

Checkpointing Jupyter

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Introduction

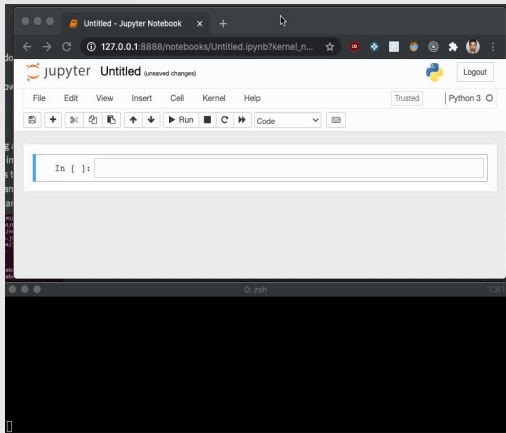
Jupyter Notebook is an application that allows people to create documents, run data analysis, create data visuals, and so much more. Due to its collaborative features, Jupyter Notebook has a great need for reproducibility through preservation of data. For our capstone project, we developed a way to use checkpointing in Jupyter so that the state of the kernel could be saved and restored. As a result, it is able to save data after the kernel closes.

Prior Work

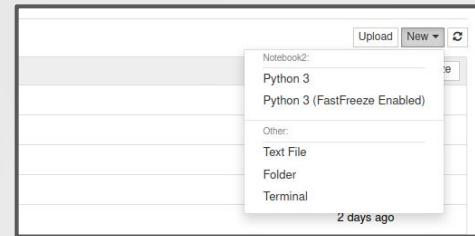
- FastFreeze - software developed by TwoSigma in order to checkpoint and restore applications.
- CRIU - a checkpointing and restoring engine
- Other checkpoint/restore applications - there are many similar applications for more specific needs.
- Research papers on different checkpointing capabilities and the need for fault tolerance through checkpointing

Methodology

- Integrated FastFreeze into the Jupyter Notebook ecosystem
 - Jupyter kernels are checkpointed
 - Done by restructuring the way kernels are formatted



Example of the Jupyter Notebook Feature



The new UI to select a kernel with FastFreeze enabled

```
[KernelApp] Starting kernel 'python3'
/home/jacob/Desktop/JN_venv
[KernelApp] Connection file: /home/jacob/.local/share/jupyter/runtime/kernel-1e19a504-3eb3-4115-b5e7-3d62de5b3ccd.json
[KernelApp] To connect a client: --existing kernel-1e19a504-3eb3-4115-b5e7-3d62de5b3ccd.json
[ff.run] (0.001s) Creating container 'JN_venvnameofkernel2.img'
[ff.run] (0.018s) Application is ready, started from scratch
```

The terminal output when FastFreeze is used with Jupyter

Evaluation

This project is evaluated through a three part user study. First, we recruit the participants. During the user study, the participant met with the team over Zoom. We asked them to use the application with no help. Then asked them to fill out a survey. After the survey, we conduct an interview to evaluate usability and functionality.