Geant 4
Software Installation, release 4.1

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Outline

- Supported platforms & compilers
- External software packages and tools
- Working area and installation area
- Toolkit installation
  - Configuring the environment manually
  - Using the Configure installation script
- Building an executable
- Integrating Geant4 in a software framework
Supported platforms & compilers

- **UNIX systems**
  - DEC-OSF/1 v.4.0, cxx 6.1 (*)
    - G4SYSTEM: DEC-cxx
    - SUN-SunOS v.5.7, CC v.5.2 (WS6)
    - G4SYSTEM: SUN-CC

- **Linux systems**
  - RedHat 6.1, g++ egcs 1.1.2
    - G4SYSTEM: Linux-egcs
  - RedHat 7.2 or greater, g++ gcc 2.95.2
    - G4SYSTEM: Linux-g++

- **Windows systems**
  - Win/NT/98/2000/XP and CygWin, MSVC++ 6.0 SP5
    - G4SYSTEM: WIN32-VC

(*) Tested but no longer under support!
Required software

- A UNIX shell and related basic UNIX commands
- C++ compiler
  - Optional: FORTRAN compiler (f77/g77) is required for building utility tools in the g3tog4 module
- GNU Make
  - GNU g++ is required for dependencies pre-processing
- CLHEP library
- Native STL (Standard Template Library)
- The Geant4 toolkit source code
External software packages - 1

Visualization/GUI tools (optional):

- X Windows
- OpenGL or MesaGL
- DAWN (PostScript renderer)
  - DAVID (Geometry debugging tool based on DAWN)
- Open Inventor or HEP Inventor
  - requires OpenGL/MesaGL and the Hepvis module
- OPACS and Open Scientist
  - interactive environment, including GUI
- Momo
  - Tcl/Tk or Java-based GUI environment
  - GGE, GPE graphics editors
- VRML browser
Module and Tools for analysis (optional)

- AIDA (Abstract Interfaces for Data Analysis)
  - JAS (Java Analysis Studio)
  - Lizard (AIDA Interactive Analysis Environment)
  - Open Scientist (Interactive Analysis Environment)

Persistency (optional)  

- HepODBMS module
- An ODMG compliant database system
  - Objectivity/DB

(*) Major design iteration foreseen for release 5.0
Working area & Installation area

- Why two different areas?
  - To allow centralized installation of the Geant4 kernel libraries and related sources in a multi-user environment
  - To decouple user-developed code and applications from the kernel
  - To allow an easy integration of the Geant4 software in an existing software framework
  - To allow multiple installations of the kernel and user code
- Working and Installation area can be the same
- Are controlled by two environment variables
  - G4WORKDIR and G4INSTALL
Configuring the environment: the manual approach for installation

- Identify the system used for the installation
  - G4SYSTEM

- Identify the area of installation (i.e. path where the source code and the kernel libraries should be based)
  - G4INSTALL
  - Optionally, specify a different path for the kernel libraries and/or the temporary object files
    - G4LIB, G4TMP
  - Optionally, specify a different path for exporting source header files
    - G4INCLUDE
Configuring the environment:
the manual approach for installation

- Specify the path of installation for CLHEP
  - CLHEP_BASE_DIR
    - should point to the area where include/ and lib/ are placed from the standard CLHEP installation procedure
    - Paths can be customised: CLHEP_INCLUDE_DIR, CLHEP_LIB_DIR
    - the CLHEP library name is assumed to be: [lib]CLHEP[.a/.lib]
      - A different name can be explicitly specified: CLHEP_LIB

- Specify the graphics/UI drivers to install
  - G4VIS_BUILD_<name>_DRIVER
  - G4UI_BUILD_<name>_DRIVER
  - the path to the related graphics/(G)UI packages, if required
    - Ex. - OGLHOME for OpenGL drivers
Configuring the environment: the manual approach for installation

- Specify installation specific attributes
  - G4DEBUG
    - To build libraries including debug symbolic information
    - By default, optimised mode is selected
  - G4LIB_BUILD_SHARED
    - To specify if to build kernel libraries as shared libraries
    - Static archive libraries are built by default
    - Adding also G4LIB_BUILD_STATIC will build both
  - G4_NO_VERBOSE
    - For better performance, verbosity code can be left out by defining this flag. The default is with verbosity on
Starting the installation

- Choose the installation layout
  - Maximum granularity of libraries (*granular libraries*)
    - Ideal for developers and local installations
    - Link list of libraries automatically generated
    - Triggered with “gmake” from $G4INSTALL/source
  - Category compound libraries (*global libraries*)
    - Convenient for a centralized multi-users installation
    - Default for shared libraries builds
    - Triggered with “gmake global” from $G4INSTALL/source

- Installing source header files
  - G4INCLUDE defines the installation path
  - Triggered by “gmake includes” from $G4INSTALL/source
Configuring the environment
to use Geant4

- Specify the working area: `G4WORKDIR`
  - If not, Geant4 assumes `G4INSTALL` as the working area
  - Products of application builds are placed in `$G4WORKDIR`
    - Binaries in `$G4WORKDIR/bin`
    - Object files and other temporary files in `$G4WORKDIR/tmp`

- Specify which graphics drivers, (G)UI drivers you want to use from the current installation (optional)
  - `G4VIS_USE_<name>`
  - `G4UI_USE_<name>`

- Specify paths to physics data (optional)
  - `G4LEVELGAMMADATA`, `G4LEDATA`, `G4RADIOACTIVEDATA`, `NeutronHPCrossSections`
Using the Configure script for installation & configuration

- The **Configure** script guides through the whole installation process described so far by defining the proper environment and triggering the actual installation
  
  ```bash
  ./Configure -install
  ```

- Once the environment has been configured, **Configure** stores the current installation setup
  - The installation setup will become the default for the current installation, in case future changes to the installation are necessary

- Once the installation is complete, **Configure** can be used to generate shell scripts for configuring the user environment to build a Geant4 application according to the current installation
  
  ```bash
  ./Configure
  ```
  - Generates `env[.sh/.csh]` scripts in the user’s current directory
  - It assumes the user specifies a working directory (**G4WORKDIR**)
    - In case not, the user’s home directory is set as default **G4WORKDIR** path


Building an executable

- Configure the environment according to the current installation
  - Source or integrate the shell script generated by `Configure`
- Define the working area (`G4WORKDIR`)
- Build any of the available examples:
  ```
  cp -r $G4INSTALL/examples $G4WORKDIR
  cd $G4WORKDIR/examples/novice/N01
  gmake
  ```
Integrating Geant4 in a framework

- Consider Geant4 as an external software package
- Well define its area of installation
  - For global libraries and source header files
- Choose an installation setup which best matches the project needs
- Adopt or integrate a configuration script reflecting the current installation