about this tool, in particular its switches. Most of the time the default value should be used, unless you are working with one of the pre-defined packages.

  See also See Section 15.4.14 [Defining project attributes], page 169, for more information on defining your own project attributes. Using the "package", "attribute" or "index" XML attributes of <tool> will implicitly create new project attributes as needed.

  If this attribute is set to "ide", then the switches cannot be set for a specific file, only at the project level. Support for file-specific switches currently requires modification of the GPS sources themselves.

`attribute (Default value is default_switches)`
: This optional attribute specifies the name of the attribute in the project which is used to store the switches for that tool.

`index (Default value is the tool name)`
: This optional attribute specifies what index is used in the project. This is mostly for internal use by GPS, and describes what index of the project attribute is used to store the switches for that tool.

This tag accepts the following children, described in separate sections:

`<switches>`
: (see Section 15.5.3 [Defining tool switches], page 181)

`<language>`
: (see Section 15.5.1 [Defining supported languages], page 180)

`<default-cmd-line>`
: (see Section 15.5.2 [Defining default command line], page 181)

15.5.1 Defining supported languages

This is the language to which the tool applies. There can be from no to any number of such nodes for one `<tool>` tag.

If no language is specified, the tool applies to all languages. In particular, the switches editor page will be displayed for all languages, no matter what languages they support.

If at least one language is specified, the switches editor page will only be displayed if that language is supported by the project.

```
<?xml version="1.0" ?>
<my_tool>
  <tool name="My Tool" >
    <language>Ada</language>
    <language>C</language>
  </tool>
</my_tool>
```

15.5.2 Defining default command line

It is possible to define the command line that should be used for a tool when the user is using the default project, or hasn't overridden this command line in the project.

This is done through the `<initial-cmd-line>` tag, as a child of the `<tool>` tag. Its value is the command line that would be passed to the tool. This command line is parsed as usual, e.g. quotes are taken into account to avoid splitting switches each time a space is encountered.

```
<?xml version="1.0" ?>
<my_tool>
  <tool name="My tool" >
     <initial-cmd-line>-a -b -c</initial-cmd-line>
  </tool>
</my_tool>
```

15.5.3 Defining tool switches

The user has to be able to specify which switches to use with the tool. If the tool is simply called through custom menus, you might want to hard code some or all of the switches. However, in the general case it is better to use the project properties editor, so that project-specific switches can be specified.

This is what GPS does by default for Ada, C and C++. You can find in the GPS installation directory how the switches for these languages are defined in an XML file. These provide extended examples of the use of customization files.

The switches editor in the project properties editor provides a powerful interface to the command line, where the user can edit the command line both as text and through GUI widgets.

The switches are declared through the `<switches>` tag in the customization file, which must be a child of a `<tool>` tag as described above.

This <switches> tag accepts the following attributes:

lines (default value is 1)
: The switches in the project properties editor are organized into boxes, each surrounded by a frame, optionally with a title. This attribute specifies the number of rows of such frames.

columns (default value is 1)
: This attribute specifies the number of columns of frames in the project properties page.

separator (default value is "")
: This attribute specifies the default character that should go between a switch and its value, to distinguishes cases like "-a 1", "-a1" and "-a=1". This can be overridden separately for each switch. Note that if you want the separator to be a space, you must use the value " " rather than " ", since XML parser must normalize the latter to the empty string when reading the XML file.

This <switches> tag can have any number of child tag, among the following. They can be repeated multiple times if you need several check boxes. For consistency, most of these child tags accept attributes among the following:

line (default value is 1)
: This indicates the row of the frame that should contain the switch. See the description of lines above.

column (default value is 1)
: This indicates the column of the frame that should contain the switch. See the description of columns above.

label (mandatory)
: This is the label which is displayed in the graphical interface

switch (mandatory)
: This is the text that should be put on the command line if that switch is selected. Depending on its type, a variant of the text might be put instead, see the description of combo and spin below. This switch shouldn't contain any space.

tip (default value is empty)
: This is the tooltip which describes that switch more extensively. It is displayed in a small popup window if the user leaves the mouse on top of the widget.

min (default value is 1)
: This attribute is used for <spin> tags, and indicates the minimum value authorized for that switch.

`max (default value is 1)`
: This attribute is used for <spin> tags, and indicates the maximum value authorized for that switch.

`default (default value is 1)`
: This attribute is used for <spin> tags. See the description below.

`noswitch (default is empty)`
: This attribute is only valid for <combo> tags, and described below.

`nodigit (default is empty)`
: This attribute is only valid for <combo> tags, and described below.

`value (mandatory)`
: This attribute is only valid for <combo-entry> tags.

`separator (default is the value given to <switches>`
: This attribute specifies the separator to use between the switch and its value. See the description of this attribute for <switches>.

Here are the valid children for <switches>:

<title>
: This tag, which accepts the `line` and `column` attributes, is used to give a name to a specific frame. The value of the tag is the title itself. You do not have to specify a name, and this can be left to an empty value.

  Extra attributes for <title> are:

  `line-span (default value is 1)`
  : This indicates how many rows the frame should span. If this is set to 0, then the frame is hidden from the user. See for instance the Ada or C switches editor.

  `column-span (default value is 1)`
  : This indicates how many columns the frame should span. If this is set to 0, then the frame is hidden from the user. See for instance the Ada or C switches editor.

<check>
: This tag accepts the `line`, `column`, `label`, `switch` and `tip` attributes. It creates a toggle button. When the latter is active, the text defined in the switch attribute is added as is to the command line. This tag doesn't have any value or child tags.

`<spin>` This tag accepts the `line`, `column`, `label`, `switch`, `tip`, `min`, `max`, `separator` and `default` attributes. This switch will add the contents of the `switch` attribute followed by the current numeric value of the widget to the command line. This is typically used to indicate indentation length for instance. If the current value of the widget is equal to the `default` attribute, then nothing is added to the command line.

`<radio>` This tag accepts the `line` and `column` attributes. It groups any number of children, each of which is associated with its own switch. However, only one of the children can be selected at any given time.

The children must have the tag `radio-entry`. This tag accepts the attributes `label`, `switch` and `tip`. As a special case, the switch attribute can have an empty value ("") to indicate this is the default switch to use in this group of radio buttons.

`<field>` This tag accepts the `line`, `column`, `label`, `switch`, `separator` and `tip` attributes. This tag describes a text edition field, which can contain any text the user types. This text will be prefixed by the value of the `switch` attribute, and the separator (by default nothing). If no text is entered in the field by the user, nothing is put on the command line.

This tag accepts two extra attributes:

`as-directory (optional)`
: If this attribute is specified and set to "true", then an extra "Browse" button is displayed, so that the user can easily select a directory.

`as-file (optional)`
: This attribute is similar to `as-directory`, but opens a dialog to select a file instead of a directory. If both attributes are set to "true", the user will select a file.

`<combo>` This tags accepts the `line`, `column`, `label`, `switch`, `tip`, `noswitch`, `separator` and `nodigit` attributes.

The text inserted in the command line is the text from the `switch` attribute, concatenated with the text of the `value` attribute for the currently selected entry. If the value of the current entry is the same as that of the `nodigit` attribute, then only the text of the `switch` attribute is put on the command line. This is in fact necessary to interpret the gcc switch "-O" as "-O1".

If the value of the current entry is that of the `noswitch` attribute, then nothing is put in the command line.

The tag <combo> accepts any number of combo-entry children tags, each of which accepts the label and value attribute.

<popup> This tag accepts the line, column, label, lines and columns attributes. This displays a simply button that, when clicked, displays a dialog with some extra switches. This dialog, just as the switches editor itself, is organizes into lines and columns of frames, the number of which is provided by the lines and columns attributes.

This tag accepts any number of children, which are the same as the <switches> attribute itself.

<dependency>

This tag is used to describe a relationship between two switches. It is used for instance when the "Debug Information" switch is selected for "Make", which forces it for the Ada compiler as well.

It has its own set of attributes:

master-page master-switch

These two attributes define the switch that possibly forces a specific setting on the slave switch. In our example, they would have the values "Make" and "-g". The switch referenced by these attributes must be of type <check>.

slave-page slave-switch

These two attributes define the switch which is acted upon by the master switch. In our example, they would have the values "Ada" and "-g". The switch referenced by these attributes must be of type <check>.

master-status slave-status

These two switches indicate which state of the master switch forces which state of the slave-status. In our example, they would have the values "on" and "on", so that when the make debug information is activated, the compiler debug information is also activated. However, if the make debug information is not activated, no specific setup is forced for the compiler debug information.

<expansion>

This tag is used to describe how switches can be grouped together on the command line to keep it shorter. It is also used to define aliases between switches.

It is easier to explain it through an example. Specifying the GNAT switch "-gnaty" is equivalent to specifying "-gnatyabcefhiklmnprst". This is in fact a style check switch, with a number of default values. But it is also equivalent to decomposing it into several switches, as in "-gnatya", "-gnatyb",... With this information, GPS will try to keep the command line length as short as possible, to keep it readable.

Both these aspects are defined in a unique <expansion> tag, which accepts two attributes: switch is mandatory, and alias is optional. Alias contains the text "-gnatyabcefhiklmnprst" in our example.

It also accepts any number of <entry> children, each has a mandatory switch access. The set of all these children define the expanded equivalent of the switch. In our example, we need one <entry> child for "-gnatya", one for "-gnatyb",....

The exact algorithm used by GPS is the following:

- For each switch on the command line, it is expanded either through the standard GNAT handling (thus "-gnatwuv" is made equivalent to "-gnatwu -gnatwv"), or through the definition in the custom file (if an XML node has a switch attribute that matches exactly, then it is replaced by all the switches given in the <entry> children).

```
If we have
  <expansion switch="-gnatwa">
     <entry switch="-gnatwc" />
     <entry switch="-gnatwd" />
  </expansion>
then any occurrence of "-gnatwa" on the command line is ex-
panded to
"-gnatwc -gnatwd"
```

- Then the switches on the command line are grouped together as much as possible. For all switch on the command line, if it starts with one of the values given to the switch attribute of an <expansion> node, then it is grouped with all other similar switches.

```
if the XML file contains
  <expansion switch="-gnatw" />
then the command line "-gnatwc -gnatt -gnatwd" is transformed
into "-gnatwcd -gnatt", grouping the switches that start with
"-gnatw".
```

- Finally, the resuling switches are compared with the alias attributes of the <expansion> nodes, and replaced appropriately.

```
if the XML file contains
```

```
   <expansion switch="-gnatwa" alias="-gnatwcd" />
then the command line generated at the second step is further
transformed into "-gnatwa -gnatt".
```

This rather complex mechanism allows one to either use the various buttons and GUI widgets to edit the switches, or to manually edit the command line.

15.5.4 Executing external tools

The user has now specified the default switches he wants to use for the external tool. Spawning the external tool can be done either from a menu item, or as a result of a key press.

Both cases are described in an XML customization file, as described previously, and both are setup to execute what GPS calls an action, i.e. a set of commands defined by the `<action>` tag.

15.5.4.1 Chaining commands

This action tag, as described previously, executes one or more commands, which can either be internal GPS commands (written in any of the scripting language supported by GPS), or external commands provided by executables found on the PATH.

The command line for each of these commands can either be hard-coded in the customization file, or be the result of previous commands executed as part of the same action. As GPS executes each command from the action in turn, it saves its output on a stack as needed. If a command line contains a special construct `%1`, `%2`... then these constructs will be replaced by the result of respectively the last command executed, the previous from last command, and so on. They are replaced by the returned value of the command, not by any output it might have done to some of the consoles in GPS.

Every time you execute a new command, it pushes the previous %1, %2... parameters one step further on the stack, so that they become respectively %2, %3... and the output of that command becomes %1.

The result value of the previous commands is substituted exactly as is. However, if the output is surrounded by quotes, they are ignored when a substitution takes place, so you need to put them back if they are needed. The reason for this behavior is so that for scripting languages that systematically protect their output with quotes (simple or double), these quotes are sometimes in the way when calling external commands.

```
<?xml version="1.0" ?>
<quotes>
  <action name="test quotes">
    <shell lang="python">'-a -b -c'</shell>
```

```
    <external> echo with quotes: "%1"</external>
    <external> echo without quotes: %2</external/>
  </action>
</quotes>
```

If one of the commands in the action raises an error, the execution of the action is stopped immediately, and no further command is performed.

15.5.4.2 Saving open windows

Before launching the external tool, you might want to force GPS to save all open files, the project.... This is done using the same command GPS itself uses before starting a compilation. This command is called `MDI.save_all`, and takes one optional boolean argument which specifies whether an interactive dialog should be displayed for the user.

Since this command aborts when the user presses cancel, you can simply put it in its own `<shell>` command, as in:

```
<?xml version="1.0" ?>
<save_children>
  <action name="test save children">
    <shell>MDI.save_all 0</shell>
    <external>echo Run unless Cancel was pressed</external>
  </action>
</save_children>
```

15.5.4.3 Querying project switches

Some GPS shell commands can be used to query the default switches set by the user in the project file. These are `get_tool_switches_as_string`, `get_tool_switches_as_list`, or, more generally, `get_attribute_as_string` and `get_attribute_as_list`. The first two require a unique parameter which is the name of the tool as specified in the `<tool>` tag. This name is case-sensitive. The last two commands are more general and can be used to query the status of any attribute from the project. See their description by typing the following in the GPS shell console window:

```
help Project.get_attribute_as_string
help Project.get_attribute_as_list
```

The following is a short example on how to query the switches for the tool "Find" from the project, See Section 15.6.2 [Tool example], page 193. It first creates an object representing the current project, then passes this object as the first argument of the `get_tool_switches_as_string` command. The last external command is a simple output of these switches

```
<?xml version="1.0" ?>
<find_switches>
  <action name="Get switches for Find">
    <shell>Project %p</shell>
```

```
    <shell>Project.get_tool_switches_as_string %1 Find </shell>
    <external>echo %1</external>
  </action>
</find_switches>
```

The following example shows how something similar can be done from Python, in a simpler manner. For a change, this function queries the Ada compiler switches for the current project, and prints them out in the messages window. The

```
<?xml version="1.0" ?>
<query_switches>
  <action name="Query compiler switches">
    <shell lang="python">GPS.Project("%p").get_attribute_as_list
      (package="compiler",
       attribute="default_switches",
       index="ada")</shell>
    <external>echo compiler switches= %1</external>
  </action>
</query_switches>
```

15.5.4.4 Querying switches interactively

Another solution to query the arguments for the tool is to ask the user interactively. The scripting languages provides a number of solutions for these.

They generally have their own native way to read input, possibly by creating a dialog.

In addition, the simplest solution is to use the predefined GPS commands for this. These are the two functions:

`yes_no_dialog`
: This function takes a single argument, which is a question to display. Two buttons are then available to the user, "Yes" and "No". The result of this function is the button the user has selected, as a boolean value.

`input_dialog`
: This function is more general. It takes a minimum of two arguments, with no upper limit. The first argument is a message describing what input is expected from the user. The second, third and following arguments each correspond to an entry line in the dialog, to query one specific value (as a string). The result of this function is a list of strings, each corresponding to these arguments.

  From the GPS shell, it is only convenient to query one value at a time, since it doesn't have support for lists, and would return a concatenation of the values. However, this function is especially useful with other scripting languages.

The following is a short example that queries the name of a directory and a file name, and displays each in the Messages window.

```
<?xml version="1.0" ?>
<query_file>
  <action name="query file and dir">
    <shell lang="python">list=GPS.MDI.input_dialog \
      ("Please enter directory and file name", "Directory", "File")</shell>
    <shell lang="python">print ("Dir=" + list[0], "File=" + list[1])</shell>
    </shell>
  </action>
</query_file>
```

15.5.4.5 Redirecting the command output

The output of external commands is send by default to the GPS console window. In addition, finer control can be exercised using the `output` attribute of the `<external>` and `<shell>` tags.

This attribute is a string that may take any value. Two values have specific meanings:

`"none"` The output of the command, as well as the text of the command itself, will not be shown to the user at all.

`""` The output of the command is sent to the GPS console window, entitled "Messages".

`other values`
A new window is created, with the title given by the attribute. If such a window already exists, it is cleared up before any of the command in the chain is executed. The output of the command, as well as the text of the command itself, are sent to this new window.

This attribute can also be specified at the `<action>` tag level, in which case it defines the default value for all `<shell>` and `<external>` tags underneath. If it isn't specified for the action itself, its default value will always be the empty string, i.e. output is sent to the GPS console.

```
<?xml version="1.0" ?>
<ls>
  <action name="ls current directory" output="default output" >
     <shell output="Current directory" >pwd</shell>
     <external output="Current directory contents" >/bin/ls</external>
  </action>
</ls>
```

15.5.4.6 Processing the tool output

The output of the tool has now either been hidden or made visible to the user in one or more windows.

There are several additional things that can be done with this output, for further integration of the tool in GPS.

1. Parsing error messages

   External tools can usually display error messages for the user that are associated with specific files and locations in these files. This is for instance the way the GPS builder itself analyzes the output of `make`.

   This can be done for your own tools using the shell command `Locations.parse`. This command takes several arguments, so that you can specify your own regular expression to find the file name, line number and so on in the error message. By default, it is configured to work seamlessly with error message of the forms:

   ```
   file:line: message
   file:line:column: message
   ```

   Please refer to the online help for this command to get more information (by e.g. typing `help Locations.parse` in the GPS Shell).

   Here is a small example on how to run a make command and send the errors to the location window afterward.

   For languages that support it, it is also recommended that you quote the argument with triple quotes, so that any special character (newlines, quotes, ...) in the output of the tool are not specially interpreted by GPS. Note also that you should leave a space at the end, in case the output itself ends with a quote.

   ```
   <?xml version="1.0" ?>
   <make>
     <action name="make example" >
        <external>make</external>
        <on-failure>
           <shell>Locations.parse """%1 """ make_example</shell>
        </on-failure>
     </action>
   </make>
   ```

2. Auto-correcting errors

   GPS has support for automatically correcting errors for some of the languages. You can get access to this auto-fixing feature through the `Codefix.parse` shell command, which takes the same arguments as for `Locations.parse`.

   This will automatically add pixmaps to the relevant entries in the location window, and therefore `Locations.parse` should be called first prior to calling this command.

   Errors can also be fixed automatically by calling the methods of the `Codefix` class. Several codefix sessions can be active at the same time, each of which is associated with a specific category.

The list of currently active sessions can be retrieved through the `Codefix.sessions()` command.

If support for python is enabled, you can also manipulate the fixable errors for a given session. To do so, you must first get a handle on that section, as shown in the example below. You can then get the list of fixable errors through the `errors` command.

Each error is of the class `CodefixError`, which has one important method `fix` which allows you to perform an automatic fixing for that error. The list of possible fixes is retrieved through `possible_fixes`.

```
print GPS.Codefix.sessions ()
session = GPS.Codefix ("category")
errors  = session.errors ()
print errors [0].possible_fixes ()
errors [0].fix ()
```

15.6 Customization examples

15.6.1 Menu example

This section provides a full example of a customization file. It creates a top-level menu named `custom menu`. This menu contains a menu item named `item 1`, which is associated to the external command `external-command 1`, a sub menu named `other menu`, etc...

```
<?xml version="1.0"?>
<menu-example>
  <action name="action1">
    <external>external-command 1</external>
  </action>

  <action name="action2">
    <shell>edit %f</shell>
  </action>

  <submenu>
    <title>custom menu</title>
    <menu action="action1">
      <title>item 1</title>
    </menu>

    <submenu>
      <title>other menu</title>
      <menu action="action2">
        <title>item 2</title>
      </menu>
    </submenu>
  </submenu>
</menu-example>
```

15.6.2 Tool example

This section provides an example that defines a new tool. This is only a short example, since Ada, C and C++ support themselves are provided through such a file, available in the GPS installation.

This example adds support for the "find" Unix utility, with a few switches. All these switches are editable through the project properties editor.

It also adds a new action and menu. The action associated with this menu gets the default switches from the currently selected project, and then ask the user interactively for the name of the file to search.

```
<?xml version="1.0" ?>
<toolexample>
  <tool name="Find" >
    <switches columns="2" >
      <title column="1" >Filters</title>
      <title column="2" >Actions</title>

      <spin label="Modified less than n days ago" switch="-mtime-"
            min="0" max="365" default="0" />
      <check label="Follow symbolic links" switch="-follow" />

      <check label="Print matching files" switch="-print" column="2" />
    </switches>
  </tool>

  <action name="action find">
    <shell>Project %p</shell>
    <shell>Project.get_tool_switches_as_string %1 Find </shell>
    <shell>input_dialog "Name of file to search" Filename</shell>
    <external>find . -name %1 %2</external>
  </action>

  <Submenu>
    <Title>External</Title>
     <menu action="action find">
       <Title>Launch find</Title>
    </menu>
  </Submenu>
</toolexample>
```

15.7 Scripting GPS

15.7.1 Scripts

Scripts are small programs that interact with GPS and allow you to perform complex tasks repetitively and easily. GPS includes support

for two scripting languages currently, although additional languages might be added in the future. These two languages are described in the following section.

Support for scripting is currently work in progress in GPS. As a result, not many commands are currently exported by GPS, although their number is increasing daily. These commands are similar to what is available to people who extend GPS directly in Ada, but with a strong advantage: they do not require any recompilation of the GPS core, and can be tested and executed interactively.

The goal of such scripts is to be able to help automate processes such as builds, automatic generation of graphs,. . .

These languages all have a separate console associated with them, which you can open from the `Tools` menu. In each of these console, GPS will display a prompt, at which you can type interactive commands. These console provide completion of the command names through the ⟨tab⟩ key.

For instance, in the GPS shell console you can start typing

```
GPS> File
```

then press the ⟨tab⟩ key, which will list all the functions whose name starts with "File".

A similar feature is available in the python console, which also provides completion for all the standard python commands and modules.

All the scripting languages share the same set of commands exported by GPS, thanks to a abstract interface defined in the GPS core. As a result, GPS modules do not have to be modified when new scripting languages are added.

Scripts can be executed immediately upon startup of GPS by using the command line switch `--load`. Specifying the following command line:

```
gps --load=shell:mytest.gps
```

will force the gps script '`mytest.gps`' to be executed immediately, before GPS starts reacting to user's requests. This is useful if you want to do some special initializations of the environment. It can also be used as a command line interface to GPS, if you script's last command is to exit GPS.

In-line commands can also be given directly on the command line through `--eval` command line switch.

For instance, if you want to analyze an entity in the entity browser from the command line, you would pass the following command switches:

```
gps --eval=shell:'Entity entity_name file_name; Entity.show %1'
```

See the section Section 15.4 [Customizing through XML files], page 140 on how to bind key shortcuts to shell commands.

15.7.2 Scripts and GPS actions

There is a strong relationship between GPS actions, as defined in the customization files (see Section 15.4.1 [Defining Actions], page 142), and scripting languages

Actions can be bound to menus and keys through the customization files or the `Edit->Key shortcuts` dialog.

These actions can execute any script command, See Section 15.4.1 [Defining Actions], page 142. This is done through the `<shell>` XML tag.

But the opposite is also true. From a script, you can execute any action registered in GPS. This can for instance be used to split windows, highlight lines in the editor,. . . when no equivalent shell function exists. This can also be used to execute external commands, if the scripting language doesn't support this in an easy manner.

Such calls are made through a call to `execute_action`, as in the following example:

```
execute_action "Split horizontally"
GPS.execute_action (action="Split horizontally")
```

The list of actions known to GPS can be found through the `Edit->Key shortcuts` dialog. Action names are case sensitive.

Some of the shell commands take subprograms as parameters. If you are using the GPS shell, this means you have to pass the name of a GPS action. If you are using Python, this means that you pass a subprogram, See Section 15.7.6 [Subprogram parameters], page 199.

15.7.3 The GPS Shell

The GPS shell is a very simple-minded, line-oriented language. It is accessible through the `Shell` window at the bottom of the GPS window. It is similar to a Unix shell, or a command window on Windows systems.

Type `help` at the prompt to get the list of available commands, or `help` followed by the name of a command to get more information on that specific command.

The following example shows how to get some information on a source entity, and find all references to this entity in the application. It searches for the entity "entity_name", which has at least one reference anywhere in the file "file_name.adb". After the first command, GPS returns an identifier for this entity, which can be used for all commands that need an entity as a parameter, as is the case for the second command. When run, the second command will automatically display all matching references in the location window.

```
GPS> Entity my_entity file_name.adb
```

```
<Entity_0x09055790>
GPS> Entity.find_all_refs <Entity_0x09055790>
```

Since the GPS shell is very simple, it doesn't provide any reference counting for the result types. As a result, all the values returned by a command, such as `<Entity_0x09055790>` in the example above, are kept in memory.

The GPS shell provides the command `clear_cache` which removes all such values from the memory. After this command is run, you can no longer use references obtained from previous commands, although of course you can run these commands again to get a new reference.

The return value of the 9 previous commands can easily be recalled by passing `%1`, `%2`,... on the command line. For instance, the previous example could be rewritten as

```
GPS> Entity my_entity file_name.adb
<Entity_0x09055790>
GPS> Entity.find_all_refs %1
```

These return values will be modified also for internal commands sent by GPS, so you should really only use this when you emit multiple commands at the same time, and don't do any other action in GPS. This is mostly useful when used for command-line scripts (see `--eval` and `--load`), or for custom files, See Section 15.4 [Customizing through XML files], page 140.

Arguments to commands can, but need not, be quoted. If they don't contain any space, double-quote ('"') or newline characters, you do not need to quote them. Otherwise, you should surround them with double-quotes, and protect any double-quote part of the argument by preceding it with a backslash.

There is another way to quote a command: use three double-quotes characters in a row. Any character loses its special meaning until the next three double-quotes characters set. This is useful if you do not know in advance the contents of the string you are quoting.

```
Locations.parse """%1 """ category_name
```

15.7.4 The Python Interpreter

Python is an interpreted object-oriented language, created by Guido Van Rossum. It is similar in its capabilities to languages such as Perl, Tcl or Lisp. This section is not a tutorial on python programming. See `http://www.python.org/doc/current/` to access the documentation for the current version of python.

If python support has been enabled, the python shell is accessible through the `Python` window at the bottom of the GPS window. You can also display it by using the menu '`Tools->Python Console`'.

You can type `help(GPS)` in the python console to see the list of functions exported by GPS to python. If you want to save the output of this (or any) command to a file, you can do:

```
>>> e=file("/tmp/gps-help.txt", "w")
>>> sys.stdout=e
>>> help(GPS)
>>> e.flush()
>>> sys.stdout=sys.__stdout__
```

The same example that was used to show the GPS shell follows, now using python. As you can notice, the name of the commands is similar, although they are not run exactly in the same way. Specifically, GPS benefits from the object-oriented aspects of python to create classes and instances of these classes.

In the first line, a new instance of the class Entity is created through the `create_entity` function. Various methods can then be applied to that instance, including `find_all_refs`, which lists all references to that entity in the location window:

```
>>> e=GPS.Entity ("entity_name", "file_name.adb")
>>> e.find_all_refs()
```

The screen representation of the classes exported by GPS to python has been modified, so that most GPS functions will return an instance of a class, but still display their output in a user-readable manner.

Python has extensive introspection capabilities. Continuing the previous example, you can find what class `e` is an instance of with the following command:

```
>>> help(e)
Help on instance of Entity:

<GPS.Entity instance>
```

It is also possible to find all attributes and methods that can be applied to `e`, as in the following example:

```
>>> dir (e)
['__doc__', '__gps_data__', '__module__', 'called_by', 'calls',
'find_all_refs']
```

Note that the list of methods may vary depending on what modules were loaded in GPS, since each module can add its own methods to any class.

In addition, the list of all existing modules and objects currently known in the interpreter can be found with the following command:

```
>>> dir ()
['GPS', 'GPSStdout', '__builtins__', '__doc__', '__name__', 'e', 'sys']
```

You can also load and execute python scripts with the `execfile` command, as in the following example:

```
>>> execfile ("test.py")
```

Python supports named parameters. Most functions exported by GPS define names for their parameters, so that you can use this Python feature, and make your scripts more readable. A notable exception to this rule are the functions that take a variable number of parameters. Using named parameters allows you to specify the parameters in any order you wish, e.g:

```
>>> e=GPS.Entity (name="foo", file="file.adb")
```

15.7.5 Python modules

On startup, GPS will automatically import (with python's `import` command) all the files with the extension '`.py`' found in the directory '`$HOME/.gps/python_startup`'. These files are loaded only after all standard GPS modules have been loaded, as well as the custom files, but before the script file or batch commands specified on the command lines with the `--eval` or `--load` switches.

As a result, one can use the usual GPS functions exported to python in these startup scripts. Likewise, the script run from the command line can use functions defined in the startup files.

Since the `import` command is used, the functions defined in this modules will only be accessible by prefixing their name by the name of the file in which they are defined. For instance if a file '`mystartup.py`' is copied to the startup directory, and defines the function `func`, then the latter will be accessible in GPS through `mystartup.func`.

The standard python mechanism for loading scripts on startup is still available. As usual, python can automatically load a script on startup. You can do this by setting an environment variable named `PYTHONSTARTUP` to the name of a file containing your start-up commands.

If you are writing a set of python scripts that other people will use, you need to provide several things:

- The python files themselves. This is a set of '`.py`' files, which the user should install in his '`python_startup`' directory.
- An XML file with the format described in the customization section of this documentation. This XML file should create a series of actions, through the `<action>` tag, exported to the user. This allows him to either create menus to execute these commands or to bind them to special key shortcuts

Alternatively, your python script can call the command `GPS.parse_xml` to specify some inline XML tags to interpret. These tags can directly create the new menus or key bindings associated with your command.

The following example defines a python command that inserts a line full of dashes ('-') at the current cursor location. This command is asso-

ciated with the key binding ⟨control-c n⟩, and can be distributed as a single XML file.

```
# This code must be stored in a file test.py in $HOME/.gps/python_startup
from GPS import *

def add_dashes_line():
   replace_text (current_context().file().name(),
                 current_context().location().line(),
                 current_context().location().column(),
                 "--------------------------------", 0, 0)
parse_xml ("""
   <action name="dashes line">
      <shell lang="python">test.add_dashes_line()</shell>
      <context>Source editor</context>
   </action>
   <key action="dashes line">control-c n</key>
""")
```

Several complex examples are provided in the GPS distribution, in the directory '`examples/python`'. These are modules that you might want to use for your own GPS, but more important that will show how GPS can be extended from Python.

If your script doesn't do what you expect it to do, there are several ways to debug it, among which the easiest is probably to add some "print" statements. Since some output of the scripts is sometimes hidden by GPS (for instance for interactive commands), you might not see this output.

In this case, you can reuse the tracing facility embedded in GPS itself. Modify the file '`$HOME/.gps/traces.cfg`', and add the following line:

```
PYTHON.OUT=yes
```

This will include the python traces as part of the general traces available in the file '`$HOME/.gps/log`'. Note that it may slow down GPS if there is a lot of output to process.

15.7.6 Subprogram parameters

A few of the functions exported by GPS in the GPS shell or in python expect a subprogram as a parameter.

This is handled in different ways depending on what language your are using:

- GPS shell

  It isn't possible to define new functions in the GPS shell. However, this concept is similar to the GPS actions (see Section 15.4.1 [Defining Actions], page 142), which allow you to execute a set of commands and launch external processes.

Therefore, a subprogram parameter in the GPS shell is a string, which is the name of the action to execute.

For instance, the following code defines the action "on_edition", which is called every time a new file is edited. The action is defined in the shell itself, although this could be more conveniently done in a separate customization file.

```
parse_xml """<action name="on_edition">
             <shell>echo "File edited"</shell></action>"""
Hook "file_edited"
Hook.add %1 "on_edition"
```

- Python

  Python of course has its own notion of subprogram, and GPS is fully compatible with it. As a result, the syntax is much more natural than in the GPS shell. The following example has the same result as above:

```
import GPS
def on_edition(self, *arg):
  print "File edited"
GPS.Hook ("file_edited").add (on_edition)
```

  Things are in fact slightly more complex if you want to pass methods are arguments. Python has basically three notions of callable subprograms, detailed below. The following examples all create a combo box in the toolbar, which calls a subprogram whenever its value is changed. The documentation for the combo box indicates that the callback in this case takes two parameters:

  - The instance of the combo
  - The current selection in the combo box

  The first parameter is the instance of the combo box associated with the toolbar widget, and, as always in python, you can store your own data in the instance, as shown in the examples below.

  Here is the description of the various subprograms:

  - Global subprograms

    These are standard subprograms, found outside class definitions. There is no implicit parameter in this case. However, if you need to pass data to such a subprogram, you need to use global variables

```
import GPS

my_var = "global data"

def on_changed (combo, choice):
   global my_var
   print "on_changed called: " + \
      my_var + " " + combo.data + " " + choice
```

```
combo = GPS.Combo \
  ("name", label="name", on_changed=on_changed)
GPS.Toolbar().append (combo)
combo.data = "My own data"
```

- Unbound methods

  These are methods of a class. You do not specify, when you pass the method in parameter to the combo box, what instance should be passed as its first parameter. Therefore, there is no extra parameter either.

  Note however than whatever class the method is defined in, the first parameter is always an instance of the class documented in the GPS documentation (in this case a GPS.Combo instance), not an instance of the current class.

  In this first example, since we do not have access to the instance of MyClass, we also need to store the global data as a class component. This is a problem if multiple instances of the class can be created.

```
import GPS
class MyClass:
   my_var = "global data"
   def __init__ (self):
      self.combo = GPS.Combo \
         ("name", label="name", on_changed=MyClass.on_changed)
      GPS.Toolbar().append (self.combo)
      self.combo.data = "My own data"

   def on_changed (combo, choice):
      ## No direct access to the instance of MyClass.
      print "on_changed called: " + \
         MyClass.my_var + " " + combo.data + " " + choice

MyClass()
```

  As the example above explains, there is no direct access to MyClass when executing on_changed. An easy workaround is the following, in which the global data can be stored in the instance of MyClass, and thus be different for each instance of MyClass.

```
import GPS
class MyClass:
   def __init__ (self):
      self.combo = GPS.Combo \
         ("name", label="name", on_changed=MyClass.on_changed)
      GPS.Toolbar().append (self.combo)
      self.combo.data = "My own data"
      self.combo.myclass = self   ## Save the instance
      self.my_var = "global data"
```

```
   def on_changed (combo, choice):
      print "on_changed called: " + \
         combo.myclass.my_var + " " + combo.data + " " + choice

MyClass()
```

- Bound methods

  The last example works as expected, but is not convenient to use. The solution here is to use a bound method, which is a method for a specific instance of a class. Such a method always has an extra first parameter, set implicitly by Python or GPS, which is the instance of the class the method is defined in.

  Notice the way we pass the method in parameter to append(), and the extra third argument to on_changed in the example below.

```
import GPS
class MyClass:
   def __init__ (self):
      self.combo = GPS.Combo \
         ("name", label="name", on_changed=self.on_changed)
      GPS.Toolbar().append (self.combo)
      self.combo.data = "My own data"
      self.my_var = "global data"

   def on_changed (self, combo, choice):
      # self is the instance of MyClass specified in call to append()
      print "on_changed called: " + \
         self.my_var + " " + combo.data + " " + choice

MyClass()
```

15.7.7 Python FAQ

This section lists some of the problems that have been encountered while using Python inside GPS. This is not a general Python discussion.

15.7.7.1 Spawning external processes

There exist various solutions to spawn external processes from a script:

- Use the functionalities provided by the `GPS.Process` class
- Execute a GPS action through `GPS.execute_action`.

  This action should have an `<external>` XML node indicating how to launch the process
- Create a pipe and execute the process with `os.popen()` calls

  This solution doesn't provide a full interaction with the process, though.

- Use a standard expect library of Python

  The use of an expect library may be a good solution. There are various python expect libraries that already exist.

  These libraries generally try to copy the parameters of the standard `file` class. They may fail doing so, as GPS's consoles do not fully emulate all the primitive functions of that class (there is no file descriptor for instance).

  When possible, it is recommended to use one of the methods above instead.

15.7.7.2 Redirecting the output of spawned processes

In general, it is possible to redirect the output of any Python script to any GPS window (either an already existing one, or creating one automatically), through the `"output"` attribute of XML configuration files.

However, there is a limitation in python that the output of processes spawned through os.exec() or os.spawn() is redirected to the standard output, and not to the usual python output that GPS has overriden.

There are two solutions for this:

- Execute the external process through a pipe

  The output of the pipe is then redirected to Python's output, as in:

```
import os, sys
def my_external():
   f = os.popen ('ls')
   console = GPS.Console ("ls")
   for l in f.readlines():
      console.write ('   ' + l)
```

  This solution allows you, at the same time, to modify the output, for instance to indent it as in the example above.

- Execute the process through GPS

  You can go through the process of defining an XML customization string for GPS, and execute your process this way, as in:

```
GPS.parse_xml ("""
   <action name="ls">
     <external output="output of ls">ls</external>
   </action>""")

def my_external():
   GPS.execute_action ("ls")
```

  This solution also allows you to send the output to a different window than the rest of your script. But you cannot filter or modify the output as in the first solution.

15.7.7.3 Contextual menus on object directories only

The following filter can be used for actions that can only execute in the Project View, and only when the user clicks on an object directory. The contextual menu entry will not be visible in other contexts

```
<?xml version="1.0" ?>
<root>
   <filter name="object directory"
           shell_cmd="import os.path; os.path.samefile (GPS.current_context().project().obj
           shell_lang="python"
           module="Explorer" />

   <action name="Test on object directory">
      <filter id="object directory" />
      <shell>echo "Success"</shell>
   </action>

   <contextual action="Test on object directory" >
      <Title>Test on object directory</Title>
   </contextual>
</root>
```

15.7.7.4 Redirecting the output to specific windows

By default, the output of all python commands is displayed in the Python console. However, you might want in some cases to create other windows in GPS for this output. This can be done in one of two ways:

- Define a new action

  If the whole output of your script should be redirected to the same window, or if the script will only be used interactively through a menu or a key binding, the easiest way is to create a new XML action, and redirect the output, as in

  ```
  <?xml version="1.0" ?>
  <root>
    <action name="redirect output" output="New Window">
       <shell lang="python">print "a"</shell>
    </action>
  </root>
  ```

  All the various shell commands in your action can be output in a different window, and this also applies for the output of external commands.

- Explicit redirection

  If, however, you want to control in your script where the output should be sent, for instance if you can't know that statically when you write your commands, you can use the following code:

  ```
  sys.stdin = sys.stdout = GPS.Console ("New window")
  print "foo"
  ```

```
print (sys.stdin.read ())
sys.stdin = sys.stdout = GPS.Console ("Python")
```

The first line redirect all input and output to a new window, which is created if it doesn't exist yet. Note however that the output of stderr is not redirected, and you need to explicitely do it for `sys.stderr`.

The last line restore the default Python console. You must do this at the end of your script, or all scripts will continue to use the new consoles.

You can alternatively create separate objects for the output, and use them in turn:

```
my_out  = GPS.Console ("New Window")
my_out2 = GPS.Console ("New Window2")

sys.stdout=my_out
print "a"
sys.stdout=my_out2
print "b"
sys.stdout=GPS.Console ("Python")
```

The parameter to the constructor `GPS.Console` indicates whether any output sent to that console should be saved by GPS, and reused for the `%1`, `%2`,... parameters if the command is executed in a GPS action. That should generally be 1, except for stderr where it should be 0.

15.7.7.5 Reloading a python file in GPS

After you have made modification to a python file, you might want to reload it in GPS. This requires careful use of python commands.

Here is an example. Lets assume you have a python file ('`"mymod.py"`') which contains the following:

```
GPS.parse_xml ("""
   <action name="my_action">
      <shell lang="python">mymod.myfunc()</shell>
   </action>""")

def myfunc():
   print "In myfunc\n"
```

As you can guess from this file, it defines an action "my_action", that you can for instance associate with a keybinding through the Edit->Key shortcuts menu.

If this file has been copied in the '`$HOME/.gps/python_startup/`' directory, it will be automatically loaded at startup.

Notice that the function `myfunc` is thus found in a separate namespace, with the name `mymod`, same as the file.

If you decide, during your GPS session, to edit this file and have the function print "In myfunc2" instead, you then have to reload the file by typing the following command in the Python console:

```
> execfile ("HOME/.gps/python_startup/mymod.py", mymod.__dict__)
```

The first parameter is the full path to the file that you want to reload. The second argument is less obvious, but indicates that the file should be reloaded in the namespace `mymod`.

If you omit the optional second parameter, Python will load the file, but the function `myfunc` will be defined in the global namespace, and thus the new definition is accessible through

```
> myfunc()
```

Thus, the key shortcut you had set, which still executes `mymod.myfunc()` will keep executing the old definition.

By default, GPS provides a contextual menu when you are editing a Python file. This contextual menu (Python->Reload module) will take care of all the above details.

15.7.7.6 Printing the GPS Python documentation

The python extension provided by GPS is fully documentation in this manual and a separate manual accessible through the Help menu in GPS.

However, this documentation is provided in HTML, and might not be the best suitable for printing, if you wish to do so.

The following paragraph explains how you can generate your own documentation for any python module, including GPS, and print the result.

```
import pydoc
pydoc.writedoc (GPS)
```

In the last comamnd, `GPS` is the name of the module that you want to print the documentation for.

These commands generate a '`.html`' file in the current directory.

Alternatively, you can generate a simple text file with

```
e=file("./python_doc", "w")
e.write (pydoc.text.document (GPS))
e.flush()
```

This text file includes bold characters by default. Such bold characters are correctly interpreted by tools such as '`a2ps`' which can be used to convert the text file into a postscript document.

15.7.7.7 Automatically loading python files at startup

At startup, GPS will automatically load a few python files. This includes the file 'autoexec.py' in its installation directory 'share/gps/python', as well as all the files that each user has put in his own '$HOME/.gps/python_startup' directory.

In addition, in order to make python files available to a group of users, several approaches are possible:

- Each user can install them in his '$HOME/.gps/python_startup' directory
- The system administrator copies them in GPS installation directory in '<prefix>/share/gps/python'
- The system administrator copies them to any directory on your system. This directory then needs to be added by each user to his PYTHONPATH environment variable. Under unix, you can alternatively modify the small 'gps' wrapper script to do this automatically on startup.

The above steps will make your files available to GPS, but will not execute them automatically (apart for the first solution described above).

If you want to automatically execute a script, there are again a number of possibilities:

- Modify the file 'autoexec.py' installed by GPS in '<prefix>/share/gps/python/', and add an import statement for each python package to execute.

  This will need to be redone after each new installation of GPS
- Ask the users to select what packages they want to load, and ask them to create a file (named for instance myautoexec.py) which contains one import statement for each package to load, as in

```
import common_package1, common_package2
```

All the methods above require you to modify the installation of GPS somehow. Alternatively, you can also provide a small wrapper script to launch GPS. Here is an example of such a script, assuming your files are in /dir/support and the file to load is support_autoexec.py.

This is a unix-shell syntax. Such shells are also available on Windows, but you can also do the following using a windows '.bat' file

```
LD_LIBRARY_PATH=/dir/support:$LD_LIBRARY_PATH
export LD_LIBRARY_PATH
gps --eval=python:'import support_autoexec.py' $*
```

15.7.8 Hooks

A **hook** is a named set of commands to be executed on particular occasions as a result of user actions in GPS.

GPS and its various modules define a number of standard hooks, which are called for instance when a new project is loaded, when a file is edited, and so on. You can define your own commands to be executed in such cases.

You can find out the list of hooks that GPS currently knows about by calling the **Hook.list** function, which takes no argument, and returns a list of hook names that you can use. More advanced description for each hook is available through the **describe_hook** command.

```
GPS> Hook.list
project_changed
open_file_action_hook
preferences_changed
[...]

GPS> hook preferences_changed
GPS> Hook.describe %1
Hook called when a file needs to be opened or closed
This hook is of type "open_file" -- see describe_hook_type
```

Python> GPS.Hook ("preferences_changed").describe()

The description of each hooks includes a pointer to the type of the hook, that is what parameters the subprograms in this hook will receive. For instance:

```
GPS> Hook.describe_type "open_file"
Common type for all hooks related to opening files.
Arguments are the following: (file, line, column,
column_end, enable_navigation, new_file, force_reload)
```

The list of all known hook types can be found through the **Hook.list_types** command. This takes no argument and returns a list of all known types of hooks. As before, you can more information for each of these type through a call to **Hook.describe_type**.

15.7.8.1 Adding commands to hooks

You can add your own command to existing hooks through a call to the **Hook.add** command. Whenever the hook is executed by GPS or another script, your command will also be executed, and will be given the parameters that were specified when the hook is run. The first parameter is always the name of the hook being executed.

This **Hook.add** applies to an instance of the hook class, and takes one parameter, the command to be executed. This is a subprogram parameter (see Section 15.7.6 [Subprogram parameters], page 199).

- GPS shell

  The command can be any GPS action (see Section 15.4.1 [Defining Actions], page 142). The arguments for the hook will be passed to the action, and are available as $1, $2,. . . . In the following example, the

message "Just executed the hook: project_changed" will be printed in the Shell console. Note that we are defining the action to be executed inline, but this could in fact be defined in a separate XML customization file for convenience.

```
GPS> parse_xml """<action name="my_action"><shell>echo "Just executed the hook"</shell>
GPS> Hook project_changed
GPS> Hook.add %1 "my_action"
```

- Python

  The command must be the name of a subprogram to execute. The arguments for the hook will be passed to this subprogram. In the following example, the message "The hook project_changed was executed by GPS" will be displayed in the Python console whenever the project changes.

```
def my_callback (name):
    print "The hook " + name + " was executed by GPS"
GPS.Hook ("project_changed").add (my_callback)
```

The example above shows the simplest type of hook, which doesn't take any argument. However, most hooks receive several parameters. For instance, the hook "file_edited" receives the file name as a parameter.

- GPS shell

  The following code will print the name of the hook ("file_edited") and the name of the file in the shell console every time a file is open by GPS.

```
GPS> parse_xml """<action name="my_action"><shell>echo name=$1 file=$2</shell></action>
GPS> Hook "file_edited"
GPS> Hook.add %1 "my_action"
```

- Python

  The following code prints the name of the file being edited by GPS in the python console whenever a new editor is opened. The second argument is of type GPS.File.

```
def my_file_callback (name, file):
    print "Editing " + file.name()
GPS.Hook ("file_edited").add (my_file_callback)
```

15.7.8.2 Action hooks

Some hooks have a special use in GPS. Their name always ends with "_action_hook".

As opposed to the standard hooks described in the previous section, the execution of the action hooks stops as soon as one of the subprograms returns a True value ("1" or "true"). The subprograms associated with that hook are executed one after the other. If any such subprogram knows how to act for that hook, it should do the appropriate action and return "1".

This mechanism is used extensively by GPS internally. For instance, whenever a file needs to be opened in an editor, GPS executes the "open_file_action_hook" hook to request its editing. Several modules are connected to that hook.

One of the first modules to be executed is the external editor module. If the user has chosen to use an external editor, this module will simply spawn Emacs or the external editor that the user has selected, and return 1. This immediately stops the execution of the "open_file_action_hook".

However, if the user doesn't want to use external editors, this module will return 0. This will keep executing the hook, and in particular will execute the source editor module, which will always act and open an editor internally in GPS.

This is a very flexible mechanism. In your own script, you could choose to have some special handling for files with a ".foo" extension for instance. If the user wants to open such a file, you would spawn for instance an external command (say "my_editor") on this file, instead of opening it in GPS.

This is done with a code similar to the following

```
from os.path import *
import os
def my_foo_handler (name, file, line, column, \
                    column_end, enable_nav, new_file, reload):
    if splitext (file.name())[1] == ".foo":
        os.spawnv \
           (os.P_NOWAIT, "/usr/bin/emacs", ("emacs", file.name()))
        return 1   ## Prevent further execution of the hook
    return 0  ## Let other subprograms in the hook do their job

GPS.Hook ("open_file_action_hook").add (my_foo_handler)
```

15.7.8.3 Running hooks

Any module in GPS is responsible for running the hooks when appropriate. Most of the time, the subprograms exported by GPS to the scripting languages will properly run the hook. But you might also need to run them in your own scripts.

As usual, this will result in the execution of all the functions bound to that hook, whether they are defined in Ada or in any of the scripting languages.

This is done through the **Hook.run** command. This applies to an instance of the Hook class, and a variable number of arguments These must be in the right order and of the right type for that specific type of hook.

If you are running an action hook, the execution will stop as usual as soon as one of the subprograms return a True value.

The following example shows how to run a simple hook with no parameter, and a more complex hook with several parameters. The latter will in fact request the opening of an editor for the file in GPS, and thus has an immediately visible effect on the interface. The file is opened at line 100. See the description of the hook for more information on the other parameters.

```
GPS.Hook ("project_changed").run()
GPS.Hook ("open_file_action_hook").run \
             (GPS.File ("test.adb"), 100, 1, 0, 1, 1, 1)
```

15.7.8.4 Creating new hooks

The list of hooks known to GPS is fully dynamic. GPS itself declares a number of hooks, mostly for its internal use although of course you can also connect to them.

But you can also create your own hooks to report events happening in your own modules and programs. This way, any other script or GPS module can react to these events.

Such hooks can either be of a type exported by GPS, which constraints the list of parameters for the callbacks, but make such hooks more portable and secure; or they can be of a general type, which allows basically any kind of parameters. In the latter case, checks are done at runtime to ensure that the subprogram that is called as a result of running the hook has the right number of parameters. If this isn't the case, GPS will complain and display error messages.

Creating new hooks is done through a call to **Hook.register**. This function takes three arguments: the name of the hook you are creating, a description of when the hook is executed for the interactive help, and the type of the hook.

The name of the hook is left to you. Any character is allowed in that name, although using only alphanumerical characters.

The description is displayed when the user calls **Hook.describe**.

The type of the hook must be one of the following:

- "" (the empty string)

  This indicates that the hook doesn't take any argument. None should be given to **Hook.run**, apart of course from the hook name, and none should be expected by the various commands connected to that hook, once again apart from the hook name itself.

- one of the values returned by **Hook.list_types**

  This indicates that the hook is of one of the types exported by GPS itself. The advantage of using such explicit types as opposed to

"general" is that GPS is able to make more tests for the validity of the parameters.

- "general"

  This indicates that the hook is of the general type that allows any number of parameter, of any type. Other script will be able to connect to it, but will not be executed when the hook is run if they do not expect the same number of parameters that was given to **Hook.run**

A small trick worth noting: if the command bound to a hook doesn't have the right number of parameters that this hook provide, the command will not be executed and GPS will report an error. You can make sure that your command will always be executed by either giving default values for its parameter, or by using python's syntax to indicate a variable number of arguments.

This is especially useful if you are connecting to a "general" hook, since you do not really know in advance how many parameters the call of **Hook.run** will provide.

```
## This callback can be connected to any type of hook
def trace (name, *args):
   print "hook=" + name

## This callback can be connected to hooks with one or two parameters
def trace2 (name, arg1, arg2=100):
   print "hook=" + str (arg1) + str (arg2)

Hook.register ("my_custom_hook", "some description", "general")
Hook ("my_custom_hook").add (trace2)
Hook ("my_custom_hook").run (1, 2) ## Prints 1 2
Hook ("my_custom_hook").run (1)    ## Prints 1 100
```

15.8 Adding support for new Version Control Systems

15.8.1 Custom VCS interfaces

The Version Control interface in GPS can be customized, either to refine the behavior of the existing system and adapt it to specific needs, or to add support for other Version Control systems.

Custom VCS interfaces are defined entirely through XML files. Those files are read in the same location as all the other XML customizations that GPS offers. See Section 15.4 [Customizing through XML files], page 140 for a complete description.

There are two steps to follow when creating a custom VCS interface. The first step is to describe the VCS itself, and the second step is to

implement actions corresponding to all the operations that this VCS can perform. The following two sections (Section 15.8.2 [Describing a VCS], page 213 and Section 15.8.3 [Implementing VCS actions], page 215) describe those steps.

GPS is distributed with XML files describing the interfaces to ClearCase and CVS. These XML files are located in the directory `share/gps/customize` in the GPS installation, and can be used as a reference for implementing new custom VCS interfaces.

15.8.2 Describing a VCS

15.8.2.1 The VCS node

The `vcs` node is the toplevel node which contains the description of the general behavior expected from the VCS. It has two attributes.

The attribute `name` indicates the identifier of the VCS. The casing of this name is important, and the same casing must be used in the project files.

The attribute `absolute_name` indicates the behavior of the VCS relative to file names, and can take the values `TRUE` or `FALSE`. If it is set to `TRUE`, it means that all commands in the VCS will work on absolute file names. If it set to `FALSE`, it means that all actions work on base file names, and that GPS will move to the appropriate directory before executing an action.

Here is an example, adapted to the use of CVS:

```
<vcs name="Custom CVS" absolute_names="FALSE">

   (... description of action associations ...)
   (... description of supported status ...)
   (... description of output parsers ...)

</vcs>
```

15.8.2.2 Associating actions to operations

GPS knows about a certain set of predefined “operations” that a VCS can perform. The user can decide to implement some of them - not necessarily all of them - in this section.

The following node is used to associate a predefined operation to an action:

```
<OPERATION  action="ACTION_LABEL" label="NAME OF OPERATION" />
```

Where:

'OPERATION'
: is the name of the predefined action. The list of predefined actions is described in Section 15.8.3 [Implementing VCS actions], page 215,

'ACTION_LABEL'
: is the name of the corresponding gps Action that will be launched when GPS wants to ask the VCS to perform OPERATION,

'NAME OF OPERATION'
: is the name that will appear in the GPS menus when working on a file under the control of the defined VCS.

15.8.2.3 Defining status

All VCS have the notion of "status" or "state" to describe the relationship between the local file and the repository. The XML node `status` is used to describe the status that are known to a custom VCS, and the icons associated to it:

```
<status label="STATUS_LABEL" stock="STOCK_LABEL" />
```

Where:

'STATUS_LABEL'
: is the name of the status, for example "Up to date" or "Needs update" in the context of CVS.

'STOCK_LABEL'
: is the stock identifier of the icon associated to this status, that will be used, for example, in the VCS Explorer. See section Section 15.4.17 [Adding stock icons], page 178 for more details on how to define stock icons.

Note that the order in which status are defined in the XML file is important: the first status to be displayed must correspond to the status "Up-to-date" or equivalent.

15.8.2.4 Output parsers

There are cases in which GPS needs to parse the output of the VCS commands: when querying the status, or when "annotating" a file.

The following parsers can be implemented in the `vcs` node.

`status_parser` **and** `local_status_parser`
: These parsers are used by the command VCS.status_parse, to parse a string for the status of files controlled by a VCS.

  They accept the following child nodes:

`<regexp>` **(mandatory)**
: Indicates the regular expression to match.

`<file_index>`
: An index of a parenthesized expression in `regexp` that contains the name of a file.

`<status_index>`
: An index of a parenthesized expression in `regexp` that contains the file status. This status is passed through the regular expressions defined in the `status_matcher` nodes, see below.

`<local_revision_index>`
: An index of a parenthesized expression in `regexp` that contains the name of the local revision (the version of the file that was checked out).

`<repository_revision_index>`
: An index of a parenthesized expression in `regexp` that contains the name of the repository revision (the latest version of the file in the VCS).

`<status_matcher>`
: A regular expression which, when matching an expressions, identifies the status passed in the node attribute `label`.

`<annotations_parser>`
: This parser is used by the command VCS.annotations_parse, to parse a string for annotations in a file controlled by a VCS.

  It accepts the following child nodes:

  `<regexp>` **(mandatory)**
  : Indicates the regular expression to match.

  `<repository_revision_index>`
  : An index of a parenthesized expression in `regexp` that contains the repository revision of the line.

  `<file_index>`
  : An index of a parenthesized expression in `regexp` that indicates the part of the line that belongs to the file.

15.8.3 Implementing VCS actions

A number of "standard" VCS operations are known to GPS. Each of these operations can be implemented, using Actions. See Section 15.4.1 [Defining Actions], page 142) for a complete description of how to implement actions.

Here is a list of all the defined VCS operations, and their parameters:

`status_files`

`$1 = whether the log files should be cleared when obtaining up-to-date status`
`$2- = the list of files to query status for.`

Query the status for a list of files. This should perform a complete VCS query and return results as complete as possible.

`status_dir`

`$1 = the directory.`

Same as above, but works on all the files in one directory.

`local_status_files`

`$* = list of files`

Query the local status for specified files. This query should be as fast as possible, not connecting to any remote VCS. The results need not be complete, but it is not useful to implement this command if the output does not contain at least the working revision.

`open`

`$* = list of files`

Open files or directories for editing. This command should be implemented on any VCS that require an explicit check-out/open/edit action before being able to edit a file.

`update`

`$* = list of files`

Bring the specified files in sync with the latest repository revision.

`update_dir`

`$* = directory`

Update the contents of one directory.

`commit`

`$1 = log file`
`$2- = list of files`

Commit/submit/check-in files or directories with provided log. The log is passed in a file.

`commit_dir`

`$1 = log`

`$2 = directory`

Commit/submit one directory with provided log. The log is passed in a file.

`history`

`$1 = file`

Query the entire changelog history for the specified file.

`history_revision`

`$1 = revision`
`$2 = file`

Query the history for corresponding revision of the specified file.

`annotate`

`$1 = file`

Query the annotations for a file.

`add`

`$1 = log`

`$2 = file or dir`

Add file/dir to the repository, with the provided revision log.

`remove`

`$1 = log`

`$2 = file or dir`

Remove file/dir from the repository, with the provided revision log.

`revert`

`$* = files`

Revert the local file to repository revision, cancelling all local changes, and close the file for editing if it was open.

`diff_head`

`$1 = file`

Display a visual comparison between the local file and the latest repository revision.

`diff_base_head`

`$1 = file`

Display a visual comparison between the revision from which the file has been checked-out and the latest revision.

`diff_working`

`$1 = file`

Display a visual comparison between the local file and the revision from which it was obtained.

`diff`

`$1 = rev`

`$2 = file`

Display a visual comparison between the local file and the specified revision.

`diff2`

`$1 = revision 1`
`$2 = revision 2`
`$3 = file`

Display a visual comparison between the two specified revisions of the file.

16 Environment

16.1 Command Line Options

```
Usage:
   gps [options] [-P project-file] [source1] [source2] ...
Options:
   --help              Show this help message and exit
   --version           Show the GPS version and exit
   --debug[=program]   Start a debug session and optionally load the
                       program with the given arguments
   --debugger debugger Specify the debugger's command line
   --host=tools_host   Use tools_host to launch tools (e.g. gdb)
   --target=TARG:PRO   Load program on machine TARG using protocol PRO
   --load=lang:file    Execute an external file written in the
                       language lang
   --eval=lang:file    Execute an in-line script written in the
                       language lang
   --tracelist         Output the current configuration for logs
   --traceon=name      Activate the logs for a given module
   --traceoff=name     Deactivate the logs for a given module
   --tracefile=file    Parse an alternate configuration file for the logs

Source files can be absolute or relative pathnames.
If you prepend a file name with '=', this file will be
searched anywhere on the project's source path
```

16.2 Environment Variables

The following environment variables can be set to override some default settings in GPS:

'GPS_ROOT'
: Override the default root directory specified when GPS is built (during the *configure* process, see the file INSTALL in the GPS sources for more details) to access information such as the location of the translation files.

'GPS_HOME'
: Override the variable HOME if present. All the configuration files and directories used by GPS are either relative to $HOME/.gps (%HOME%\.gps under Windows) if GPS_HOME is not set, or to $GPS_HOME/.gps (respectively %GPS_HOME%\.gps) if set.

'GPS_DOC_PATH'
: Set the search path for the documentation. See Chapter 3 [Integrated Help], page 13 for more details.

‘GPS_CUSTOM_PATH’
: Contains a list of directories to search for custom files. See Section 15.4 [Customizing through XML files], page 140 for more details.

‘GPS_CHANGELOG_USER’
: Contains the user and e-mail to use in the global ChangeLog files. Note that the common usage is to have two spaces between the name and the e-mail. Ex: "John Does <john.doe@home.com>"

‘GDK_USE_XFT’
: Only relevant to Linux and Solaris (8 and above) systems. If this variable is set to 1, then the fonts used in most parts of gps will be anti-aliased fonts.

  This option is enabled by default when running GPS locally (DISPLAY set to ":0.0") and disabled otherwise. Setting this variable explicitely overrides the default behavior.

16.3 Files

‘$HOME/.gps’
: GPS state directory. Defaults to C:\.gps under Windows systems if HOME is not defined.

‘$HOME/.gps/log’
: Log file created automatically by GPS. When GPS is running, it will create a file named ‘log.<pid>’, where ‘<pid>’ is the GPS process id, so that multiple GPS sessions do not clobber each other’s log. In case of a successful session, this file is renamed ‘log’ when exiting; in case of an unexpected exit (a bug box will be displayed), the log file is kept under its original name.

  Note that the name of the log file is configured by the ‘traces.cfg’ file.

‘$HOME/.gps/aliases’
: File containing the user-defined aliases (see Section 15.4.12 [Defining text aliases], page 165).

‘$HOME/.gps/customize’
: Directory containing files with user-defined customizations. All files found under this directory are loaded by GPS during start up. You can create/edit these files to add your own menu/tool-bar entries in GPS, or define support for new languages. see Section 15.4 [Customizing through XML files],

page 140 and see Section 15.4.11 [Adding support for new languages], page 161.

'`$HOME/.gps/custom_key`'
: Contains all the menu shortcuts defined in GPS. This file is automatically created if you have activated the dynamic key bindings feature (see [Dynamic key bindings], page 124).

'`$HOME/.gps/keys.xml`'
: Contains all the key bindings for the actions defined in GPS or in the custom files. This only contains the key bindings overridden through the key shortcuts editor (see Section 15.3 [The Key Manager Dialog], page 139).

'`$HOME/.gps/debugger.log`'
: Log file created by the integrated debugger to trace of communication between GPS and gdb.

'`$HOME/.gps/desktop`'
: Desktop file in XML format (using the menu `File->Save More->Desktop`), loaded automatically if found.

'`$HOME/.gps/history`'
: Contains the state and history of combo boxes (e.g. the `Run->Custom...` dialog).

'`$HOME/.gps/preferences`'
: Contains all the preferences in XML format, as specified in the preferences menu.

'`$HOME/.gps/sessions`'
: Directory containing the debugging sessions.

'`$HOME/.gps/sessions/`*session*'
: Each file in the `sessions` directory represents a particular session saved by the user.

'`$HOME/.gps/traces.cfg`'
: Default configuration for the system traces. These traces are used to analyze problems with GPS. By default, they are sent to the file '`$HOME/.gps/log.<pid>`'.

  This file is created automatically when the '`$HOME/.gps/`' directory is created. If you remove it manually, it won't be recreated the next time you start GPS. When upgrading to a new version of GPS, it is recommended to remove it since its contents may change from version to version.

'*prefix*'
: The prefix directory where GPS is installed, e.g '`/opt/gps`'.

'*prefix*`/bin`'
: The directory containing the GPS executables.

‘*prefix*/etc/gps’
: The directory containing global configuration files for GPS.

‘*prefix*/lib’
: This directory contains the shared libraries used by GPS.

‘*prefix*/doc/gps/html’
: GPS will look for all the documentation files under this directory.

‘*prefix*/doc/gps/examples’
: This directory contains source code examples.

‘*prefix*/doc/gps/examples/language’
: This directory contains sources showing how to provide a shared library to dynamically define a new language. See Section 15.4.11 [Adding support for new languages], page 161.

‘*prefix*/doc/gps/examples/tutorial’
: This directory contains the sources used by the GPS tutorial.

‘*prefix*/share/gps/customize’
: Directory containing files with system-wide customizations (see Section 15.4.11 [Adding support for new languages], page 161 and Section 15.4.12 [Defining text aliases], page 165).

‘*prefix*/share/gps/gps-animation.gif’
: Animated image displayed in the top right corner of GPS to indicate that actions (e.g compilation) are on going.

‘*prefix*/share/gps/gps-splash.jpg’
: Splash screen displayed by default when GPS is started.

‘*prefix*/share/locale’
: Directory used to retrieve the translation files, when relevant.

16.4 Reporting Suggestions and Bugs

If you would like to make suggestions about GPS, or if you encountered a bug, please report it to mailto:report@gnat.com if you are a supported user, and to mailto:gps-devel@lists.act-europe.fr otherwise.

Please try to include a detailed description of the problem, including sources to reproduce it if possible/needed, and/or a scenario describing the actions performed to reproduce the problem, as well as the tools (e.g *debugger*, *compiler*, *call graph*) involved.

The files ‘$HOME/.gps/log’ and ‘$HOME/.gps/debugger.log’ may also bring some useful information when reporting a bug.

In case GPS generates a bug box, the log file will be kept under a separate name (‘$HOME/.gps/log.<pid>’ so that it does not get erased by further sessions. Be sure to include the right log file when reporting a bug box.

16.5 Solving Problems

This section addresses some common problems that may arise when using or installing GPS.

‘Non-privileged users cannot start GPS’

Q: I have installed GPS originally as super user, and ran GPS successfully, but normal users can’t.

A: You should check the permissions of the directory $HOME/.gps and its subdirectories, they should be owned by the user.

‘GPS crashes whenever I open a source editor’

This is usually due to font problems. Editing the file ‘$HOME/.gps/preferences’ and changing the name of the fonts, e.g changing *Courier* by *Courier Medium*, and *Helvetica* by *Sans* should solve the problem.

‘GPS refuses to start the debugger’

If GPS cannot properly initialize the debugger (using the menu Debug->Initialize), it is usually because the underlying debugger (gdb) cannot be launched properly. To verify this, try to launch the ’gdb’ command from a shell (i.e outside GPS). If gdb cannot be launched from a shell, it usually means that you are using a wrong version of gdb (e.g a version of gdb built for Solaris 8, but run on Solaris 2.6).

‘GPS is frozen during a debugging session’

If GPS is no longer responding while debugging an application you should first wait a little bit, since some communications between GPS and gdb can take a long time to finish. If GPS is still not responding after a few minutes, you can usually get the control back in GPS by either typing ⟨Ctrl-C⟩ in the shell where you’ve started GPS: this should unblock it; if it does not work, you can kill the gdb process launched by GPS using the ps and kill, or the top command under Unix, and the Task Manager under Windows: this will terminate your debugging session, and will unblock GPS.

‘My Ada program fails during elaboration. How can I debug it ?’

If your program was compiled with GNAT, the main program is generated by the binder. This program is an ordinary Ada

(or C if the '-C' switch was used) program, compiled in the usual manner, and fully debuggable provided that the '-g' switch is used on the gnatlink command (or '-g' is used in the gnatmake command itself).

The name of this package containing the main program is 'b~xxx.ads/adb' where xxx is the name of the Ada main unit given in the gnatbind command, and you can edit and debug this file in the normal manner. You will see a series of calls to the elaboration routines of the packages, and you can debug these in the usual manner, just as if you were debugging code in your application.

'How can I debug the Ada run-time library ?'

The run time distributed in binary versions of GNAT hasn't been compiled with debug information. Thus, it needs to be recompiled before you can actually debug it.

The simplest is to recompile your application by adding the switches '-a' and '-f' to the gnatmake command line. This extra step is then no longer required, assuming that you keep the generated object and ali files corresponding to the GNAT run time available.

Another possibility on Unix systems is to use the file 'Makefile.adalib' that can be found in the adalib directory of your GNAT installation and specify e.g '-g -O2' for the 'CFLAGS' switches.

'The GPS main window is not displayed'

If when launching GPS, nothing happens, you can try to rename the '.gps' directory (see Section 16.3 [Files], page 220) to start from a fresh set up.

'My project have several files with the same name. How can I import it in GPS?'

GPS's projects do not allow implicit overriding of sources file, i.e. you cannot have multiple times the same file name in the project hierarchy. The reason is that GPS needs to know exactly where the file is, and cannot reliably guess which occurrence to use.

There are several solutions to handle this issue:

- Put all duplicate files in the same project

  There is one specific case where a project is allowed to have duplicate source files: if the list of source directories is specified explicitly. All duplicate files must be in the same project. With these conditions, there is no ambiguity for GPS and the GNAT tools which file to use, and

the first file found on the source path is the one hiding all the others. GPS only shows the first file.

You can then have a scenario variable that changes the order of source directories to give visibility on one of the other duplicate files.

- Use scenario variables in the project

  The idea is that you define various scenarios in your project (For instance compiling in "debug" mode or "production" mode), and change the source directories depending on this setup. Such projects can be edited directly from GPS (in the project properties editor, this is the right part of the window, as described in this documentation). On top of the project explorer (left part of the GPS main window), you have a combo box displayed for each of the variable, allowing a simple switch between scenarios depending on what you want to build.

- Use extending projects

  These projects cannot currently be created through GPS, so you will need to edit them by hand. See the GNAT user's guide for more information on extending projects.

  The idea behind this approach is that you can have a local overriding of some source files from the common build/source setup (if you are working on a small part of the whole system, you may not want to have a complete copy of the code on your local machine).

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