How to run Lumerical FDTD on the FAS Odyssey cluster (SEAS users only)

*Lumerical FDTD* is a finite-difference-time-domain solver for time-dependent Maxwell's equations. The solver is parallelized using MPI. In order to use FDTD, one needs to first build the model using Lumerical CAD software. Currently SEAS Computing has limited CAD licenses. If you need to use CAD on a regular basis, we encourage you to buy a license for CAD directly from Lumerical. Once you have the CAD based model available, you can use FAS RC resources for solving the model with FDTD.

*As we have limited CAD licenses, please try to use Lumerical design environment (CAD) only when necessary and terminate the CAD session when not needed.*

Getting started

Obtain a FAS RC account by visiting:

https://account.rc.fas.harvard.edu/request/

Please consult the documentation available via the above link for connecting to FAS systems and familiarizing yourself with the SLURM queue management system. For any help, contact RC using the information available on:

https://rc.fas.harvard.edu/about/contact/

Lumerical and SLURM

This example illustrates solving 'nanowire.fsp' model that is available in the Lumerical package. The following SLURM script 'runscript_lumerical.sh' will load the necessary SW using modules, copy the 'nanowire.fsp' file from the lumerical install directory, and then run the model using parallel (OpenMPI) version of FDTD. The script requests 2 CPU cores (as indicated by `#SBATCH -n 2`, and solves the problem using 2 MPI processes (as indicated by `mpirun -np ...`):

```
#!/bin/bash
#
#SBATCH -n 2        # Number of cores
#SBATCH -t 0-00:05  # Runtime in D-HH:MM format
#SBATCH -p general  # Partition to submit to
# SLURM requires memory specification. For lumerical, this may be found from
# CAD via the "Check" button at the top.
#SBATCH --mem-per-cpu=500 #Memory per cpu in MB (see also --mem)
# Note that the module lumerical-seas/8.11.422-fasrc01 is only for SEAS users.

source new-modules.sh
module load intel/15.0.0-fasrc01 impi/5.1.2.150-fasrc01
lumerical-seas/8.15.736-fasrc01

cp /n/sw/lumerical-8.15.736-1_seas/examples/nanowire.fsp .

# use $SLURM_NTASKS env set by #SBATCH -n value
mpirun -np $SLURM_NTASKS fdtd-engine-impi-lcl nanowire.fsp

date

exit
```

You can download the above script as `runscript_lumerical.sh` and submit it to SLURM as follows:

```bash
sbatch ./runscript_lumerical.sh
```
Lumerical CAD

Lumerical models can be created using the CAD interface. The best approach to running CAD is on your local machines. If you need to use FAS RC machines, the instructions are below (IMPORTANT: SEAS computing has few CAD licenses and they are regularly oversubscribed. If your work depends on CAD, you are urged to buy a copy of CAD to run on your laptop/desktop as we cannot guarantee availability of CAD. If you receive a message to the effect "licenses are not available" or "Maximum license count reached", please wait some time and try again.):

In order to run CAD, you need to have enabled X-windows capability, i.e. use putty with xming (on windows) or ssh with `-X` option on Mac and Linux. You can also use the remote desktop capability. The instructions are at:

https://rc.fas.harvard.edu/resources/access-and-login/

On odyssey, you can run Lumerical CAD using SLURM. If you use ssh, this process is likely to be slow (you can speed it up somewhat with the compression option, i.e. `ssh -C` option). Once you are logged in, you can find the available versions of lumerical with:

```
source new-modules.sh
grep -i lumerical
```

and load a suitable module. (Please only use modules in the SEAS tree, i.e. seas/lumerical-<version>.) To open an interactive session with SLURM, proceed as follows:

```
source new-modules.sh
module load intel/15.0.0-fasrc01 impi/5.1.2.150-fasrc01
lumerical-seas/8.15.736-fasrc01
srun -p interact --mem 4000 --pty --x11=first -t 0-2:00 -n 1 -N 1 /bin/bash
```

This will schedule an interactive CAD session. Note that the SLURM command ‘srun’ requires memory to be specified. The options ‘--mem 4000’ requests 4 Gigs of memory, which is a reasonable amount to start with; ‘-t 0-2:00’ requests a 2 hour session; and ‘-n 1 -N 1’ requests 1 core on 1 node. Please do not run Lumerical on the login node. Please do not run CAD on the login node.

Here is the link for Lumerical documentation:

- Lumerical Online Help