Prerequisites and Installation Guide for OpenFOAM, Jupyter with Docker

1 Introduction

This guide provides step-by-step instructions for setting up and running OpenFOAM with a custom solver (pimpleScalarsFoam) using Docker on different operating systems.

Note: Installation errors can be resolved during the training week (Wednesday, after 3:30 PM)

2 Prerequisites

Before starting, ensure you have:

- At least 20GB of free disk space
- At least 8GB RAM recommended
- Internet connection for downloading Docker and OpenFOAM images

3 Linux Installation

3.1 Install Docker

Run these commands in sequence:

```
# Update package index and install prerequisites
sudo apt-get update && sudo apt-get install -y \
    apt-transport-https \
    ca-certificates \
    curl \
    gnupg \
    lsb-release

# Add Docker's official GPG key
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /usr/share/
    keyrings/docker-archive-keyring.gpg

# Set up stable repository
echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/docker-archive-
    keyring.gpg] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable" | sudo tee
    /etc/apt/sources.list.d/docker.list > /dev/null

# Install Docker Engine
sudo apt-get update && sudo apt-get install -y docker-ce docker-ce-cli containerd.io

# Add user to docker group
sudo usermod -aG docker $USER

# Verify installation
docker --version
```

Note: After adding your user to the docker group, log out and log back in for the changes to take effect.

3.2 Run OpenFOAM

Execute these commands in sequence:

```
# Start OpenFOAM container
docker run -it --name cfd1_container -p 8888:8888 -v $(pwd):/data opencfd/openfoam-default /bin/
    bash

# Download and run setup script
apt update && apt install -y git
git clone https://github.com/Nausheen13/cedar-course.git
chmod +x cedar-course/setup_openfoam.sh
./cedar-course/setup_openfoam.sh

# Switch to foam user
su - foam  # or su - sudofoam

# Source OpenFOAM environment (only if needed)
source /opt/openfoam/openfoam2306/etc/bashrc
```

If the above bashrc path doesn't work, find the correct path:

```
# Find OpenFOAM bashrc location
find / -name "bashrc" -type f 2>/dev/null | grep -i openfoam

# Source the found bashrc (example path)
source /usr/lib/openfoam/openfoam2412/etc/bashrc

# Run the solver
cd cedar-course/mefenemic-base
pimpleScalarsFoam
```

3.3 Install Jupyter

Execute these commands (in the root):

```
# Install Python and create virtual environment
apt-get update
apt-get install -y python3-full python3-venv
python3 -m venv /opt/jupyter_venv

# Activate virtual environment and install Jupyter
source /opt/jupyter_venv/bin/activate
pip install --upgrade pip
pip install -r cedar-course/requirements.txt

#Now in the user (su - foam)
. /opt/jupyter_venv/bin/activate

# Launch Jupyter Notebook
jupyter notebook --ip 0.0.0.0 --port 8888 --no-browser --allow-root
```

4 Windows Installation

4.1 Install WSL2 (Windows Subsystem for Linux)

1. Open PowerShell as Administrator and run:

```
wsl --install
```

2. Restart your computer 3. Open Ubuntu from Start menu and set up your username/-password

4.2 Install Docker Desktop

1. Download Docker Desktop from Docker Hub (`https://www.docker.com/products/docker-desktop`) 2. Run the installer with administrator privileges 3. Ensure "Use WSL 2 instead of Hyper-V" is selected during installation 4. Start Docker Desktop after installation

4.3 Run OpenFOAM

Open Ubuntu terminal from the Start menu and follow the same commands as in the Linux section.

5 macOS Installation

5.1 Install Docker Desktop

1. Download Docker Desktop for Mac from Docker Hub (`https://www.docker.com/products/docker-desktop`) 2. Drag Docker to Applications folder 3. Start Docker Desktop

5.2 Run OpenFOAM

Open Terminal and follow the same commands as in the Linux section.

6 Common Issues and Solutions

6.1 Docker Permission Issues

```
# Fix permission denied errors
sudo usermod -aG docker $USER
# Log out and log back in after running this command
```

6.2 WSL2 Memory Issues (Windows)

Create or edit /.wslconfig in your Windows user directory:

```
[wsl2]
memory=8GB
processors=4
```

6.3 Volume Mount Issues

- Ensure you're in the correct directory when running Docker
- On Windows, use proper path conversion for WSL
- On macOS, ensure the directory is shared in Docker Desktop preferences

7 Verification

Verify your installation:

```
# Check Docker installation
docker --version

# Check OpenFOAM
pimpleScalarsFoam -help

# Check case setup
ls -l /data/cedar-course/mefe-swakless
```

8 Additional Resources

- Docker Documentation: `https://docs.docker.com/`
- OpenFOAM Documentation: `https://www.openfoam.com/documentation/`
- WSL2 Documentation: `https://docs.microsoft.com/en-us/windows/wsl/`
- Course Repository: `https://github.com/Nausheen13/cedar-course`