Open Composer: A Web-Based Application for Generating and Managing Batch Jobs on HPC Clusters

Masahiro Nakao, Keiji Yamamoto
(RIKEN Center for Computational Science)

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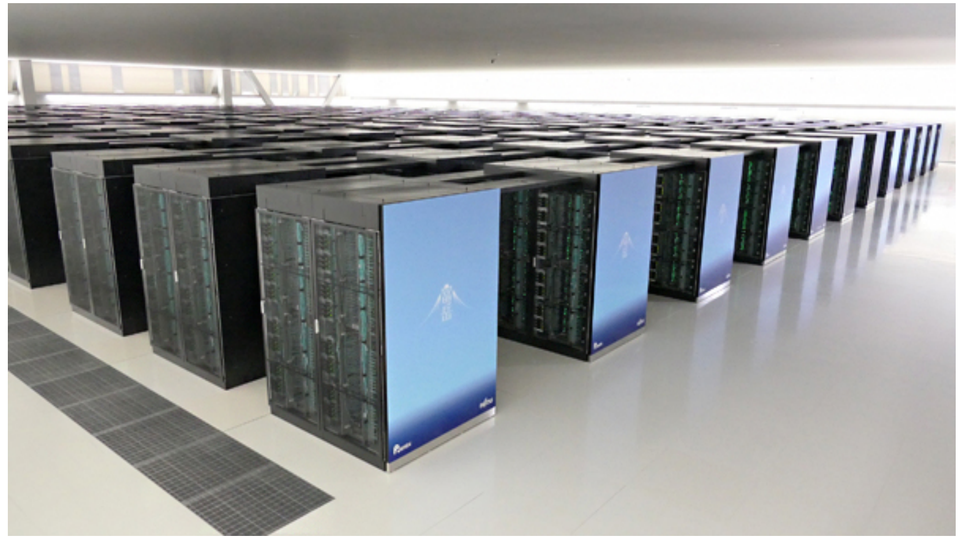
Background (1/3) : Barriers to HPC Accessibility

- The primary use case of HPC clusters is to execute real-world applications as batch jobs
- Using HPC clusters often requires technical skills:
  - Install an SSH client
  - Generate an SSH key pair and register its pub key
  - Be familiar with Linux commands
  - Understand directives and commands for job schedulers (e.g. Slurm, PBS, Grid Engine)



```
#!/bin/bash
#SBATCH -p fx700      // Queue
#SBATCH -N 1          // Number of nodes
#SBATCH -t 1:00:00    // Required time
mpiexec ./a.out
```

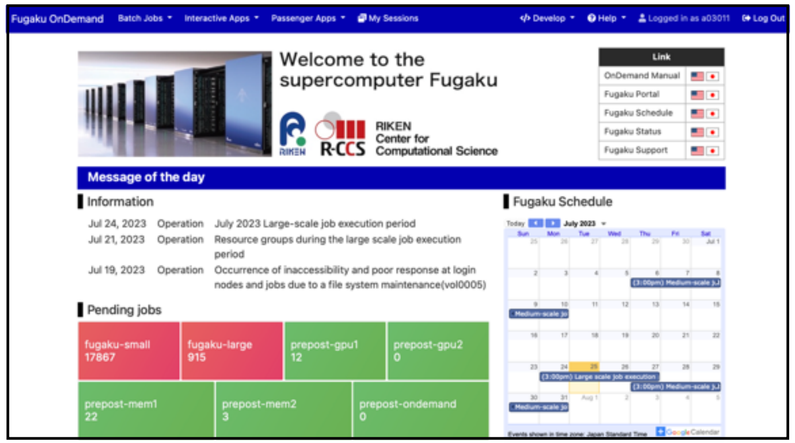
Example of a batch job script in Slurm

When users move to an HPC cluster with a different job scheduler, they often have to re-learn how to use it

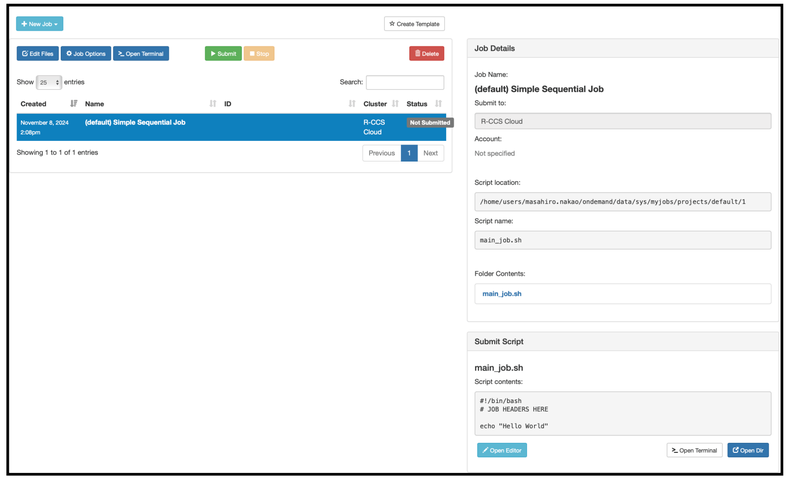
Background (2/3) : Open OnDemand

https://www.openondemand.org/

- Open OnDemand, a web portal for HPC clusters
- Open source software developed by Ohio State University
- Used all over the world
- Provides a unified web-based interface to access HPC clusters, without requiring SSH or Linux commands
- Includes a mechanism to run custom applications
- Offers many functions, including batch job creation, GUI-based job launchers (e.g., JupyterLab), file management, data transfer tools, job monitoring, and terminal access



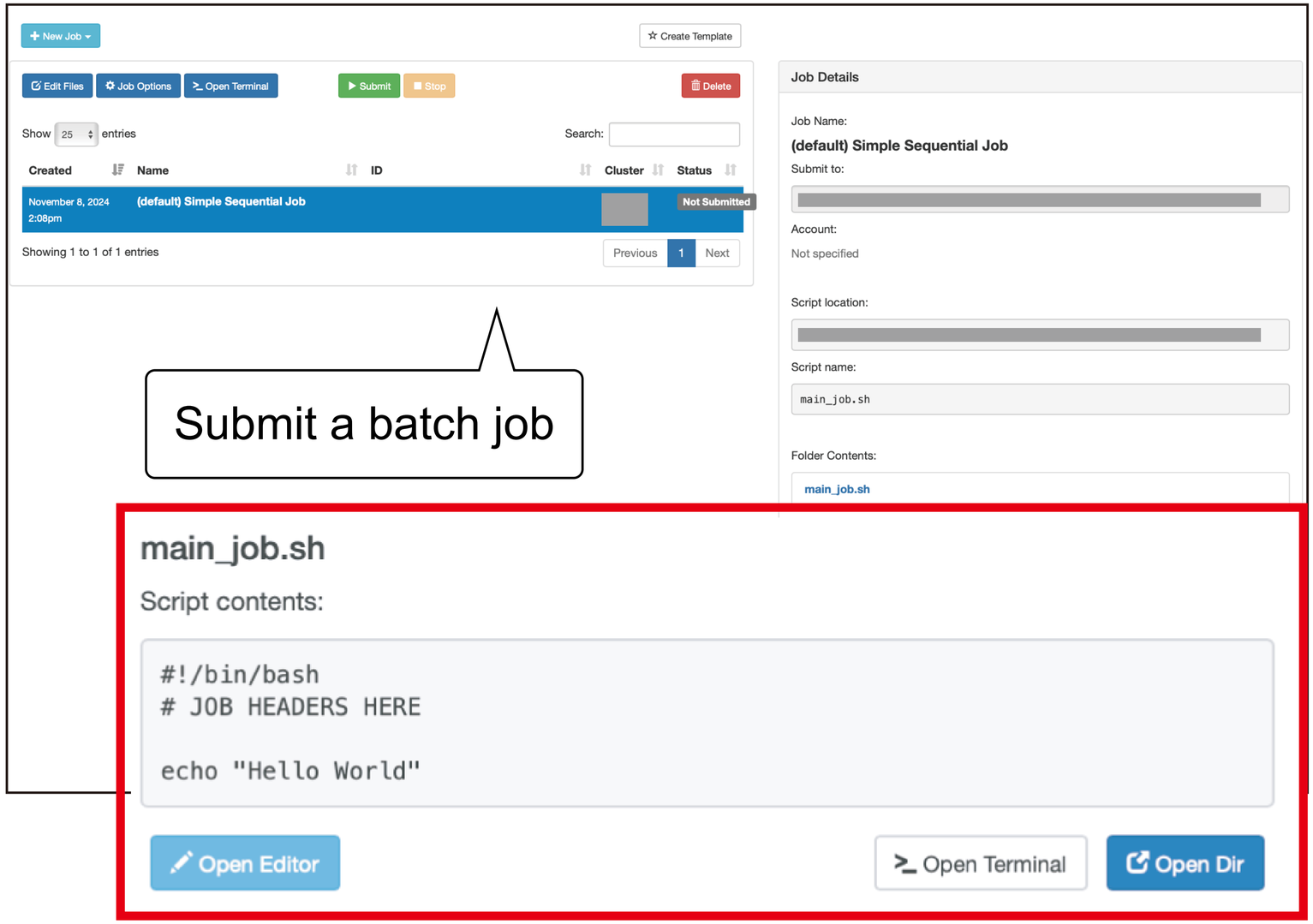
Our portal by Open OnDemand



Creating a batch job

However, for batch job creation, users must write the scripts manually, which can be challenging

Background (3/3) : Job Composer



- Pre-installed application on Open OnDemand to create batch jobs
- Batch jobs can be submitted from a web browser using GUI
- Users must write batch job scripts with job scheduler directives manually

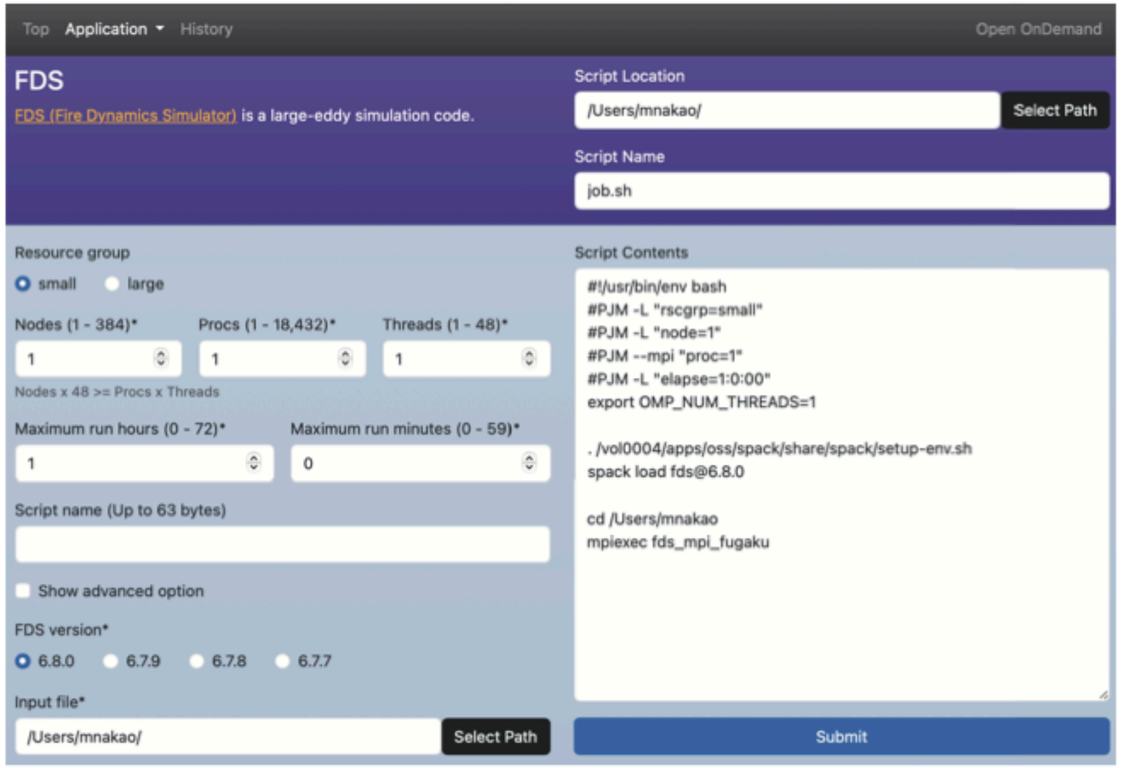
We also want to simplify batch job creation on Open OnDemand

Objective

https://github.com/RIKEN-RCCS/OpenComposer

We have developed Open Composer, a web-based application for generating and managing batch jobs on HPC clusters

- Runs on Open OnDemand
  - Allows easy deployment in any environment where Open OnDemand is available
- Open-source software under the MIT license
- Enables users to generate job scripts automatically by entering parameters into web forms tailored to each application
- Reduces the learning burden of job schedulers and minimizes script-writing errors
- Provides job management, including submission, deletion, and status monitoring



Design of Open Composer

- **Running on Open OnDemand**
  - **Enables easy deployment**
  - **Reduces development cost by leveraging Open OnDemand's built-in features, such as authentication and data transfer**
- Script Auto-Generation
  - Job scripts are automatically generated based on user input through a web interface
  - Includes error checking to prevent submission failures
- Editable Script
  - Users can also directly modify generated job scripts to meet specific requirements
- Job Management
  - Supports job submission, deletion, and status monitoring
  - Unified interface that hides the differences between job schedulers

Implementation of Open Composer

- Backend
  - Using the open-source Ruby framework Sinatra (https://sinatrarb.com/)
  - Sinatra is available in the Open OnDemand environment without any additional installation
- Frontend
  - Bootstrap (CSS + JavaScript) for a responsive web interface
  - JavaScript and HTML to update job scripts in real time
    - We didn't use any external libraries to minimize dependencies
- Code Statistics (as of November 2025, Version 1.7.0)
  - Ruby: 2,322 lines
  - JavaScript: 1,070 lines
  - HTML (including ERB): 409 lines

https://github.com/RIKEN-RCCS/OpenComposer

Installation of Open Composer

- Administrator

```
# cd /var/www/ood/apps/sys
# git clone https://github.com/RIKEN-RCCS/OpenComposer.git
# vim OpenComposer/conf.yml.erb
```

or

- General user

```
$ cd ${HOME}/ondemand/dev
$ git clone https://github.com/RIKEN-RCCS/OpenComposer.git
$ vim OpenComposer/conf.yml.erb
```

```
scheduler: slurm
```

It's very easy. No additional software is required.

In most cases, a user needs to specify only the item "scheduler".
Open Composer supports Slurm, PBS, Grid Engine, and Fujitsu TCS job schedulers.

Creating web form for each application

- Definition file for each application in YAML format
- Open Composer supports the following input form types (widget):
  - **number**: Enter a number
  - **text**: Enter text
  - **email**: Enter an email address
  - **select**: Select one item from a select box
  - **multi_select**: Select multiple items from a select box
  - **radio**: Select one item from a radio button
  - **checkbox**: Select multiple items from a checkbox
  - **path**: Select the path to a file or directory on the server

Example of definition file

```
form:
  queue:
    widget: radio
    label: Queue
    value: small
    direction: horizontal
    options:
      - [small]
      - [large]
  time:
    widget: number
    size: 2
    label: [Max hours (0-24), Max minutes (0-59)]
    value: [ 1, 0]
    min: [ 0, 0]
    max: [24, 59]
    step: [ 1, 1]
  nodes:
    widget: number
    label: Number of nodes (1 - 128)
    value: 1
    min: 1
    max: 128
    step: 1
  binary:
    widget: path
    label: Executable binary

script: |
  #!/bin/bash
  #SBATCH -p #{queue}
  #SBATCH -t #{time_1}:#{time_2}:00
  #SBATCH -N #{nodes}
  mpiexec #{binary}
```

Other functions and summary

- Other functions
  - Dynamic form widget such as hiding, disabling, changing values
  - Detailed error checking in Ruby
  - Preprocess
  - Multiple schedulers
  - Integration with Open OnDemand functions

These features make job script generation more flexible and enhance the user experience

- Summary
  - Development of Open Composer, a web application that can automatically generate and submit batch job scripts
  - Reducing learning costs and the frequency of job script writing errors