

GridCAE Live Demo

User Guide

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1. Introduction

BEinGRID is a European Commission (EC) funded project aiming to promote the benefits of Grid technology to industry. Grid middleware, for example UNICORE, gLite and Globus Toolkit, is open-source software for managing networked computing and data resources. At present, Grid middleware is used mainly by academic communities and its development is funded by national funding bodies and the EC. The EC would like industry within Europe to benefit from this freely available software and hence funded a technology transfer project, BEinGRID, to this end.

One of the main outcomes of BEinGRID is the 'BEinGRID Demos' which are promotional material telling stories of successful use of the Grid within industry settings, from both a business and a technology perspective. The purpose of this package is to demonstrate how Grid technologies can increase the cost-effectiveness and accelerate the uptake of Computer Aided Engineering and in particular Computational Fluid Dynamics (CFD).

This guide will show you how to run the GridCAE demo. You will submit a simple simulation job to a Grid and view the results. Please refer to Section 2 to make sure your computer satisfies the requirements for running this demo. Section 3 explains the simulation problem. You can then proceed to Section 4 to understand how the simulation is produced using Grid technologies. Section 5 and 6 give a step by step instruction on how to obtain, install, run and uninstall this demo on Windows and Linux systems. Definitions of the terms used in this guide are found in the Glossary section at the end of this document.

For further information about GridCAE, please visit:

<http://www.beingrid.eu/gridcae.html>

For any questions or feedback, please send an email to the following address with the subject 'GridCAE user query':

be-demos-team@epcc.ed.ac.uk

2. Requirements

Disk space: 170 MB

Physical Memory: 100 MB

Operating system: Microsoft Windows 2000/XP/Vista or Linux

JRE 1.6.0 or above

WinZip, tar, or a similar compression/decompression program

Internet connection

Administrator/root privileges not required

3. The Simulation Problem

The live demo shows a Computational Fluid Dynamics (CFD) simulation where the problem is to investigate the dynamics of a dam break¹.

Initially, there is a column of water contained by a wall and a dam. To make the simulation more interesting, there is a small obstacle in the middle. This setting is shown in Figure 1. The situation immediately after the dam breaks is shown in Figure 2. We are making a simplified assumption that the dam suddenly disappears.

We would like to produce a simulation that shows how the water flows in the first two seconds after the dam break.

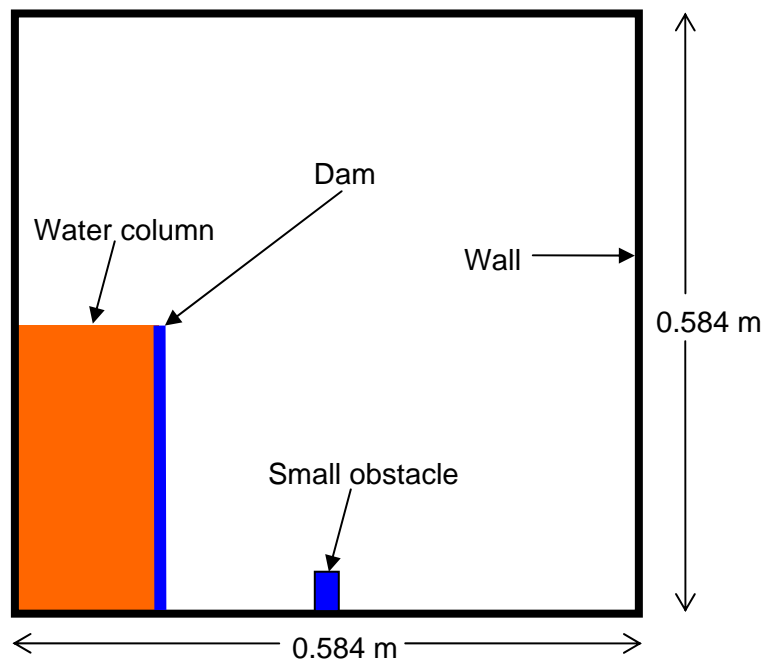


Figure 1: Initial setting, dam blocking a water column.

¹ Simulation problem adapted from OpenFOAM tutorial files.

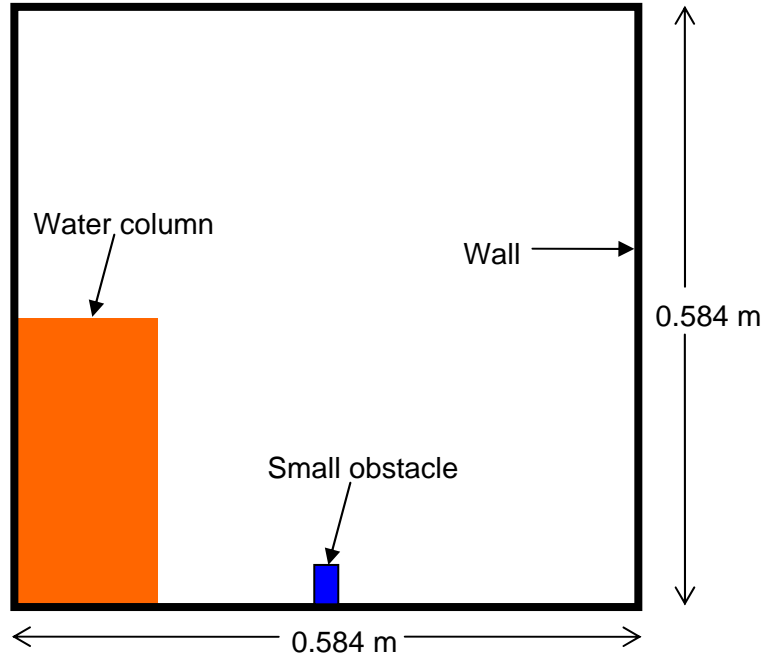


Figure 2: Setting immediately after the dam breaks.

4. Using Grid technology to solve the problem

4.1 Overview

The simulation problem requires heavy computational processing. We thus pass the job over to a Grid with a powerful processing capacity. Figure 3 shows how this is done.

Submitting the job: An application called ModeFRONTIER orchestrates the whole process of executing the job. It takes the input file and passes it to a client side program. The client side program is called the GRIA Client and it communicates with the corresponding server side program, the GRIA Server.

Processing the job: The GRIA Server runs on the Grid. It accepts jobs from GRIA clients and executes them on the Grid. In this scenario the processing of the CFD simulation is carried out by OpenFOAM.

Returning the results: When OpenFOAM completes the simulation, the GRIA server sends the result back to the GRIA client, which in turn forwards it to ModeFRONTIER. ModeFRONTIER then opens the output for the user to see.

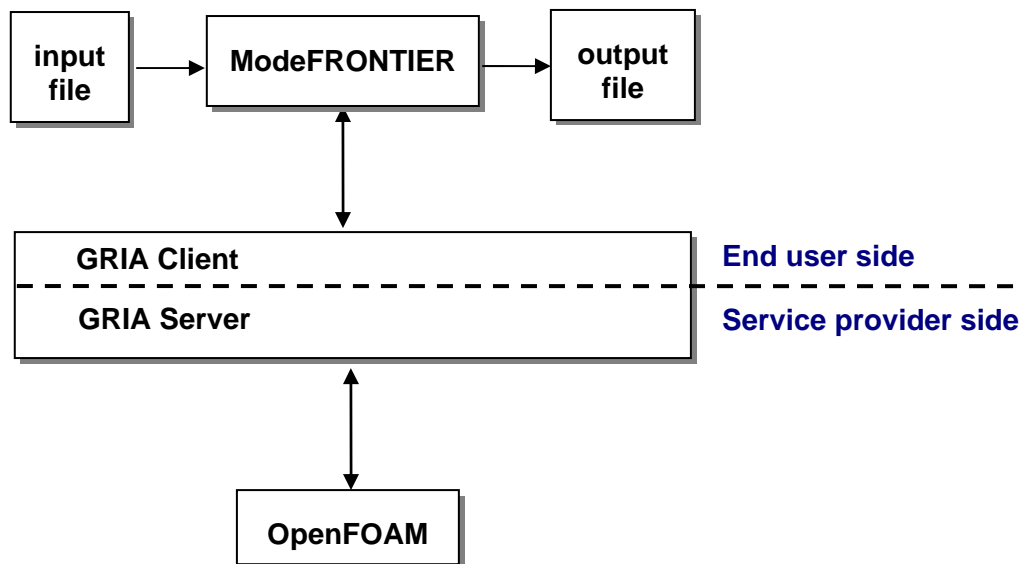


Figure 3: Solving CFD problems using a Grid.

4.2 Using ModeFRONTIER to define the workflow

We will run the demo with the help of ModeFRONTIER, a multi-objective optimization and design environment software. In this scenario we will use it to define a workflow that specifies how the job is submitted, processed and the result is displayed. Figure 4 shows the workflow and the purpose of each node.

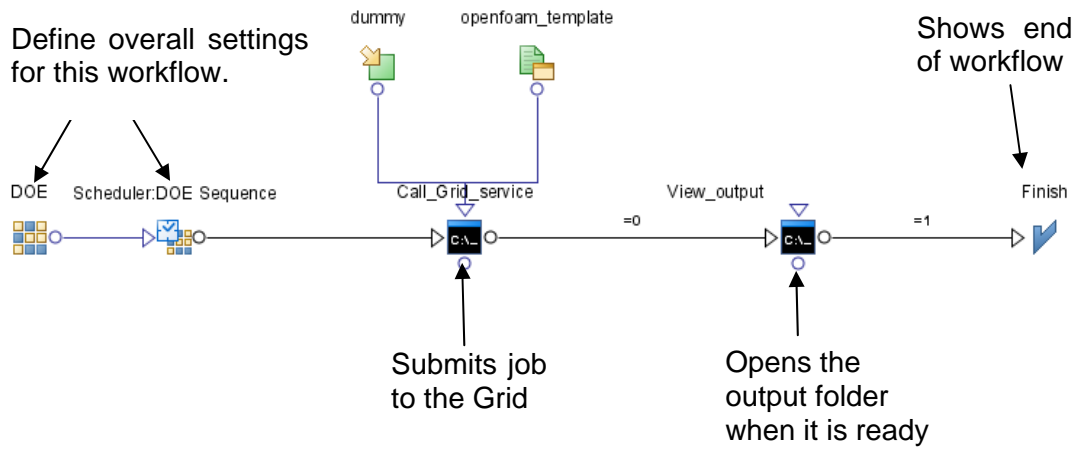


Figure 4: ModeFRONTIER workflow defining how the job is submitted, processed, and displayed.

5. Running the Demo on Windows

The following sections walk through the process of installing and running the technical demo on a MS Windows machine.

5.1 Obtain software

If you have not already done so, go to <http://www.beingrid.eu/demos.html>, navigate to the GridCAE demo and download the files under the 'Live Demo' tab. Windows users should download the file GridCAEPresentation-LiveWindowsDemo.zip.

You will also need to obtain an evaluation copy of the modeFRONTIER software from ESTECO. To do this, please e-mail federico.urban@esteco.com and c.ancona@enginsoft.it and CC be-demos-team@epcc.ed.ac.uk, with the following information:

- Your name
- The organization you work for
- The event that the demo will be shown at
- The location of the event
- The date(s) of the event
- The requested start date of the licence (to allow for testing prior to the event)
- The MAC address of the computer you will install modeFRONTIER on. You can find this by typing "ipconfig /all" in a DOS prompt and copying the information under "Physical Address". You can see an example of this in Figure 5.
- The hostname of the computer you will install modeFRONTIER on. You can find this by typing "hostname" into a DOS prompt.

A template e-mail can be found in the "email_template.txt" in the download bundle.

ESTECO will reply with a URL from which you can download the software. Please let the demos team at be-demos-team@epcc.ed.ac.uk know if you have any problems obtaining an evaluation copy of modeFRONTIER.

```

C:\WINDOWS\system32\cmd.exe
C:\Documents and Settings\amouat>ipconfig /all

Windows IP Configuration

    Host Name . . . . . : gx620am
    Primary Dns Suffix . . . . . : epcc.ed.ac.uk
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : epcc.ed.ac.uk

Ethernet adapter VMware Network Adapter VMnet8:

    Connection-specific DNS Suffix  . : 
    Description . . . . . : VMware Virtual Ethernet Adapter for VMnet8
    Physical Address. . . . . : 00-50-56-C0-00-08
    Dhcp Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 192.168.59.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 
    DHCP Server . . . . . : 192.168.59.254
    Primary WINS Server . . . . . : 192.168.59.2
    Lease Obtained. . . . . : 27 August 2008 13:45:01
    Lease Expires . . . . . : 27 August 2008 14:15:01

Ethernet adapter VMware Network Adapter VMnet1:

    Connection-specific DNS Suffix  . : 
    Description . . . . . : VMware Virtual Ethernet Adapter for VMnet1
    Physical Address. . . . . : 00-50-56-C0-00-01
    Dhcp Enabled. . . . . : No
    IP Address. . . . . : 192.168.232.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : epcc.ed.ac.uk
    Description . . . . . : Broadcom NetXtreme 57xx Gigabit Controller
    Physical Address. . . . . : 00-13-72-C1-20-67
    Dhcp Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 129.215.63.115
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 129.215.63.254
    DHCP Server . . . . . : 129.215.63.254
    DNS Servers . . . . . : 129.215.63.234
    . . . . . : 129.215.63.235
    Primary WINS Server . . . . . : 129.215.56.7
    Lease Obtained. . . . . : 27 August 2008 13:27:41
    Lease Expires . . . . . : 27 August 2008 14:27:41

C:\Documents and Settings\amouat>

```

Figure 5: IPConfig screenshot with MAC Address highlighted

5.2 Setup

5.2.1 Extract

1. Create a folder called BEinGRID_GridCAE_Demo anywhere on your file system.
2. Move the file GridCAE_Live_Demo_Win.zip to the folder that you created above.
3. Unzip the file GridCAE_Live_Demo_Win.zip in the same directory. You normally find an option to unzip when you right click on the file.
4. Unzip the evaluation copy of modeFRONTIER to the same directory.

5.2.2 Install

1. Open the folder BEinGRID_GridCAE_Demo\ModeFRONTIER\setupfiles and run

install.exe.

2. Follow the instructions on the screen. In the “Choose Components” window, you can deselect “Project” and “Documentation” because these are not required for the demo. Install the application in:

BEinGRID_GridCAE_Demo\ModeFRONTIER\installation

You can select the default options for the other steps.

5.2.3 Check your installation

Click on Start/Programs/ESTECO/modeFRONTIER 4.0/modeFRONTIER. If everything has gone well ModeFRONTIER should start and you will see an empty project window. If a modeFRONTIER Licence Manager window opens, please consult the modeFRONTIER documentation for information on configuring your licence.


If you continue to have difficulties please contact be-demos-team@epcc.ed.ac.uk for support. Please send your query with the subject ‘GridCAE user query’.

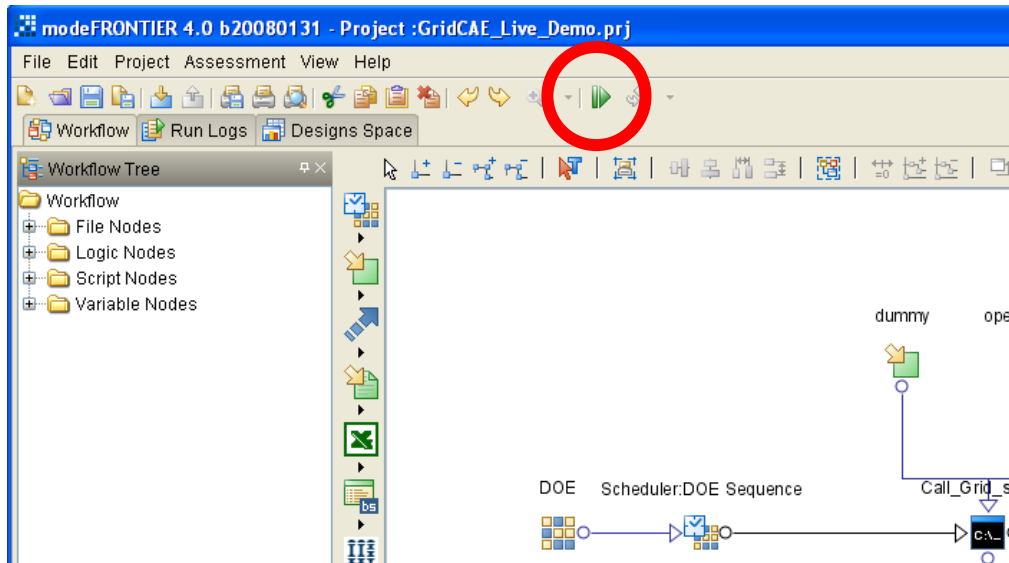
5.3 Running the demo

1. Start modeFRONTIER by clicking on Start/Programs/ESTECO/modeFRONTIER 4.0/modeFRONTIER.


NOTE: When you start modeFRONTIER for the first time, you could be presented with a dialog box with options. If this happens, choose to disable this box.


2. Click on File/Open Project and browse to the BEinGRID_GridCAE_Demo directory. Select BEinGRID_GridCAE_Demo.prj and click on “Open Project”.

3. Click on the project Run/Stop button  to run the project (please refer to the picture below to see the location of this button). In the Run Project window, browse to BEinGRID_GridCAE_Demo folder, select BEinGRID_GridCAE_Demo.prj again and click on “Run Project”.



4. Choose “Overwrite”.

5. The job will now be sent to the grid for processing. As the job is being processed, you will see two processes listed in the process log at the bottom of the ModeFRONTIER window and the Run/Stop button will have a stop sign . It takes a little more than two minutes for the processing to complete. This process is explained in detail in Section 4.

6. When the output is ready, the Run/Stop button will change back to a run sign  and there will be no processes listed in the process log. A folder which contains the output data will be automatically opened. Unzip the file output.zip. This will give you a file named damBreak.gif. Double click on this file to see the simulation produced. If you were not able to see the animation, try opening the file with Windows Picture and Fax Viewer or your browser (Internet Explorer, Firefox, etc).

NOTE: You can find an example output in the folder “data\example_output”.

5.4 Uninstall

1. Close ModeFRONTIER if it is open.
2. Click on Start > Programs > ESTECO > modeFRONTIER 4.0 > modeFRONTIER > Uninstall. Follow the instructions on the screen.

3. Delete the BEinGRID_GridCAE_Demo directory.

6. Running the Demo on Linux

The following sections walk through the process of installing and running the technical demo on a Linux machine.

6.1 Obtain software

If you have not already done so, go to <http://www.beingrid.eu/demos.html>, navigate to the GridCAE demo and download the files under the 'Live Demo' tab. Linux users should download the file GridCAEPresentation-LiveLinuxDemo.zip.

You will also need to obtain an evaluation copy of the modeFRONTIER software from ESTECO. To do this, please e-mail federico.urban@esteco.com and c.ancona@enginsoft.it and CC be-demos-team@epcc.ed.ac.uk, with the following information:

- Your name
- The organization you work for
- The event that the demo will be shown at
- The location of the event
- The date(s) of the event
- The requested start date of the licence (to allow for testing prior to the event)
- The MAC address of the computer you will install modeFRONTIER on. You should be able to find this in the output of the "ifconfig" command under "HWaddr".
- The hostname of the computer you will install modeFRONTIER on

A template e-mail can be found in the "email_template.txt" in the download bundle.

ESTECO will reply with a URL from which you can download the software. Please let the demos team at be-demos-team@epcc.ed.ac.uk know if you have any problems obtaining an evaluation copy of modeFRONTIER.

6.2 Setup

6.2.1 Extract

1. Create a folder called BEinGRID_GridCAE_Demo anywhere on your file system.
2. Move the file GridCAE_Live_Demo_Linux.zip to the folder that you created above.
3. Unzip the file GridCAE_Live_Demo_Linux.zip in the same directory. You can use the following command:

```
unzip GridCAE_Live_Demo_Linux.zip
```

4. Unzip the modeFRONTIER software to the same directory

6.2.2 Install

1 Switch to the BEinGRID_GridCAE_Demo/ModeFRONTIER/setupfiles folder and issue the following command to make the modeFRONTIER installer executable:

```
chmod u+x install.sh
```

2. Run “install.sh”.

3. Follow the instructions on the screen. We suggest that you choose to use the Graphical setup. In the “Choose Components” window, you can deselect “Project” and “Documentation” because these are not required for the demo. For the installation path, specify the path to the folder:

```
BEinGRID_GridCAE_Demo/ModeFRONTIER/installation
```

You can select the default options for the other steps.

6.2.3 Check your installation

Click on Start/Programs/ESTECO/modeFRONTIER 4.0/modeFRONTIER. If everything has gone well ModeFRONTIER should start and you will see an empty project window. If a modeFRONTIER Licence Manager window opens, please consult the modeFRONTIER documentation for information on configuring your licence.


If you continue to have difficulties please contact be-demos-team@epcc.ed.ac.uk for support. Please send your query with the subject ‘GridCAE user query’.

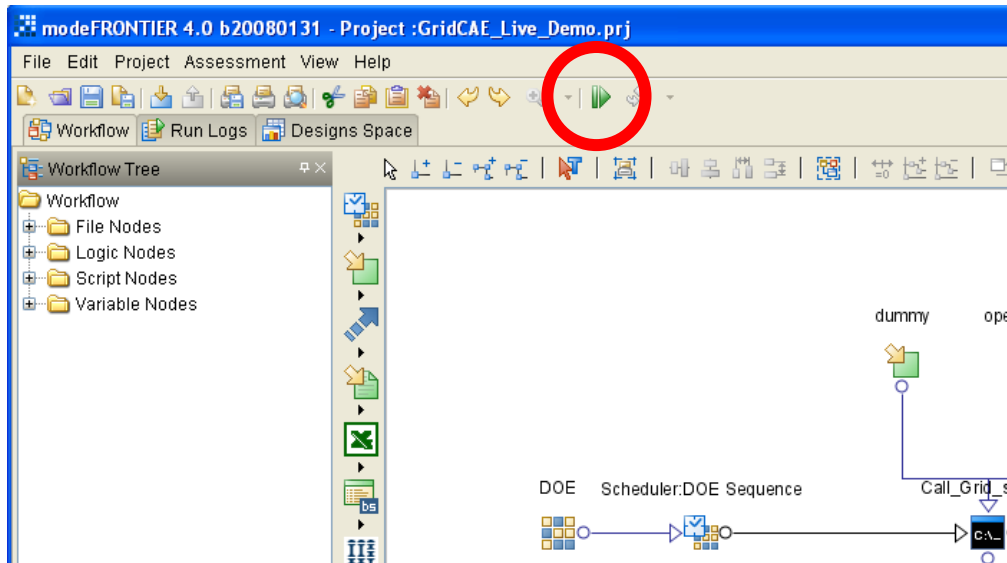
6.3 Running the demo

1. Start modeFRONTIER by running “frontier” from the bin directory of modeFRONTIER installation.


NOTE: When you start modeFRONTIER for the first time, you could be presented with a dialog box with options. If this happens, choose to disable this box.


2. Click on File/Open Project and browse to BEinGRID_GridCAE_Demo directory. Select BEinGRID_GridCAE_Demo.prj and click on “Open Project”.

3. Click on the project Run/Stop button  to run the project (please refer to the picture below to see the location of this button). In the Run Project window, browse to BEinGRID_GridCAE_Demo folder, select BEinGRID_GridCAE_Demo.prj again and click on “Run Project”.



4. Choose “Overwrite”.

5. The job will now be sent to the grid for processing. As the job is being processed, you will see two processes listed in the process log at the bottom of the ModeFRONTIER window and the Run/Stop button will have a stop sign . It takes a little more than two minutes for the processing to complete. This process is explained in detail in Section 4.

6. When the output is ready, the Run/Stop button will change back to a run sign  and there will be no processes listed in the process log. When you see this, go to the BEinGRID_GridCAE_Demo/data folder and unzip the file output.zip. This will give you a file named damBreak.gif. Open this file to see the simulation.

5. The job will take a little more than two minutes to finish. When the job is completed, there will be no processes listed in the process log. You can then go to BEinGRID_GridCAE_Demo/data folder and unzip the file output.zip. This will give you a file by the name damBreak.gif. Open this file to see the simulation (we recommend using your browser).

NOTE: You can find an example output in the folder “data/example_output”.

6.4 Uninstall

1. Close ModeFRONTIER if it is open.

2. Switch to the bin directory of modeFRONTIER and issue the following command to

make the uninstaller executable:

```
chmod u+x uninstall.sh
```

3 Run uninstall.sh file:

```
./uninstall.sh
```

4. Remove the BEinGRID_GridCAE_Demo directory.

7. Presentation

The following section gives instructions to set the PDF presentation in a continuous loop when leaving it on display.

Select 'Edit' then 'Preferences' from the menu, see Figure 6.

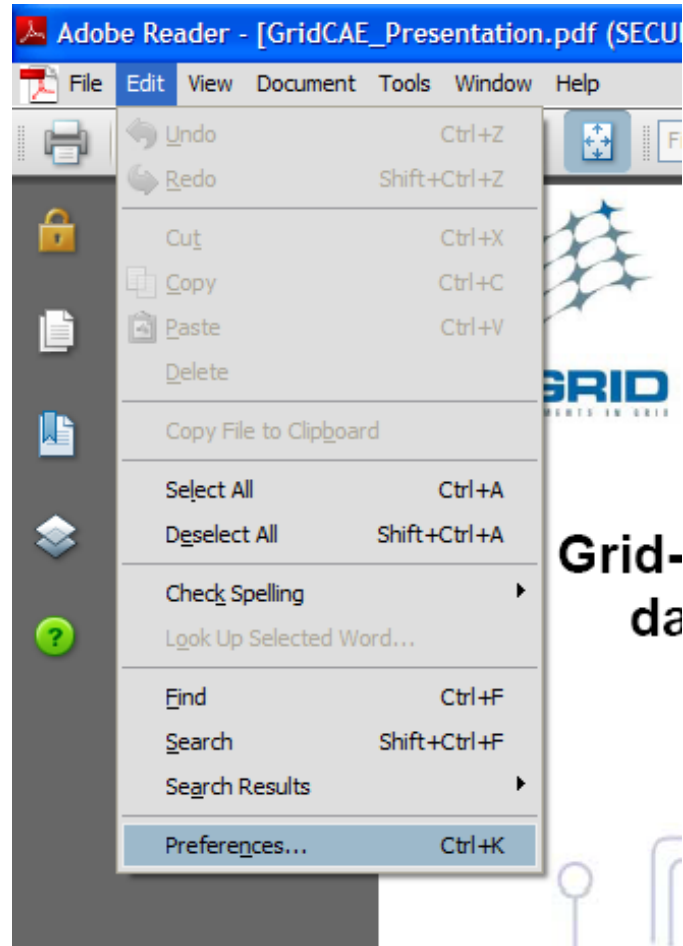


Figure 6: Select 'Edit' then 'Preferences'.

On the preferences panel select the options shown in Figure 7, namely 'Loop after last page' and 'Advance every', 5 seconds is a suitable time.

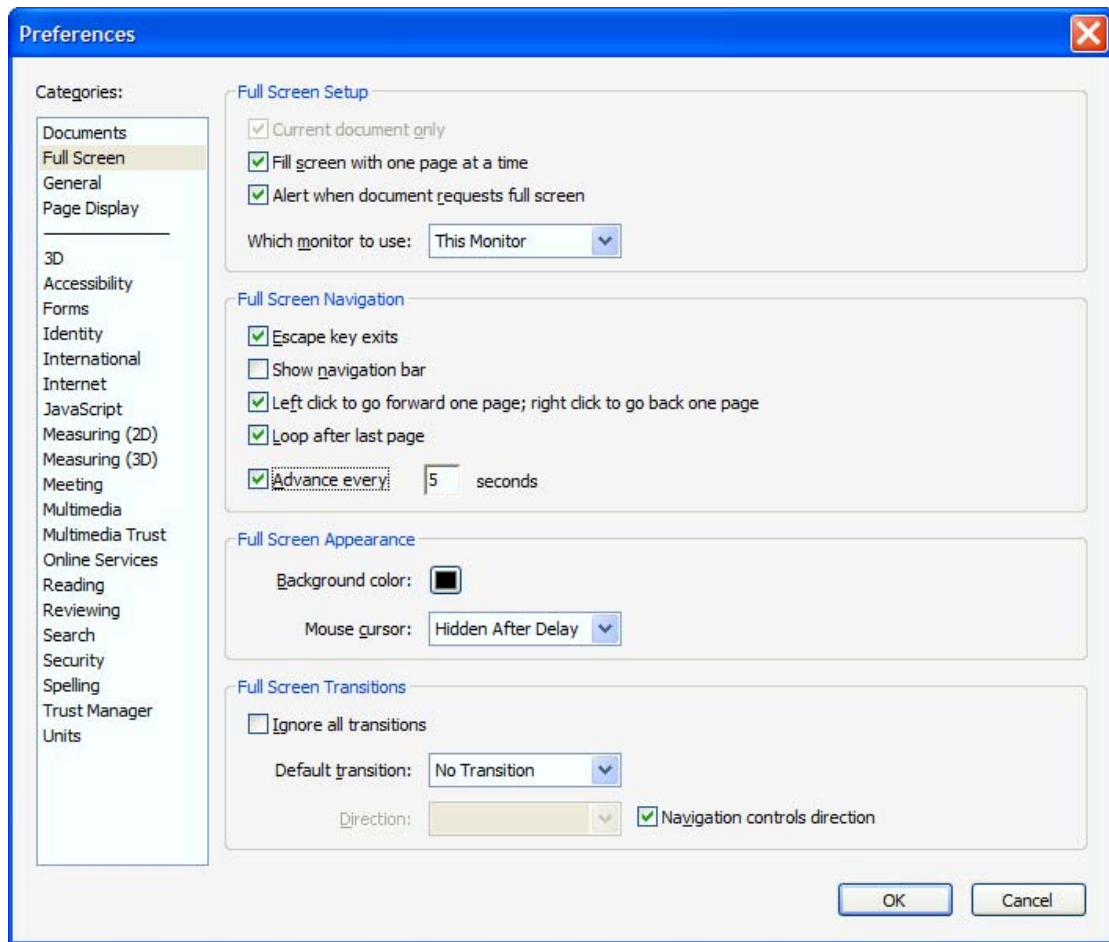


Figure 7: PDF preferences panel set for looping.

Once set up the PDF can be put into full screen continuous loop by selecting 'View' then 'Full Screen Mode', see Figure 8, or pressing Ctrl-L

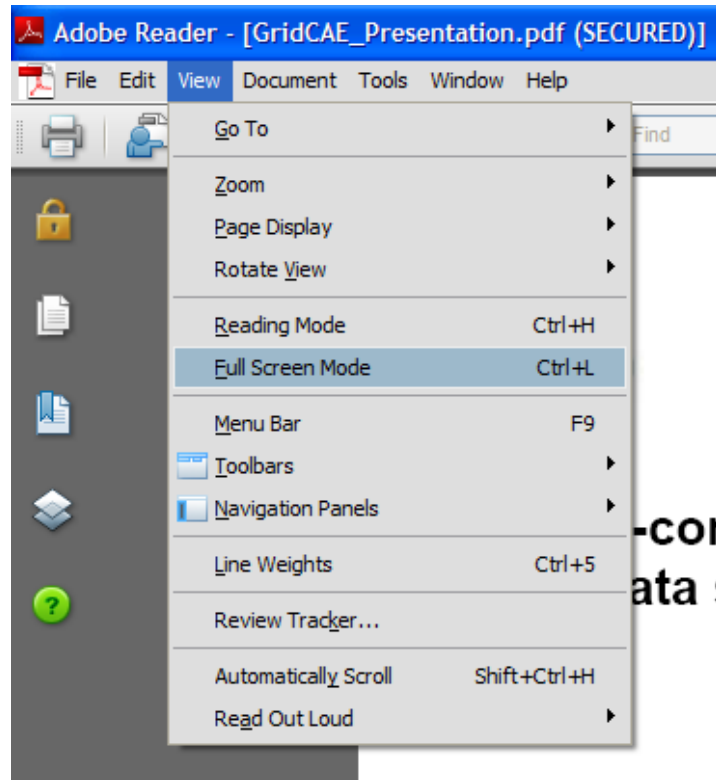


Figure 8: PDF Full screen mode.

The loop can be exited by pressing the 'Esc' key.

8. Glossary

BEinGRID: Business Experiments in Grid www.beingrid.eu. BEinGRID undertakes a series of targeted business pilots designed to implement and deploy Grid solutions in a broad spectrum of European business sectors.

CFD: Computational Fluid Dynamics

GRIA: Grid Resources for Industrial Applications. GRIA is a service-oriented infrastructure designed to support business to business collaborations through service provision across organisational boundaries.

Grid: In the context of this demo, it means a collection of processors working together to process a heavy job.

GridCAE: Grid Computer Aided Engineering. The term is used to refer to the business experiment which uses Grid technology for Computer Aided Engineering. In the BEinGRID website www.beingrid.eu, you might see this business experiment being referred to as BE01.

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