

A Pathway from Fortran to PyMT

Over the past few months, the CSDMS software engineers have developed a pathway for integrating Fortran models into PyMT. A sketch of the process is shown in Figure 1.

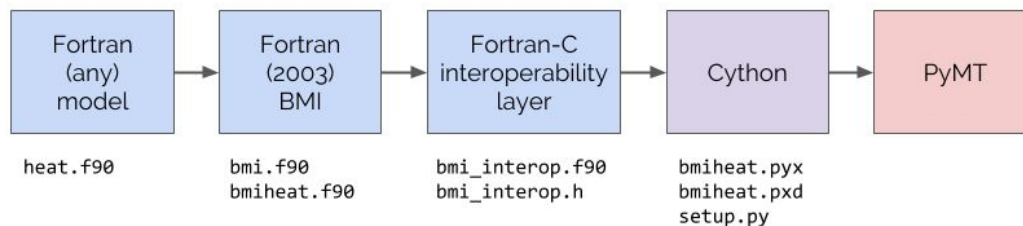


Figure 1. A diagram of the process to bring a Fortran model (here, the "heat" example from the Fortran BMI) into PyMT.

A model with a Fortran BMI (see <https://github.com/csdms/bmi-fortran>) is wrapped with a C interoperability layer. This interoperability layer uses the ISO_C_BINDING module, introduced in Fortran 2003, that allows Fortran code to be compiled and linked into a C library. Each BMI function is wrapped with a new function that uses C types from the this module. The C library created from the interoperability layer can be called from Cython (<https://cython.org>), which provides an extension language for accessing C libraries from Python. Cythonized code can be called directly from Python, and therefore from PyMT.

Although the process is straightforward, the details can be tricky; for example, types in three languages (Fortran, C, and Python) must be in alignment. The great thing about this process, though, is that the model developer never sees it; they just provide a BMI-ed model to CSDMS. Further, the process has been templated and automated (see <https://github.com/csdms/cookiecutter-bmi-wrap>), so that once a model is provided to CSDMS, it can be quickly added to PyMT. Last--and this may be the neatest part-- to a PyMT user, they're just using Python. They never see that it's actually a Fortran model running under the hood.

Hopefully this process will allow existing (and new!) Fortran models to be easily integrated into the CSDMS Modeling Framework and accessible through PyMT, as well as providing them with a friendlier Python interface.