Introduction to Eclipse II: Debugging MPI code

September 8, 2021

Ge Baolai, *Western University*
SHARCNET | Compute Ontario | Compute Canada

Outline

- Eclipse
- Scope of the talk
- Developing C/C++ and Fortran code
- Debugging serial code
- Debugging parallel MPI code
- Further reading

Compute · Calcul Ontario

SHARCNET™

General Interest Seminars 2021-2022

Western

About Eclipse

What is Eclipse

An IDE for development and debugging

- C/C++
- Fortran
- Other languages
- MPI, OpenMP, threaded
- Others?

It runs on your local computer (and remote systems).

What Eclipse is not

It is a front-end, with an editor and code analyzer for C/C++, Fortran, MPI and others, to the underlying compilers and debuggers. It DOES NOT come with

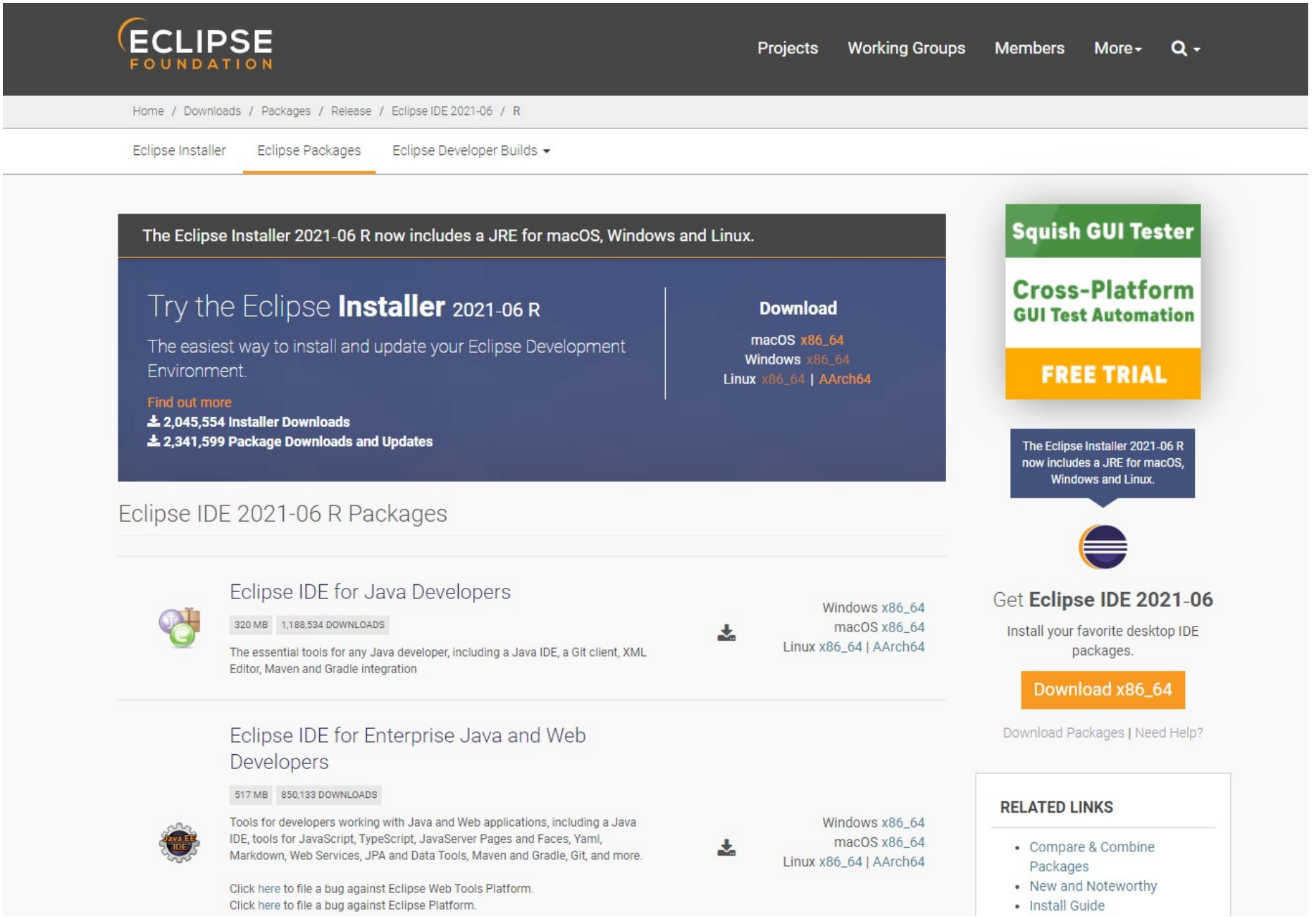
- Compilers
- Debuggers
- Memory analyzers
- Schedulers

Why Eclipse

Debugging parallel code is not straightforward. Options for debugging parallel, MPI code

- DDT (cost)
- TotalView (cost)
- gdb (free) – command line based, hard to use.
- Eclipse (free) – GUI, reasonably intuitive to use.
- Others?

Why Eclipse


ECLIPSE FOUNDATION
Projects
Working Groups
Members
More
Home / Downloads / Packages / Release / Eclipse IDE 2021-06 / R
Eclipse Installer
Eclipse Packages
Eclipse Developer Builds
The Eclipse Installer 2021-06 R now includes a JRE for macOS, Windows and Linux.
Try the Eclipse Installer 2021-06 R
The easiest way to install and update your Eclipse Development Environment.
Find out more
2,045,554 Installer Downloads
2,341,599 Package Downloads and Updates
Download
macOS x86_64
Windows x86_64
Linux x86_64 | AArch64
Eclipse IDE 2021-06 R Packages
Eclipse IDE for Java Developers
320 MB
1,188,534 DOWNLOADS
The essential tools for any Java developer, including a Java IDE, a Git client, XML Editor, Maven and Gradle integration
Windows x86_64
macOS x86_64
Linux x86_64 | AArch64
Eclipse IDE for Enterprise Java and Web Developers
517 MB
850,133 DOWNLOADS
Tools for developers working with Java and Web applications, including a Java IDE, tools for JavaScript, TypeScript, JavaServer Pages and Faces, Yaml, Markdown, Web Services, JPA and Data Tools, Maven and Gradle, Git, and more.
Click here to file a bug against Eclipse Web Tools Platform.
Click here to file a bug against Eclipse Platform.
Windows x86_64
macOS x86_64
Linux x86_64 | AArch64
Squish GUI Tester
Cross-Platform GUI Test Automation
FREE TRIAL
The Eclipse Installer 2021-06 R now includes a JRE for macOS, Windows and Linux.
Get Eclipse IDE 2021-06
Install your favorite desktop IDE packages.
Download x86_64
Download Packages | Need Help?
RELATED LINKS
Compare & Combine Packages
New and Noteworthy
Install Guide

Why Eclipse

Eclipse IDE for RCP and RAP Developers

322 MB | 10,045 DOWNLOADS

A complete set of tools for developers who want to create Eclipse plug-ins, Rich Client Applications or Remote Application Platform (RCP+RAP), plus Maven and Gradle tooling, and an XML editor. It contains the EGit tooling for accessing Git version control systems, and Eclipse Passage which helps with license management for Eclipse-based products.

Windows x86_64
macOS x86_64
Linux x86_64 | AArch64

Eclipse Modeling Tools

442 MB | 9,361 DOWNLOADS

The Modeling package provides tools and runtimes for building model-based applications. You can use it to graphically design domain models, to leverage those models at design time by creating and editing dynamic instances, to collaborate via Eclipse's team support with facilities for comparing and merging models and model instances structurally, and finally to generate Java code from those models to produce complete applications. In addition, via the package's discover catalog, you can easily install a wide range of additional powerful, model-based tools and runtimes to suit your specific needs.

Windows x86_64
macOS x86_64
Linux x86_64 | AArch64

Eclipse IDE for Scientific Computing

320 MB | 5,728 DOWNLOADS

Tools for C, C++, Fortran, and UPC, including MPI, OpenMP, OpenACC, a parallel debugger, and remotely building, running and monitoring applications.

Windows x86_64
macOS x86_64
Linux x86_64 | AArch64

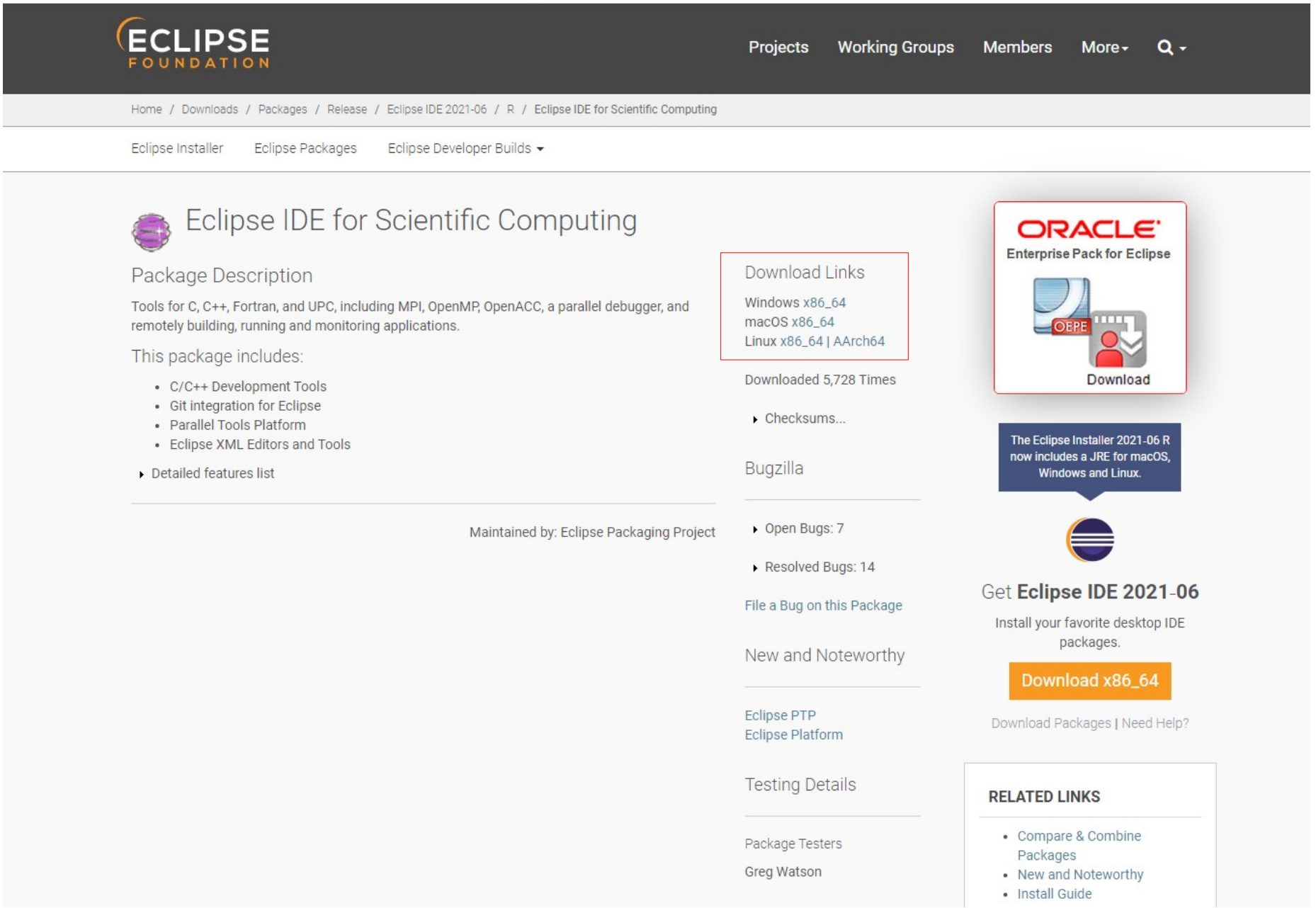
Eclipse IDE for Scout Developers

293 MB | 3,655 DOWNLOADS

Eclipse Scout is a Java/HTML5 framework to develop business applications that run on the desktop, on tablets and mobile devices. This package includes Eclipse IDE support for Scout developers and source code.

Windows x86_64
macOS x86_64
Linux x86_64 | AArch64

Why Eclipse


ECLIPSE FOUNDATION
Projects
Working Groups
Members
More
Home / Downloads / Packages / Release / Eclipse IDE 2021-06 / R / Eclipse IDE for Scientific Computing
Eclipse Installer
Eclipse Packages
Eclipse Developer Builds
Eclipse IDE for Scientific Computing
Package Description
Tools for C, C++, Fortran, and UPC, including MPI, OpenMP, OpenACC, a parallel debugger, and remotely building, running and monitoring applications.
This package includes:
C/C++ Development Tools
Git integration for Eclipse
Parallel Tools Platform
Eclipse XML Editors and Tools
Detailed features list
Maintained by: Eclipse Packaging Project
Download Links
Windows x86_64
macOS x86_64
Linux x86_64 | AArch64
Downloaded 5,728 Times
Checksums...
Bugzilla
Open Bugs: 7
Resolved Bugs: 14
File a Bug on this Package
New and Noteworthy
Eclipse PTP
Eclipse Platform
Testing Details
Package Testers
Greg Watson
ORACLE
Enterprise Pack for Eclipse
OEPE
Download
The Eclipse Installer 2021-06 R now includes a JRE for macOS, Windows and Linux.
Get Eclipse IDE 2021-06
Install your favorite desktop IDE packages.
Download x86_64
Download Packages | Need Help?
RELATED LINKS
Compare & Combine Packages
New and Noteworthy
Install Guide

Requirements

- Windows
  - Compilers, debugger, e.g. from cigywin distribution.
  - But **WSL** – a true Linux environment running on top of Windows by Microsoft - is recommended. See a tutorial on enabling WSL on Windows at https://youtube.sharcnet.ca/.
- Linux
  - GCC compilers, gdb.
  - make, cmake.
  - OpenMPI
- Mac OS

General advice

- It's always a good practice to install an MPI implementation on your own machine (laptop or desktop), so you have immediate access and can practice and develop code.
- For Linux and Mac OS X, install **OpenMPI** or **MPICH**.
- For Windows, we recommend
  - Enable **Windows Subsystem for Linux** (WSL) and
  - Install a Linux distro, e.g. Ubuntu, Debian, etc. on it.
- Install latest GNU compilers and gdb.

Scope of The Tutorial

What are covered and what aren't

What to be introduced in this tutorial

- Eclipse on Linux.
- C/C++ and Fortran code.
- MPI code.

What NOT to be covered

- Threaded, OpenMP code.
- OpenACC code.
- Non GCC compilers, debuggers.
- Running and debugging code on remote systems.
- Use of git.

Development and Debugging

Using gdb and avoiding stepping into foreign territories

One may set in $HOME/.gdbinit rules to skip non user sources, for example, by putting the following lines

```
# Skip C++ compiler / reserved namespace symbols...
skip -rfu ^__.*::.*

# Skip ISO C++ namespace symbols...
skip -rfu ^std.*::.*
skip -rfu ^tr.*::.*
skip -rfu ^posix::.*

# Skip these namespaces' symbols...
skip -rfu ^boost::.*
skip -rfu ^cv::.*
```

Creating Fortran project

Rule of thumb

- Choose C/C++ project
- Choose C/C++ managed build
- Add Fortran toolchains
- Configure the build to use gfortran (or mpifort if using OpenMPI)

Having multiple files?

If you are creating or importing a new project that has multiple source files, you may just put them in the src folder. The CDT make management is smart to create a Makefile that takes care them.

Q&A