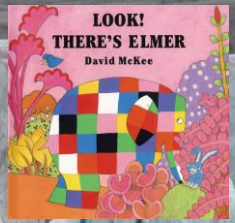

Elmer/Ice Git + cmake

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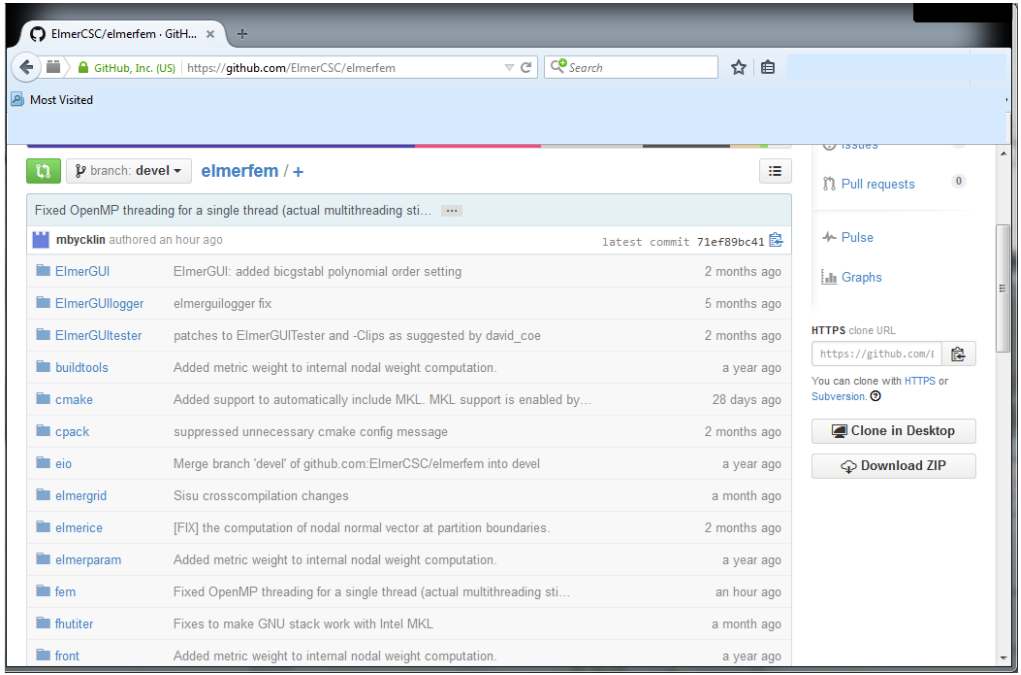
Elmer/Ice user meeting, EGU GA 2015

New distribution system

- SVN (on SourceForge) is frozen since February 2015
- Git: http://github/com under: ElmerCSC/elmerfem
- Hence: **https://github.com/ElmerCSC/elmerfem**
- Git works different than SVN:
  - Distributed repositories (including local repositories)
  - Works with branches
    - We have a few of them in Elmer, the main Elmer branch is *devel*
    - Recommended to use *elmerice* branch, as Elmer/Ice related updates preferentially are pushed to this branch

New distribution system



How to obtain source code?

- "I am just interested in obtaining the source code, what do I have to do?"
  - Previous: `svn checkout svn://svn.code.sf.net/p/elmerfem/code/trunk/`
  - New: `git clone https://github.com/ElmerCSC/elmerfem.git`
- "I want to contribute to the development, hence also submit changes to the repository"
  1. Tell us (=CSC) your GitHub ID
  2. Under certain circumstances we add you to the developer list
  3. Get yourself familiar (if not already) with Git
  4. If you touch stuff outside elmerice –directory, sign the IP waiver agreement with CSC

Git

- Fetching repository and linking local *elmerice* branch to original:

```
git clone git://www.github.com/ElmerCSC/elmerfem
```

- Check which branch you are in: `git status` or

```
git branch -a
```

- Changing to other branch (and tying it to the GitHub):

```
git checkout --track origin/elmerice
```

- How to update?: `git pull`

Git policies

1. Elmer/Ice specific changes (i.e., inside sub-directory elmerice) to *elmerice*-branch
2. also changes that are induced by Elmer/Ice to out-of-elmerice sub-directories should preferably be pushed from within *elmerice* branch
3. everyone CSC already trusted with GitHub access can do a merge from *devel* to *elmerice* branch (just check stuff in advance)
4. merges back from *elmerice* to *devel* branch should be only made by people from inside CSC. You can make a **pull request** (https://help.github.com/articles/creating-a-pull-request/)
5. try to avoid procedures like cherry-picking and rebasing – if necessary, talk to people at CSC first

New configuration system - Cmake

- Moving from GNU autotools to cmake
  - Inside elmerfem-directory, make a build-directory: `mkdir builddir`
  - From within builddir try
  - This requires that you have
    1. C and F90 compiler
    2. Hypre + Mumps installed
  - Thereafter: `make && make install`

```
cmake ../  \
 -DCMAKE_INSTALL_PREFIX=/elmer/installation/path \
 -DCMAKE_C_COMPILER=/path/to/compiler/executable \
 -DCMAKE_Fortran_COMPILER=/path/to/compiler/executable \
 -DWITH_MPI:BOOL=TRUE \
 -DWITH_Mumps:BOOL=TRUE \
 -DWITH_Hypre:BOOL=TRUE \
 -DWITH_Trilinos:BOOL=FALSE \
 -DWITH_ELMERGUI:BOOL=FALSE \
 -DWITH_ElmerIce:BOOL=TRUE
```

Cmake

- Toolchain files can be used mainly in cross-platform compilations
  - Examples under `elmerfem/cmake/Toolchains`
  - Include with `-DCMAKE_TOOLCHAIN_FILE=/path/to/toolchainfile.cmake`
- Else use pre-cache files
  - Include with: `-C file.cmake`

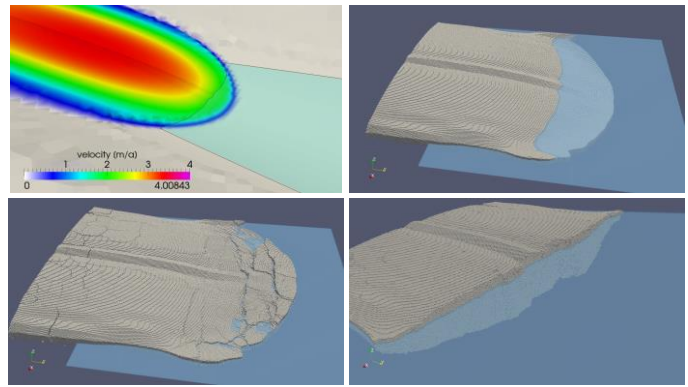
```
# CMake toolchain file for building with GNU compilers
#
# Author: Mikko Byckling, CSC - IT Center for Science Ltd.
# Version: 0.1

SET(CMAKE_SYSTEM_NAME Linux)
SET(CMAKE_SYSTEM_PROCESSOR x86_64)
SET(CMAKE_SYSTEM_VERSION 1)

# Specify the cross compilers (serial)
SET(CMAKE_C_COMPILER gcc)
SET(CMAKE_Fortran_COMPILER gfortran)
SET(CMAKE_CXX_COMPILER g++)

# Specify the cross compilers (parallel)
SET(MPI_C_COMPILER mpicc)
SET(MPI_CXX_COMPILER mpic++)
SET(MPI_Fortran_COMPILER mpif90)

# Compilation flags (i.e. with optimization)
SET(CMAKE_C_FLAGS "-O3 -g -m64 -ftree-vectorize \
 -funroll-loops" CACHE STRING "")
SET(CMAKE_CXX_FLAGS "-O3 -g -m64 -ftree-vectorize\
 -funroll-loops" CACHE STRING "")
SET(CMAKE_Fortran_FLAGS "-O3 -g -m64 -ftree-vectorize\
 -funroll-loops" CACHE STRING "")
```

Cmake worked on …

- Linux Mint 17 (including Hypre and MUMPS, but Debian Trilinos did not work)
- Fedora (on CSC's HP-blade cluster taito.csc.fi)
- Cray Compute Linux (cross compilation) on CSC's Cray-XE cluster
- Windows 7
- OS X Maverik (instructions will follow in near future)
- If you have a toolchain or pre-cache file for a certain platform, please share (zwinger@csc.fi)

Coupling of continuum model and DPM

- Glacier built-up with Elmer/Ice (synthetic ”Svalbard-ish” setup)
- Transfer of tongue geometry into DPM
- DPM run (~1 Mio. Particles, 64 processes, 4h)
- Connectivity algorithm to detect new ice-front
- Back-transfer into Elmer/Ice



Urgently needed developments in Elmer/Ice?

- **Transport dominated physics**:
- Passive tracer transport
- Age/depth
- Kinematic free surface equation
- FreeSurfaceSolver
  - cheating by using standard Galerkin
- Discontinuous Galerkin (troublesome)
- Semi-Lagrangian method
  - Issues with limiters
  - Existing code, needs to be adapted

$$\frac{\partial \Psi}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{\Psi} = \begin{matrix} 0 \\ 1 \\ w + a_{\perp} \end{matrix}$$

Acknowledgements

- Mikko Byckling, Sami Ilvonen, Peter Råback, Juha Ruokolainen, Juhani Kataja (CSC)
- Olivier Gagliardini (LGGE), Pierre-Marie Lefeuvre (U. Oslo), Hakime Seddik (ILTS) -> Mac
- NCoE eSTICC
  - Supported porting on large machines in Nordic countries
- NCoE SVALI

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