



# **GPRBuild, a multi-language builder**

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## GPRBuild, a multi-language building tool

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- **Using GPR project files**
- **For native and cross platforms**
- **Configurable**
- **Adaptable to new languages and new platforms**
- **Builds executables, shared libraries and archives**

## GPRBuild: Origins

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- **gnatmake, without project files**
- **gnatmake with project files, Ada only (2000)**
- **gpr2make: Makefile builder (Ada/C/C++) (2002)**
- **gprmake, Ada/C/C++ (2004) use gnatmake for Ada**
- **gprbuild, multi-language (2008)**

## GPRBuild: Three phases

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- **Compilation phase**
- **Post-Compilation phase**
- **Linking phase**

## GPRBuild uses GPR project files

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- **Languages**
- **Main**
- **Source\_Dirs**
- **Source\_Files**
- **Source\_List\_File**
- **Excluded sources/dirs**

## GPRBuild: Configuration

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- **GPRBuild uses a configuration project file**
- **Default locations**
- **Default name: default.cgpr**
- **May be specified on the command line**
- **--config=**
- **--autoconf=**

## Gprconfig: a tool to build configuration project files

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- **Use XML files as database**
- **Takes as entries target and toolchains**
- **`--config=language[,version[,runtime[,path[,name]]]]`**
- **May be call in interactive or batch mode**

## GPRBuild: Autoconfiguration

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- **If needed, GPRBuild calls GPRConfig automatically**
- **Scan the GPR project files to get the languages**
- **If no language is specified, defaults to Ada**

```
gprconfig --batch -o /.../auto.cgpr --target=all --config=ada,,
```

## Extracts from a configuration project file

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configuration project Default is

```
for Toolchain_Version ("Ada") use "GNAT 6.3";
for Archive_Builder use ("ar", "cr");
for Archive_Builder_Append_Option use ("q");
for Archive_Indexer use ("ranlib");
for Archive_Suffix use ".a";
for Library_Builder use "/home/celier/local//libexec/gprbuild/gprlib";
for Shared_Library_Suffix use ".so";
for Library_Auto_Init_Supported use "true";
for Default_Language use "Ada";
```

package Compiler is

```
for Driver ("Ada") use "/home/celier/local/bin/gcc";
for Required_Switches ("Ada") use
  Compiler'Required_Switches ("Ada")
  & ("-c", "-x", "ada", "-gnatA");
end Compiler;
```

## Extracts from a configuration project file (2)

```
package Naming is
  for Spec_Suffix ("Ada") use ".ads";
  for Body_Suffix ("Ada") use ".adb";
  for Casing use "lowercase";
  for Dot_Replacement use "-";
end Naming;
```

```
package Binder is
  for Objects_Path_File ("Ada") use "ADA_PRJ_OBJECTS_FILE";
  for Required_Switches ("Ada") use
    Binder'Required_Switches ("Ada") & ("-I-");
  for Driver ("Ada") use "/home/celier/local//libexec/gprbuild/gprbind";
end Binder;
```

```
package Linker is
  for Max_Command_Line_Length use "8192";
  for Response_File_Format use "GNU";
  for Driver use Compiler'Driver ("Ada");
end Linker;
end Default;
```

## Naming schemes

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- **Suffix of sources/bodies:**
- **Body\_Suffix or Implementation\_Suffix**
- **Suffix of header/specs:**
- **Spec\_Suffix or Specification\_Suffix**
- **For Ada, casing of file name: Casing**
- **For Ada, replacement of '.': Dot\_Replacement**

## Naming Exceptions

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- **For Ada, Body or Spec**

for Body (“Pkg”) use “pkg.body”;  
for Spec (“Pkg”) use “pkg.spec”;

- **For other languages**

for Implementation\_Exceptions (“C++”) use  
 (“file1.c++”, “file2.c++”)

for Specification\_Exceptions (“C++”) use  
 (“file1.h++”, “file2.h++”);

## Compilation Phase

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- **Compile or recompile any source that is not found up to date**
- **Parallel compilations (specified with -jnn)**
- **Use switches as defined in the GPR project files, in the configuration project file and on the command line.**

## Compilation Phase: switches

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- **Required switches defined in the config project file**
- **Global compilation switches**
- **Switches in package Compiler**
- **Switches on the command line: `-cargs, -cargs:<lang>`**

for Switches ("Ada") use ("-O2");

for Switches ("main.adb") use ("-g");

```
gprbuild prj.gpr -cargs -g -cargs:ada -gnatv
```

## Compilation Phase: Search Paths

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- **Specified through switches or env. Variables**
- **Include\_Switches**
- **Include\_Path**
- **Include\_Path\_File**

for Include\_Switches ("C") use ("-I", "");  
for Include\_Path ("Ada") use "ADA\_INCLUDE\_PATH";  
for Include\_Path\_File ("Ada") use "ADA\_PRJ\_INCLUDE\_FILE";

## Compilation Phase: Dependencies

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- **Either ALI file (GNAT) or Makefile fragment (.d)**
- **Generated during compilation or independently**
- **Dependency\_Switches**
- **Dependency\_Driver**

for Dependency\_Switches ("C") use ("-Wp,-MMD,");

for Dependency\_Driver ("toto") use ("toto", "-depend", "");

## Compilation Phase: config files

- **Config files are specified to the compiler (GNAT)**

```
for Config_File_Switches ("Ada") use ("-gnatec=");
for Config_Body_File_Name ("Ada") use
  "pragma Source_File_Name_Project (%u, Body_File_Name => ""%f"");";
for Config_Spec_File_Name ("Ada") use
  "pragma Source_File_Name_Project (%u, Spec_File_Name => ""%f"");";
for Config_Body_File_Name_Pattern ("Ada") use
  "pragma Source_File_Name_Project " &
  " (Body_File_Name => ""*%b"", " &
  " Casing          => %c," &
  " Dot_Replacement => ""%d"");";
for Config_Spec_File_Name_Pattern ("Ada") use
  "pragma Source_File_Name_Project " &
  " (Spec_File_Name => ""*%s"", " &
  " Casing          => %c," &
  " Dot_Replacement => ""%d"");";
for Config_File_Unique ("Ada") use "False";
```

## Compilation Phase: Mapping Files

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- **Specified to the compiler (GNAT)**
- **Speeds up the search for sources**

```
for Mapping_File_Switches ("Ada") use ("-gnatem=");  
for Mapping_Spec_Suffix ("Ada") use "%s";  
for Mapping_Body_Suffix ("Ada") use "%b";
```

```
main%b  
main.adb  
/home/celier/gpr/main.adb  
pkg%s  
pkg.ads  
/home/celier/gpr/pkg.ads
```

## Post-Compilation Phase

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- **Builds libraries and archives, if any**
- **Binds executables, when needed**

## Post-Compilation Phase: Building libraries/archives

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- **Use auxiliary tool “gprlib” (configurable)**
- **Communication with gprlib through library exchange file**

```
for Library_Builder use "/home/celier/local//libexec/gprbuild/gprlib";  
for Library_Support use "full"; -- “none”/”static_only”/”full”
```

```
for Archive_Builder use ("ar", "cr");  
for Archive_Builder_Append_Option use ("q");  
for Archive_Indexer use ("ranlib");  
for Archive_Suffix use ".a";
```

```
for Shared_Library_Prefix use "lib";  
for Shared_Library_Minimum_Switches use ("-shared");  
for Shared_Library_Suffix use ".so";
```

## Post-Compilation Phase: Binding Ada sources

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- **Only performed when there are Ada sources to bind**
- **Use auxiliary tool “gprbind” (configurable)**
- **Communication with gprbind through binding exchange file**
- **gprbind invokes gnatbind**

```
package Binder is
  for Objects_Path_File ("Ada") use "ADA_PRJ_OBJECTS_FILE";
  for Required_Switches ("Ada") use
    Binder'Required_Switches ("Ada") & ("-I-");
  for Driver ("Ada") use
    "/home/celier/local//libexec/gprbuild/gprbind";
end Binder;
```

## Linking Phase

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- **To link executables**
- **Executable names/suffixes may be specified**
- **Driver depends on toolchains**

```
package Linker is
  for Max_Command_Line_Length use "8192";
  for Response_File_Format use "GNU";
  for Driver use Compiler'Driver ("Ada");
end Linker;
```

## Linking Phase: Response Files

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- **Specified with Linker attributes**
- **Three possible formats:**
  - **GNU**
  - **Object list**
  - **Option list**

Example of the GNU format:

```
INPUT ("b__main.o"  
"/home/celier/gpr/pkg.o"  
)
```

## Special “languages”

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- **Languages with no “compiler”**

for Driver (“project file”) use “”;

- **No object generated**

for Object\_Generated (“toto”) use “false”;

- **Object files not linked**

for Objects\_Linked (“java”) use “false”;

## GPRBuild: contributions

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- **Do not hesitate to make comment/contributions**
- **<http://libre.adacore.com>**
- **GPRBuild sources will soon be available**
- **[celier@adacore.com](mailto:celier@adacore.com)**