

Banco de Portugal's Microdata Research Laboratory

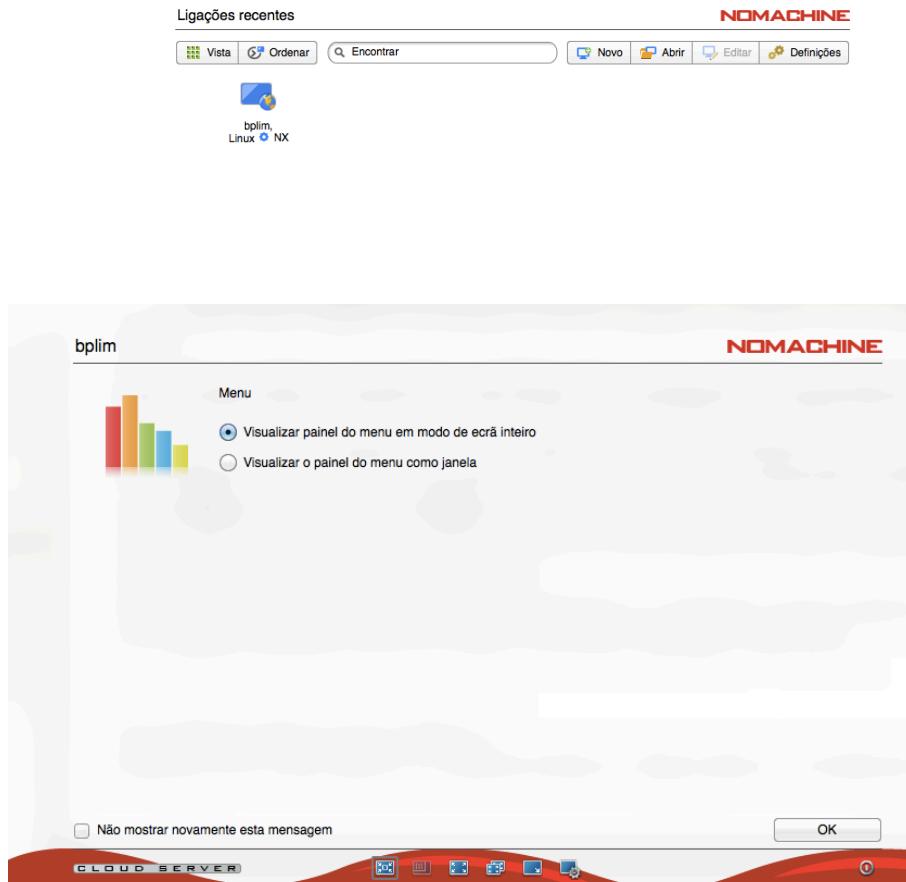
External Server Manual

May 27, 2020

Access to the External Server

1. Upon access approval, the User will be able to connect to the external server using one of two possibilities.
 - NoMachine client access (*preferred*): see **Appendix 4** for details on installation and use
 - Browser access (*low performance*): see **Appendix 5** for further details
2. Password policy:
 - The first password delivered must be changed at the first login.
 - After 60 days the password will expire: change the password within this time frame (see Appendix 3 for instructions on how to change the password)
 - The passwords to be specified must meet the requirements described in Appendix 3.
3. Upon access using 'NoMachine'

These are the first three screens you will see





4. Select the “**Kickoff Application Launcher**” menu (in the lower left corner):



5. Then you should:

- Click on the “**Applications**” button
- Select “**BPLIM**” and click on your project (i.e., “pxxx_name”). At this stage, you should see a graphical environment (‘Dolphin’ application¹) like this:

¹Dolphin is an intuitive and easy-to-use file manager. You can use it, for example, to browse the directory, to create or to delete files/directories (by using the right mouse button). For more information about Dolphin, please visit: <https://userbase.kde.org/Dolphin>.



You can see the prompt command line together with ‘Dolphin’ using the keyboard shortcut ‘F4’.

The directories that you have access to within the folder include:

initial_dataset	Data sources provided by BPLIM. <i>You have read-only access to this directory.</i>
results	Output files that researchers wish to generate and extract from the server. <i>You have read-write access to this directory.</i>
tools	Specific analysis tools. <i>You have read-only access to this directory.</i>
work_area	Temporary work directory. <i>You have read-write access to this directory.</i>
/bplimext/doc/Manuals	Manuals and auxiliary files are available here.

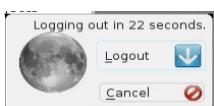
- You will have in your **work_area** folder templates for both Stata and R. By default the template file is read only.
- By default you also have two files (see image above): (1) stata15mp.sh; (2) xstata15mp.sh. Files with the “sh” extension allow you to send commands to your operating system or to enter your operating system for interactive use. The first one starts Stata version 15 in non-graphical mode, while the second launches Stata 15 in graphical mode. You can start both applications by typing in the Linux shell, for example, ‘xstata15mp.sh’, or by double clicking the file name in ‘Dolphin’.²
- To reset and disconnect the remote desktop connection or session, you can simply log out your remote session, as shown on the screenshot below. After you log out, close the window.³

²In case ‘xstata15mp.sh’ does not launch Stata please see ‘Section 5.1.b’.

³Click on the cross button at the upper right corner to close.



Confirm before exiting by clicking on the "Logout" button to close the window⁴



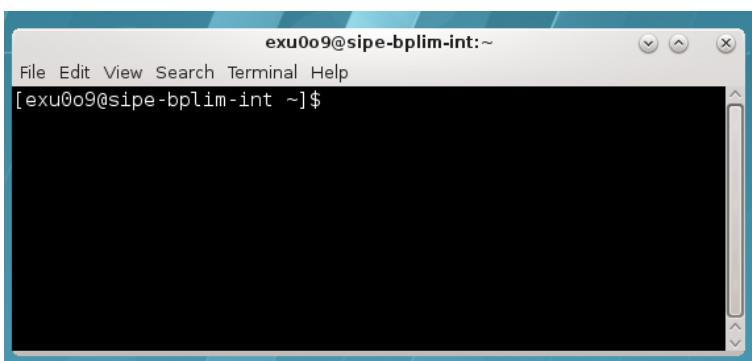
- In case you do not logout, your session will be left open until your next login. You may use this facility to run your programs. However, one must be aware that this option uses resources from the server, so the efficient solution to run your programs “over night” is using the batch mode as described in Step 6 below. Furthermore, in case the server is rebooted during a maintenance procedure your session will be automatically close and unsaved documents will be lost. We recommend you save at regular intervals your statistical programs.

Using the ‘shell’ in a Linux Operating System

If you wish to run your programs in ***batch*** mode, then you must use the ‘shell’ of Linux. You can also use the ‘shell’ to organize the files in your working space.

1. The ‘shell’⁵ in Linux can be accessed from

RedHat > Applications > System > Terminal



⁴Note that before exiting the server, you need to make sure that all active programs have been closed (unless they have been launched in ***batch*** mode). Running programs in ***batch*** mode is justified for procedures that require high computational resources, intense calculation and / or long processing time.

⁵The ‘shell’ supports the commands in Linux operating system (some are disabled).

2. See the Appendix for a list of some of the most used commands.
3. In case you are using a non-English keyboard, the ‘true’ keyboard might be different from the one you see. The changes apply mostly to the symbols, not letters or numbers. For example, in case you have a Portuguese keyboard on your computer the ‘+’ is now in key ‘?’ , or the ‘*’ is in SHIFT + ?. This issue is specific to the Operating System of your computer
4. Remember that Linux is case-sensitive: e.g., “LS” and “ls” are treated as different commands.
5. You can use the arrow keys to scroll up and down through the commands you’ve entered.
6. You can use the “Tab” key to complete the command line automatically.
7. E.g., type the following line to list elements within a folder in a ‘human readable’ format, h, long list format, l, in reverse order, r, sort by modification time, t, and almost all files, A,

```
ls -lArth
```

Using Stata

1. Stata can be accessed in interactive graphical or non-graphical modes.⁶

- Interactive non-graphical mode

Move to the desired folder, e.g.,

```
cd /bplimext/projects/I001_jdoe/
```

and type

```
/opt/bplimext/stata15/stata-mp
```

```
exu009 : stata-mp - Konsole
File Edit View Bookmarks Settings Help
. sysuse auto
(1978 Automobile Data)
r; t=0.00 17:36:05

. sum
      Variable |       Obs        Mean    Std. Dev.     Min     Max
make |           0
price |       74    6165.257   2949.496    3291    15906
mpg |       74    21.2973   5.785503     12      41
rep78 |       69    3.405797   .9899323      1      5
headroom |       74    2.993243   .8459948     1.5      5
trunk |       74   13.75676   4.277404      5      23
weight |       74   3019.459   777.1936   1760    4840
length |       74   187.9324   22.26634    142    233
turn |       74   59.64865   4.399354     31      51
displacement |       74   197.2973   91.83722     79     425
gear_ratio |       74    3.014865   .4562871    2.19     3.89
foreign |       74    .2972973   .4601885      0      1
r; t=0.00 17:36:08
. exit
```

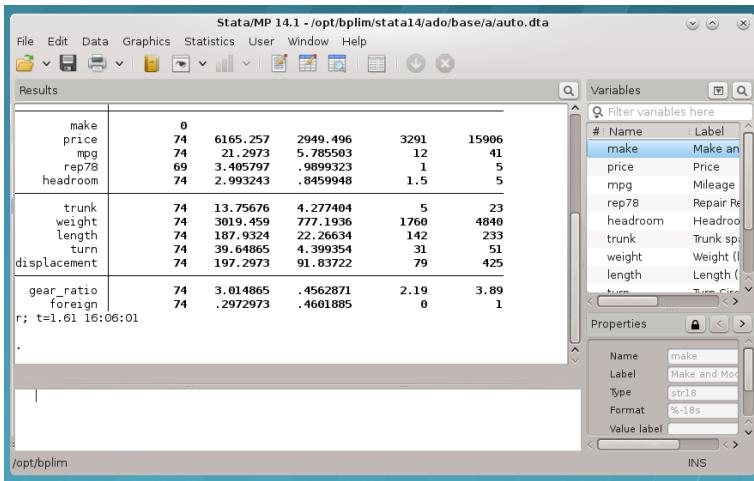
- You may add a ‘path’ to your system folder by typing, for the example on Stata 15, the following command in the shell

```
PATH = $PATH:/opt/bplimext/stata15
```

- For the interactive graphical mode click on the icons “**xstata14mp.sh**” (Stata 14) or “**xstata15mp.sh**” (Stata 15) located in the ‘desktop’, depending on the desired Stata version,



⁶The version of Stata on the server has the same features as the Stata on Windows or Mac. By default when the Stata starts in this way the “working directory” active becomes your folder “work_area”.



- You can use the ‘Do-file Editor’ in Stata to create your own “do-files” and “ado-files”, or alternatively you can use *KWrite* editor (or ‘gedit’)
- You can open it from **RedHat > Applications Applications > Utilities > KWrite**. You can also launch ‘KWrite’ from the ‘shell’ by typing ‘kwrite’
- In case the icon is not in your desktop, use Dolphin, move to folder ‘/opt/bplimext/stata15’, and drag and drop the file ‘xstata-mp’ into the desktop

2. To look for “ado-files”:

“Ado-files” are text files containing the Stata program. It is advisable that one create and save his/her “ado-files” so the results can be replicated later by running the saved “ado-files” on the BPLIM’s datasets.

Stata looks for “ado-files” in several places. When it comes to personal ado-directories, they can be categorized in four ways:

- (SITE), the directory for “ado-files” your site might have installed;
- (PLUS), the directory for “ado-files” you personally might have installed;
- (PERSONAL), the directory for “ado-files” you might have written;
- (OLDPLACE), the directory where Stata users used to save their personally written ado-files.

The ado-files you have just written or those created for this project can be found in the current directory (..).

Specific ‘ado-files’ you may ask to be made available in the server will be placed in your folder ‘/bplimext/projects/YOURPROJECTID/tools’. You should add this folder to your Stata ‘ado-files’ folder by executing the following command within Stata,

```
sysdir set PERSONAL "/bplimext/projects/YOURPROJECTID/tools"
```

You may also edit your ‘profile.do’ file, located in your root folder, “/home/YOURPROJECTID/”, and add key instructions you may want to be executed every time you start Stata. The above instruction is one of such cases. You can create, or edit, the file ‘profile.do’ using ‘Do-file Editor’ within Stata (‘vi profile.do’ or KWrite are also a possibility).

The **sysdir** command within Stata will tell you where they are on your computer:

```

24 19:44 RESULTS          stata/MP 15.0
24 File Edit Data Graphics Statistics User Window Help
24
25 Results
25 r; t=0.00 11:35:59
26
26 . sysdir
26  STATA: /opt/bplimext/stata15/
26  BASE: /opt/bplimext/stata15/ado/base/
26  SITE: /opt/bplimext/ado/
26  PLUS: ~/ado/plus/
26  PERSONAL: /bplimext/projects/TesteExterno/tools/
26  OLDPLACE: ~/ado/
26 r; t=0.00 11:36:03
26

```

The screenshot shows the Stata/MP 15.0 interface with the title bar "stata/MP 15.0". The menu bar includes "File", "Edit", "Data", "Graphics", "Statistics", "User", "Window", and "Help". Below the menu is a toolbar with icons for file operations. The main window is titled "Results" and contains the output of the "sysdir" command. The command was run at 19:44 and completed at 11:36:03. The output shows the current directory structure starting from "/opt/bplimext/stata15/".

Stata in ‘batch’ mode

1. Start a '*shell*' in Linux and navigate to the directory of the “do-file” file that you want to run (ex: prog1.do)

```
cd /bplim/projects/I001_jdoe/work_area/ cd /bplimext/projects/I001_jdoe/work_area/
```

2. You might find it easier to use ‘Dolphin’ (= File Manager) to move over your folder structure. In this case, we recommend activating the ‘shell’ (= ‘Terminal’) associated with ‘Dolphin’

- use Dolphin/File Manager
 - click ‘F4’ to activate the shell with Dolphin. Benefit: fast transition within folders and, at the same time, the ability to run shell commands
3. Create an ASCII file named, e.g., ‘batch_prog1’

4. Inside the file write just a line with the execution command you would type in the ‘shell’; e.g.,

```
/opt/bplimext/stata15/stata-mp do /bplimext/projects/BPlim_inicial/work_area/prog1.do
```

5. You can use, for example, the command line app ‘vi’ to create the batch file

```

exu009@sipe-bplim-int:/bplim/projects/BPlim_inicial/work_area
File Edit View Search Terminal Help
/opt/bplim/stata14/stata-mp do /bplim/projects/BPlim_inicial/work_area/prog1.do ^

"batch_prog1" 1L, 80C written
1,1 All

```

The screenshot shows a terminal window with the command "vi" running. The file "batch_prog1" has been created with 1 line and 80 characters written. The terminal prompt is "exu009@sipe-bplim-int:/bplim/projects/BPlim_inicial/work_area".

6. The batch file can also be created using apps like ‘kwrite’ or Stata ‘do file editor’

The screenshot shows the KWrite text editor window titled "batch_prog1 - KWrite". The menu bar includes "File", "Edit", "View", "Bookmarks", "Tools", "Settings", and "Help". The toolbar includes icons for "New", "Open", "Save", "Save As", "Close", "Undo", and "Redo". The main text area contains the command " /opt/bplim/stata14/stata-mp do /bplim/projects/BPlim_inicial/work_area/prog1.do". The status bar at the bottom shows "Line: 1 Col: 1" and "INS LINE batch_prog1".

OR



7. You may add the extension ‘.txt’ to the name of the batch file, as sometimes Stata *doeditor* does not ‘see’ the file ‘batch’, while it ‘sees’ ‘batch.txt’

8. Once the batch file is created one runs the .do file in batch mode by typing in the ‘Terminal’:

at now -f batch.txt

9. Type ‘man at’ to see further option of the command ‘at’; e.g., one could type

at now + 5 hours -f batch.txt

or

at now + 4 minutes --f batch_prog1

to run the Stata program within 5 hours or 4 minutes from now, respectively. ‘man’ is the help function in Linux

10. Type ‘top’ in the shell/Terminal to confirm the program is running

11. Under ‘top’ type ‘i’ to hide irrelevant processes (show less output)

12. To kill a running process with ‘top’ press ‘k’, for ‘kill’, write > the process number and then type ‘9’. The process number is > identified in the first column as PID

13. To get out of the top, type ‘q’

14. Useful features of the command ‘at’:

- ‘atq’: use it to see programs in the batch queue (an ‘=’ sign indicates the program is running; an ‘a’ indicates it is in the queue and we see the time when it will be executed)
- ‘atrm #’: remove a batch from the batch queue
- one can see how the batch is running by typing

‘tail -f logcrc_may21.log’

It allows you to see an updated version of the last lines of the log; *i.e.*, it updates each time the log is changed by Stata. A key advantage of tail is that it does not interfere with the log file, namely it does not write over it.

15. Another way to run a program in the background is by using the command ‘screen’

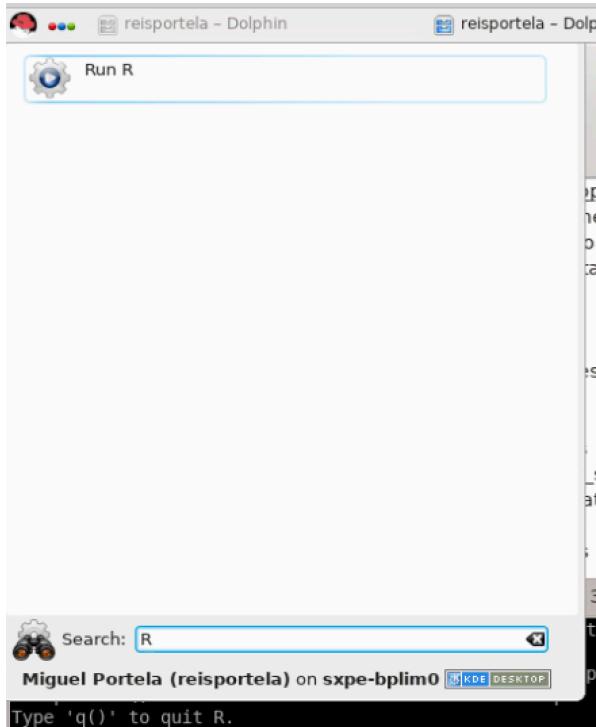
- ‘screen’ is useful when one wants to run Stata in interactive mode and still guarantee that if the network connection goes down one does not lose the session. We can simply kill the ‘NoMachine’ session and recover it later by typing ‘screen -r’
- We can run several instances of screen. If this is the case, after opening a new NoMachine session we need to type in the Terminal shell ‘screen -d’ to identify the running background sessions. We can retrieve a particular session by knowing the ‘pid’ number and typing ‘screen -r 34176’

Additional Statistical Software

You can also use ‘R’ and ‘python’ by issuing in the shell the respective designation. Both applications can only be used in the ‘shell’. You can check the packages available in R by typing ‘installed.packages()’.

Using R

1. As with Stata, R can be accessed in interactive graphical or non-graphical modes.
 - Interactive non-graphical mode: go to the Red Hat symbol and type ‘R’ in the Search box



- Alternatively, you can open a Terminal and type R
 - Please make sure R is in your PATH; type \$PATH in the Terminal. If this is not the case, type PATH=\$PATH:/usr/bin/
2. Using RStudio.
 - Open a Terminal and type rstudio
 - Please make sure RStudio is in your PATH; type \$PATH in the Terminal. If this is not the case, type PATH=\$PATH:/opt/bplimext/R/usr/lib64/rstudio/bib/

Using julia

1. Open a Terminal and type julia (julia is located in /opt/bplimext/julia/bib/, you can add it to your PATH)
2. Use Atom: open a Terminal and type atom (/opt/bplimext/julia/bib/)

Using Python

1. Open a Terminal and type python3 (/usr/bin/)

Allowed outputs

Stata results can be exported to a file on disk using one of the following formats:

1. ASCII files: e.g., log files
2. graphs: as .PNG (do not use the option save, or saving, within a graph command; instead, use the separate command line ‘graph export xyz.png’)
3. csv: CSV (Comma Separated Value format), e.g., for use with MS Excel
4. rtf: Rich Text Format for use with word processors
5. xls or xlsx: Excel files with output tables
6. tex: Latex format

Remove outputs

Place in the “results” folder all the outputs you want to remove from the server.⁷

1. Send an email with the title “**project I001_jdoe**: request for result extraction” to “**bplim@bportugal.pt**”.
2. Upon validation, the results will be sent to you via email.

Scientific support

Researchers will be provided with the necessary scientific and computational support (*i.e.*, advises on programming, computational resources, micro econometrics, and econometrics of panel data for research undertaken with the selected Microdata).

Appendix 1 – Basic ‘shell’ Commands on Linux

- **top** List the procedures that are being executed on the server
 - press ‘i’ option to omit background processes;
 - click press ‘h’ para **help on top options**; ‘h’ > option to obtain the **top command help**.
- **pwd** Show current working directory
- **cd** Change directory
cd /bplimext/projects/I001_jdoe/work_area/
‘cd ~’ moves to your home folder
- **cp** Copy file(s) to a given path
cp prog1.do /bplimext/projects/I001_jdoe/results
- **mv** Move file(s) or rename a file from a given path
mv prog1.do /bplimext/projects/I001_jdoe/results
- **rm** Delete a file
rm /bplimext/projects/I001_jdoe/results/prog1.do
- **mkdir** Creates a directory
mkdir programas

⁷You may only remove text files that do not contain data or results that allow identification. For all the graphs you request as an output you must provide the corresponding Table to replicate it. You may only export graphs in .PNG format (no vector graph is allowed).

- **rmdir** Deletes a directory
rmdir programas
- **screen** Switch between screen
screen top
- **man** Show the manual page for the given command
man ls
- **du -h** Check the information of disk usage of files and directories.
The “**-h**” option with “**du**” command provides results in “Human Readable Format”.
Ex: du /bplimext/projects/I001_jdoe/work_area/
 - **df -h** Check disk space utilization and show the disk space > statistics in “human readable” format.
 - **vi** View ‘ASCII’ files; e.g., log files
 - **ghostscript** Preview files with the extensions of **.eps** and **.pdf**
ghostscript /bplimext/projects/I001_jdoe/results/‘file_name.pdf’
 - **okular** View ‘PDF’
 - **find** Find files
Structure: find /path option filename
find . -name “*.do”
Send the ‘find’ output to a file:
find . -name “*.do” > find_results.txt
Look for a particular string within the ‘find’ output:
find . -name “*.do” | grep “analysis”
Identify files with extension ‘.do’ that **contain** the word ‘graph’:br/>find . -name “*.do” -exec grep “graph export” ‘{}’ \; -print
 - **passwd** Change your password
 - **To exit** a program, type **CTRL + C** (‘CTRL + C’ kills a particular execution in the shell)

Appendix 2 – Using the ‘vi’ file editor

1. In the shell type ‘vi batch1.txt’
2. This are the main shortcut keys
 - a. ‘i’ insert text
 - b. ‘ESC’ key get out of the ‘insert’ mode
 - c. ‘x’ delete specific characters
 - d. ‘dd’ delete a full line
 - e. ‘10 dd’ delete 10 lines
 - f. ‘yy’ copy lines
 - g. ‘p’ paste lines
 - h. ‘SHIFT + G’ go to the last line
 - i. ‘gg’ goes to the first line

- j. ‘ESC + q!’ exit ‘vi’ without writing
 - k. ‘w!’ write and replace the file
 - l. ‘ESC + q’ exit the ‘vi’ session
 - m. Check, for example, <https://www.cs.colostate.edu/helpdocs/vi.html>
3. Much easier solution: call ‘gedit’ file editor
 4. Linux commands I have to add to the manual
 5. ‘CTRL + R’: allows me to recover a previous command
 6. vi .bash_history

Appendix 3 – External server’s password requirements

Rule	Value	Notes
Maximum Password Lifetime	60 days	After 60 days the password will expire and has to be changed in the next login. The password can be changed at any moment using: (1), “All Applications Settings System Settings – Account Details”, click “Change Password”; or, (2), in the ‘Shell’ type ‘passwd’

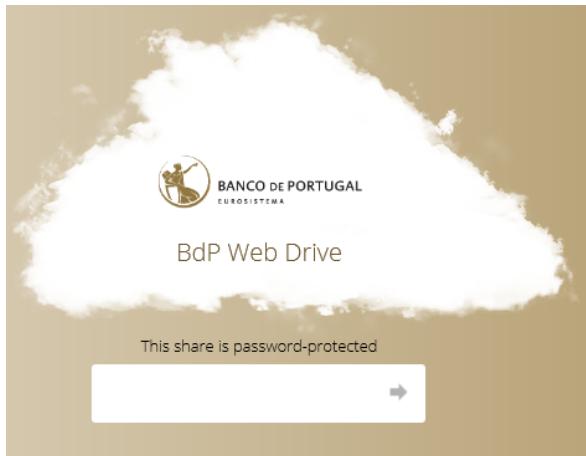
Minimum Number of Character Classes	4	You should include at least 4 classes of characters in the password. For example, small letters, capital letters, numbers and punctuation marks. There are a total of five classes: 1. Capital letters : A-Z 2. Small letters: a-z 3. Numbers: 1-9 4. Punctuation marks: <space> ! % & () * + . , { } [] ~ " # \$ ' - / \ ^ _ ' 5. Characters above 127 (0x7F): marked characters (á, á, ä, à, etc.); symbols (@, £, §, º, ª, «, », etc.) Number of characters: by using the same character 3 or more times may imply the use of an additional class (it is highly recommended that you do not use consecutively the same character more than 2 times)
Minimum Length of Password	8	The minimum size of the password is 8 characters (it may be higher in case you repeat characters)
Password History	7	One cannot use a password defined in the previous set of 7 passwords
Maximum Consecutive Failures	6	If the user fails 6 consecutive times the password the account will be locked for the time defined in “Lockout Time”
Fail Interval	60 sec.	Time interval for attempts to enter a password to be considered consecutive. If more than 60 seconds have elapsed since the last attempt, consecutive attempts are no longer considered, ie the number of failures, according to the requirement “Maximum Consecutive Failures” becomes one.

Lockout Time	600 sec.	Time (10 minutes) during which the account will be locked if the maximum number of failed attempts is reached.
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Appendix 4 – Download, install and configure NoMachine client

Step 1: go to the link below and use the credentials provided by BPLIM to access the site. **Note:** sometimes the internet provider, *e.g.*, an University, may block the access to this particular web site. Please check with your provider in case you get an error while trying to use the link.

<https://www.bportugal.pt/webdrive/index.php/s/irAzxZmir8KHyzD/authenticate>



Step 2: download the file with an extension compatible with your OS (Operation System)

Name	Type
nomachine-enterprise-client_5.1.42_2.exe	File
nomachine-enterprise-client_6.0.62_6.dmg	File

2 files

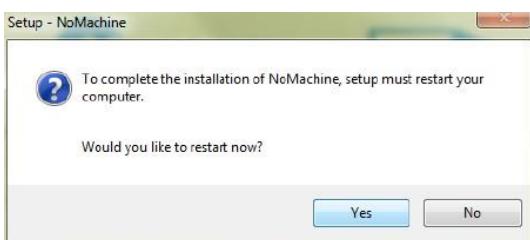
Step 3: install ‘NoMachine’







Step 4: reboot your computer



Step 5: NoMachine client access configuration

Step 5.1: start 'NoMachine' and create a new connection



Step 5.2: Choose 'NX protocol'



Step 5.3: Define the 'Host' as bplimexterno.bportugal.pt, 'Port' 4000

Click 'Use UDP communication for multimedia data'



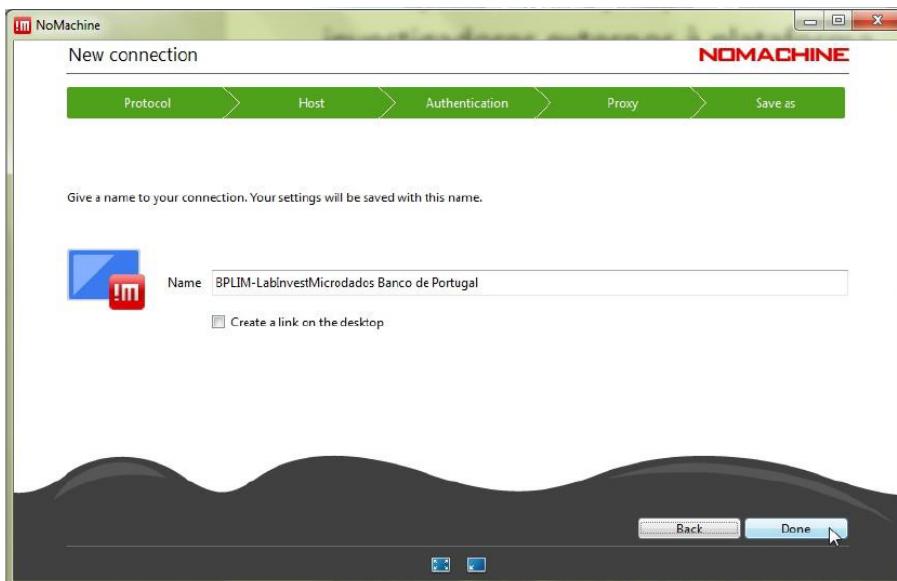
Step 5.4: Use password authentication, with or without proxy, depending on the instructions of the network administrator / user's computer support, with the name “BPLIM-LabInvestMicrodados Banco de Portugal”.



Step 5.5: Do not use a ‘proxy’



Step 5.6: Define a name for the connection



Step 5.7: Once the entry for bplimexterno.bportugal.pt has been created, connect:



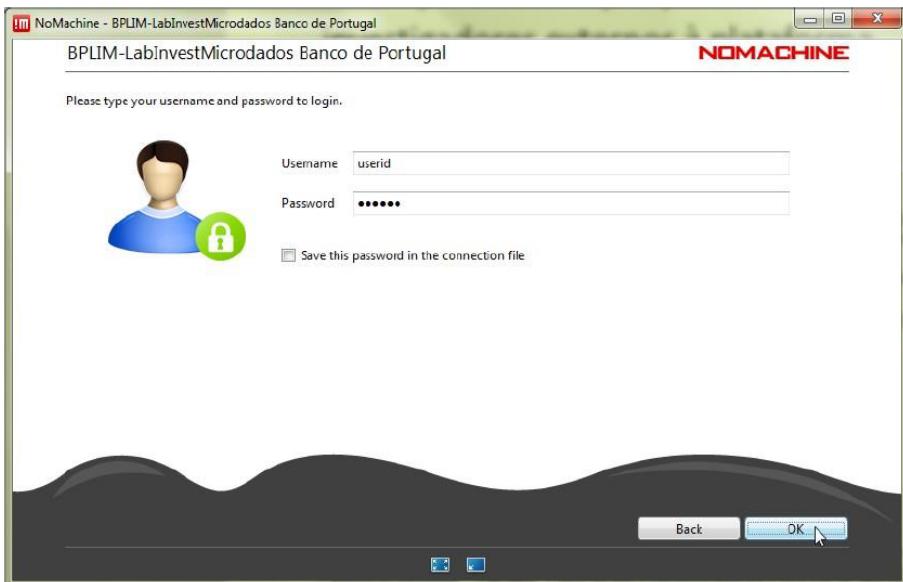
Step 5.8: Before the first effective connection it may be necessary to accept the certificate from bplimexterno.bportugal.pt

The Investigator should verify that the "fingerprint" (verification code) is:

**SHA256 ED 1B D9 E2 C2 F8 C6 08 1A 53 5F 97 DA 71 77 D9 D2 EE 7A 5F
9C 35 87 B3 19 F4 7E A1 CB 2C 68 0B**



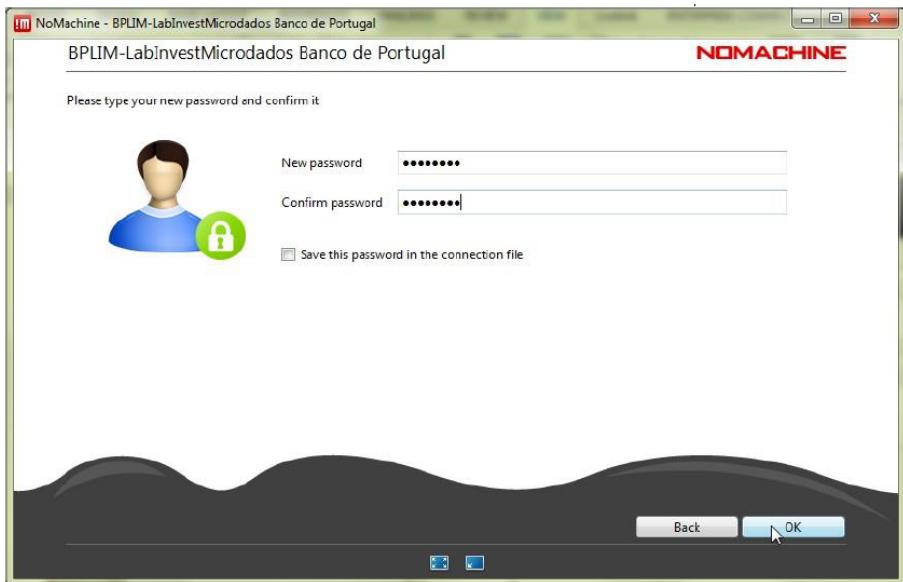
Step 5.9: Connect with the UserID (**case sensitive**) and password provided by Banco de Portugal:



Step 5.10: After the first successful login, it is necessary to change the password, which must comply with the Password Policy defined above.

If the new password does not comply with the Password Policy, the original password provided by the Banco de Portugal will be re-requested. See Appendix 3 for details.

The NoMachine client does not tell you why the new password was not accepted – it is the responsibility of the user to verify that the new password is in compliance.



Step 5.11: Upon login success the following screens should appear



Once logged in and with access to a KDE session, click on the upper right corner of the KDE desktop, as shown below, to access the menu and then expand the screen as exemplified for greater ease of use.

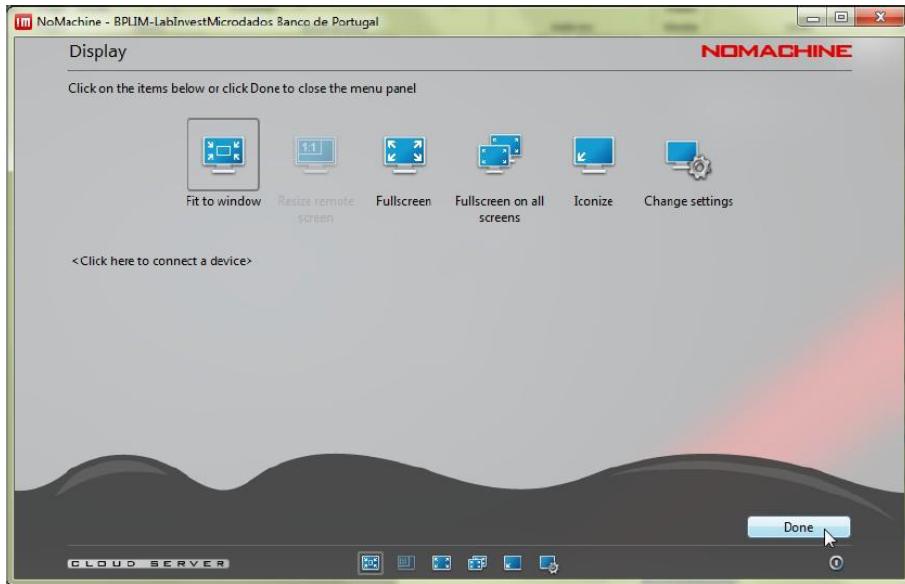
Step 5.12: You should see the following screen.



Step 5.13: Click 'Display'



Step 5.14: Click 'Fit to window' and click 'Done'



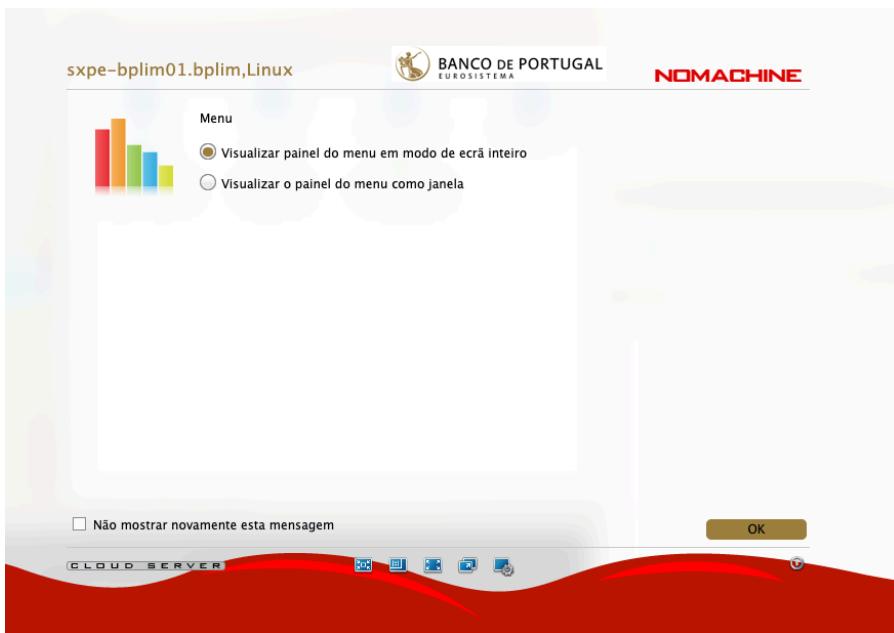
Appendix 5 – Browser access

Use a browser (recommended Chrome, Firefox, Opera or Safari) and go to
<https://bplimexterno.bportugal.pt:4443>

Below are the sequential screens you should see. In steps 4 to 7 you can define your settings.



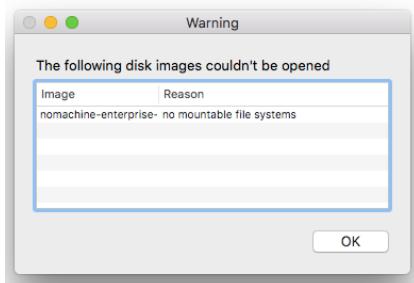






Appendix 6 – Frequently Asked Questions

1. Mac users are not able to install NoMachine, receiving the following message



Please check if your Mac OSX is updated. Temporary solution: download NoMachine Enterprise Client from the official website, and run the installation file:

<https://www.nomachine.com/download-enterprise#NoMachine-Enterprise-Client>

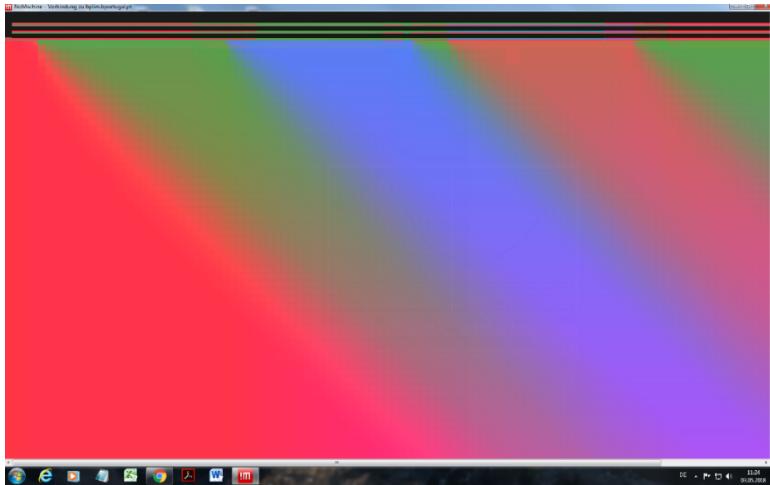
2. NoMachine authentication failure



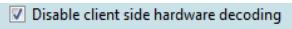
- In some cases it occurs due to a different keyboard layout. For example, if you have a Portuguese keyboard, but the website assumed a US keyboard, and your password contains a symbol like ‘ç’, than you will get a “wrong password” message. Please check the keyboard layout that is active when you type the password. Alternatively, change the password after the first login with NoMachine. Use linux’s command ‘passwd’.
- Login fails and the system shows the message: "Could not connect to the server. Error is 138: Connection is timed out" Please check if your network has a strict firewall; e.g., some researchers

are not able to reach BPLIM's server within their University network. Please check if in a different location, like at home, the connection works.

3. User pressed 'Lock' instead of 'Log out' and the unlock/password does not work:
 - Check if the keyboard settings are correct (e.g., PT or UK)
 - Close the 'NoMachine' connection and start a new one. Before the last step -before the 'Login'- right click and choose 'Logout'. Double-click for the new connection
4. "Cannot see the screen in NoMachine" (see image below)



5. OPTION A: move your mouse on top the upper right corner of NoMachine, you should see a "folded like sheet", left-click your mouse, go to 'Display', 'Change settings', and click in 'Disable client side hardware decoding'



6. OPTION B: Close the 'NoMachine' connection and start a new one. Before the last step -before the 'Login'- right click and choose 'Logout'. Double-click for the new connection
7. "Error: Parameter 'agentm_display' has bad value" (see image below)



- Your home folder is full (/home/USER_LOGIN): ***Do not save files in your home folder***
- Ask BPLIM Staff to empty space in your home folder