



Compiler Research

Status And Plans

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C++ as a service — rapid software development and dynamic interoperability with Python and beyond

- ❖ **Cling** The first C++11-compliant interpreter used in the field of High-Energy Physics for data analysis and interoperability.
- ❖ **ClangRepl** is a generalization of Cling in LLVM/Clang upstream and is a product of OAC- 1931408. It be more reliable, easier to deploy. It follows the best practices adopted by the LLVM developers community. It supports CUDA, OpenMP and Wasm.

C++ as a service — rapid software development and dynamic interoperability with Python and beyond

Hands on details can be seen in our [showcase](#) presentation.

Software Deliverables

- ❖ **CppInterOp** is a product of OAC-1931408 and exposes API from Clang and LLVM in a mostly backward compatible way. The API support downstream tools that utilize interactive C++ by using the compiler as a service. That is, embed Clang and LLVM as a libraries in their codebases. The API are designed to be minimalistic and aid non-trivial tasks such as language interoperability on the fly. In such scenarios CppInterOp can be used to provide the necessary introspection information to the other side helping the language cross talk. The package makes it easy to deploy as it ships Clang as a service without any dependencies.
- ❖ **Cppy** is an undervalued, cutting-edge Python/C++ language interoperability tool originated by Wim Lavrijsen, LBL. It is the de-facto standard for efficient Python/C++ interoperability in the field of particle physics. As part of OAC-1931408 our group collaborated with LBL improve packaging and reduce the dependencies allowing cppy to move closer to LLVM orbit.

Software Deliverables

- ❖ **Xeus-Clang-Repl** is a product of OAC-1931408 that is a Jupyter plugin supporting C++ development based on ClangRepl.
- ❖ **Xeus-Cpp** is a product of OAC-1931408 in collaboration with the QuantStack company. It is a Jupyter kernel for C++ based on the native implementation of the Jupyter protocol xeus. It supports the Wasm version of Jupyter – JupyterLite. Generalization of Xeus-Clang-Repl.

Future Plans in the C++ as a Service Area

- ❖ Continue investing in ClangRepl, Cppyy, Xeus-Cpp and CppInterOp in the context of the partnerships we have built

Clad — Enabling Differentiable Programming in Science

Source Transformation Automatic Differentiation With Clad

- ❖ Over the years our team has invested its spare cycles in automatic differentiation for C++ by advancing the Clad project
- ❖ NSF has funded the team for the next three years to advance Clad into a principled software tool fitting a broader use-cases in science
- ❖ Stay tuned for the official kick-off.

Interactive C++, Automatic Differentiation & AI

- ❖ Continue the ongoing activities such as team meetings, monthly meetings, student engagement and building cross-science collaborations
- ❖ Our team main focus will be Automatic Differentiation and Interactive C++ and its applications in AI in natural sciences

Open Projects

- ❖ Open projects are tracked in our [open projects page](#).

Next Meetings

- ❖ Monthly Meeting — 11rd Jan, 1700 CET / 0800 PDT
 - ❖ Open Source Software For The Win, Saqib

If you want to share your knowledge / experience with interactive C++ we can include presentations at an upcoming next meeting

Thank you!