

## A) PREPARE FTI RUNTIME AND EXAMPLES

### Preparation

- 1) Download package:  
git clone <https://github.com/kellekai/fti.git> fti-tutorial-git  
git checkout tutorial
- 2) Change into base directory  
cd fti-tutorial-git

### Configure and Install

- 3) Create build directory and change into it:  
mkdir build; cd build
- 4) Run:  
cmake -DCMAKE\_INSTALL\_PREFIX:PATH=../fti-release ..; make; make install

### Executables and fti-library files

The fti library is installed in ../../fti-release  
The tutorial files you find in ./tutorial

*(Remark: Of course you can modify the installation folders as you like!)*

## B) DEMONSTRATION OF THE RESILIENCE FEATURES

To demonstrate the various safety levels of FTI, we will execute an example which uses the api function 'FTI\_Snapshot()'. Run the example in each case for at least one minute and interrupt the execution after that time by pressing 'ctrl+c'.

### L1 – local checkpoint on the nodes

Change into folder ./tutorial/L1 and run the execution with 'make hd1'. While the program is running, you may follow the events by observing the contents in the 'local' folder. In order to do that you can use the commands:

```
watch -n 1 'find local'
watch -n 1 'du -kh local'
or
cd local; watch -n 1 'ls -lR'
```

*(It may be illuminating to open the files in the 'meta' folder, using a text editor. What kind of information do you think is kept in these files?)*

After interrupting the execution, run again 'make hd1'. The execution will (hopefully) resume from where the checkpoint was taken.

After the successful restart, interrupt the execution and delete one of the checkpoint files. The files are stored as (you can also simply delete the whole node directory):

```
local/<NODE>/<EXEC-ID>/<LEVEL>/ckpt<ID>-Rank[Pcof/Rsed]<RANK>.fti
```

You will notice, that in that case the program won't be able to resume the execution.

## **L2 – local checkpoint on the nodes + copy to the neighbor node**

Change into folder `./tutorial/L2` and run the execution with `'make hd2'`. While the program is running, you may follow the events by observing the contents in the `'local'` folder.

After interrupting the execution, run again `'make hd2'`. The execution will also in this case (hopefully) resume from where the checkpoint was taken.

After the successful restart, interrupt the execution and delete one of the checkpoint files.

You will notice that now the program (hopefully) **will** be able to resume the execution. Try to delete more than one file. How many files you can delete (*and which?*) in order to keep the execution being able to resume?

## **L3 – local checkpoint on the nodes + copy to the neighbor node + RS encoding**

Change into folder `./tutorial/L3` and run the execution with `'make hd3'`. While the program is running, you may follow the events by observing the contents in the `'local'` folder.

After interrupting the execution, run again `'make hd3'`. The execution will (surprisingly) also in this case resume from where the checkpoint was taken.

After the successful restart, interrupt the execution and delete one of the checkpoint files.

The program will resume its execution. How many files you can delete here, in order to keep the execution being able to resume? Is it relevant in this case which of the files you delete?

## **L4 – flush of the checkpoints to the parallel file system**

Change into folder `./tutorial/L4` and run the execution with `'make hd4'`. While the program is running, you may follow the events by observing the contents in the `'global'` folder.

After interrupting the execution, run again `'make hd4'`. The execution will resume from where the checkpoint was taken.

## **C) PRACTICE**

1)

In the `./tutorial/practice` folder you will find the source code of the program we used to demonstrate the FTI features. In this case without FTI being implemented. Try to implement FTI. You can use either the `'FTI_Snapshot'` or `'FTI_Checkpoint'` function to cause FTI taking a checkpoint.

2)

Change into the folder `./tutorial/experiment` and play with the settings of the configuration file. To run the program, type: `'mpirun -n 8 hd.exe config.fti <GRIDSIZE>'`. Perform executions with `'Head=0'` and `'Head=1'`, do you notice any difference in the execution duration? (Note: *You may take frequent L3 checkpointing and a gridsize of 256 or higher. In that case you will most likely see a difference.*)

(Remark: `<GRIDSIZE>` denotes the dynamic memory of each mpi process in MB)