



Workshop

# What the Hack is the Mainframe?

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**mlh** localhost

**IBM Z**

1

*Using your Web Browser,  
Open this URL:*

**<http://mlhlocal.host/lhd-resources>**

---

2

*Click on the workshop you're attending, and find:*

- Setup Instructions
- The Code Samples
- A demo project
- A Workshop FAQ
- These Workshop Slides
- More Learning Resources



***Our Mission** is to Empower Hackers.*

**90,000+**  
HACKERS

**12,000+**  
PROJECTS CREATED

**400+**  
CITIES

***We hope you learn something awesome today!***  
*Find more resources: <http://mlh.io/>*

## What will you **learn** today?

- 1 Who is IBM and what is a Mainframe?
- 2 Controlling a powerful machine from a Terminal
- 3 Mainframe file systems and how to navigate them

# Table of Contents

- ▶ **0.** Introduction to IBM & Mainframes
  - 1.** Software setup
  - 2.** Connecting to Mainframes & Terminal
  - 3.** Navigating the Mainframe
  - 4.** z/OS File systems
  - 5.** Review!

# What is a Mainframe?

A Mainframe is a very large and powerful computer, capable of running extremely complex & demanding applications for thousands of users simultaneously.

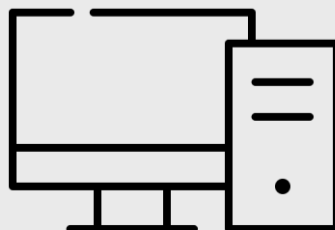


The mainframe offers **99.999%** availability, often referred to as “Five Nines”, while processing **1.2 million transactions per second**

# What is a Mainframe?

A mainframe is a type of computer that is specifically built for high-volume workloads, full-time availability, and full data encryption. They serve businesses around the world 24/7.

In this workshop, you'll connect to a mainframe and hack around with a few simple challenges.



# What is a Mainframe?

The mainframe is meant to be accessed remotely, which is what makes it possible for 1000's of people to access these machines at the same time.

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There are protocols designed specifically for this practise.

*Here are some well known ones.*

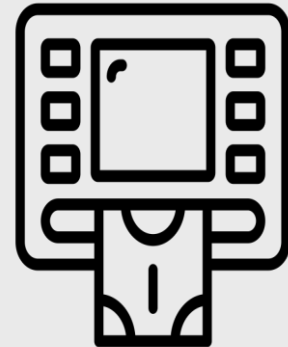
- Web
- Terminals
- APIs



# Who uses Mainframes?

*Everyone!*

If you have ever used a credit card or withdrawn money from an ATM, a Mainframe was behind that transaction.



Companies that run demanding and popular web applications that require simultaneous access to the same data benefit from using Mainframes.

# Who is IBM?

IBM is one of the largest hardware & software companies in the world.

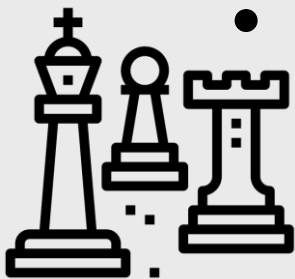


They have been designing, engineering, and building solutions in software, hardware, and technology for over a century.

You might recognize some of their significant contributions

## IBM is responsible for ...

- Mainframe computers
- Deep Blue Chess Ai
- Quantum Computers
- ATM Machines
- Barcodes / Universal Product Codes
- Relational Databases



*And so much more.. seriously!*



# MASTER THE MAINFRAME

BE A PART OF ONE OF THE WORLD'S  
LARGEST STUDENT COMPETITIONS!

**SEPTEMBER 9th - DECEMBER 31st 2019**  
**Register Now!**

# Cool! That's a little about IBM

The next steps are going to guide you through

- Downloading & running a 3270 emulator
  - Logging into the Mainframe
  - Changing your account password
- Learning to navigate and use the Mainframe!

# Table of Contents

**0.** Introduction to IBM & Mainframes



**1.** Software setup

**2.** Connecting to Mainframes & Terminal

**3.** Navigating the Mainframe

**4.** z/OS File systems

**5.** Review!

## So, what's this 3270?

- Mainframes can be accessed remotely by dedicated systems called Terminals. 3270 refers to the family of terminals that were used to access these mainframes.
- Today, it is possible to emulate these systems entirely in software, which is why the software is called a 3270 Terminal *Emulator*.

There are many ways to connect to a mainframe, and some a lot of people prefer using 3270!

## Access with 3270

3270 Terminal sessions allow for reliable connections while not requiring a lot of network bandwidth

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However not every computer provides a 3270 utility, so you will need to install software known as an **emulator**.



# Software Requirements

You will need to download an emulator from one of the URL's provided.

**mlhlocal.host/3270-Windows**

**mlhlocal.host/3270-Mac**

*Select the URL  
provided for your  
operating system!*

# Software Requirements

**Windows, Mac** and **Linux** are all supported slightly different to one and other.

So you have different downloads to make 3270 accessible on your computer.

**Don't worry! We'll take you through every step of that and help you set up!**

## Access with 3270: Mac

For the Mac connection we're going to use a free application known as **tn3270**.

1. On the provided website, select **HTTP download**.

### Download the Latest Version of tn3270

Version 3.4.0 is an update to version 3.3 that adds support latest versions of OS X, it also includes experiment supp

- OS X Version 3.4.0, November 9, 2013, 2.0 MB (for OS X 10.3.9 and later)

[HTTP download](#)

[Alternate site download](#)

1. You will download a disk image(dmg) file. Click **HTTP download** to open up the tn3270 application!

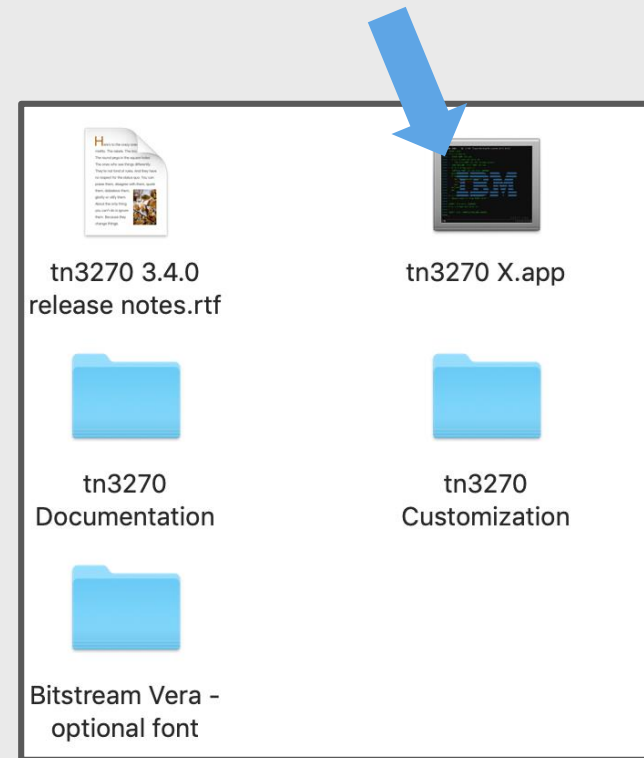


tn3270\_X\_3.4.....dmg



## Access with 3270: Mac

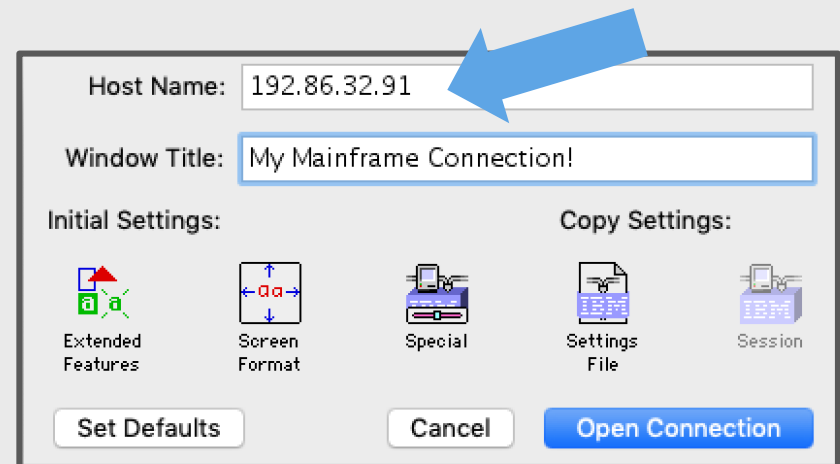
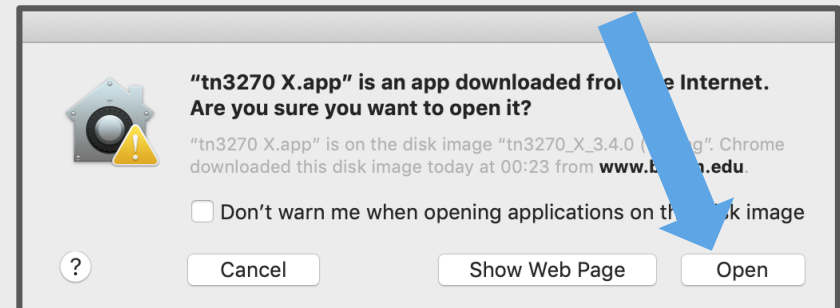
3. Double-Click **tn3270 X.app** to run your 3270 emulator.



The Mac download doesn't require a long installation process, once the disk image is open you can run the app locally!





## Access with 3270: Mac

- Click open to access the application.
- You should now be looking at the User Interface which asks you for a **host name** otherwise known as an *internet facing IP address*. Enter this IP Address for the host name **192.86.32.91**



# Access with 3270: Windows

1. Navigate to the webpage provided for the Windows telnet emulator **Vista TN3270** download.

	<h2 style="text-align: center;">Tom Brennan Software</h2>	
<ul style="list-style-type: none"> <li>Home</li> <li>Features</li> <li>Screen Shots</li> <li>Requirements</li> <li>Download</li> <li>Ordering</li> <li>Support</li> <li>Vista Blog</li> <li>About Me</li> <li>Other Items</li> </ul>	<p style="text-align: center;"><b>Home of the <i>Vista tn3270</i> Terminal Emulator</b></p> <p>  <b>Vista tn3270</b> is a Windows program designed to emulate IBM 3270 terminals connected to a host via IP link. Currently it is available for a free 30 day trial, and costs only <b>\$30</b>. If you are looking for an emulator created with <b>mainframe programmers</b> in mind, then give this one a try. You might find some unique features unavailable even on the highest priced commercial emulators.         </p> <p> <a href="#">Click here to download.</a> </p> <p>   <b>For encryption users:</b> Vista uses <a href="#">OpenSSL</a> for encryption, and last year the <a href="#">Heartbleed bug</a> was in the news. This year news of a possible SSL attack called <a href="#">POODLE</a> that apparently does not affect TLS. The latest version of Vista contains a recent version of OpenSSL that fixes Heartbleed, along with support for (up to) TLS 1.2 which addresses POODLE.         </p> <hr/> <div style="display: flex; justify-content: space-between;"> <div data-bbox="531 1185 1033 1249"> <p><u><b>Features</b></u> Vista has features designed especially for programmers, such as built-in multiple cut and paste buffers, fully tailorable keyboard, extensive select/copy/paste</p> </div> <div data-bbox="1052 1185 1555 1249"> <p><u><b>Screens</b></u> Vista uses bitmapped raster fonts for the clearest text possible. There are 2 sets, "Thick" and "Thin", in 73 sizes each from 4x6 to 16x36. With so many sizes you</p> </div> </div>	

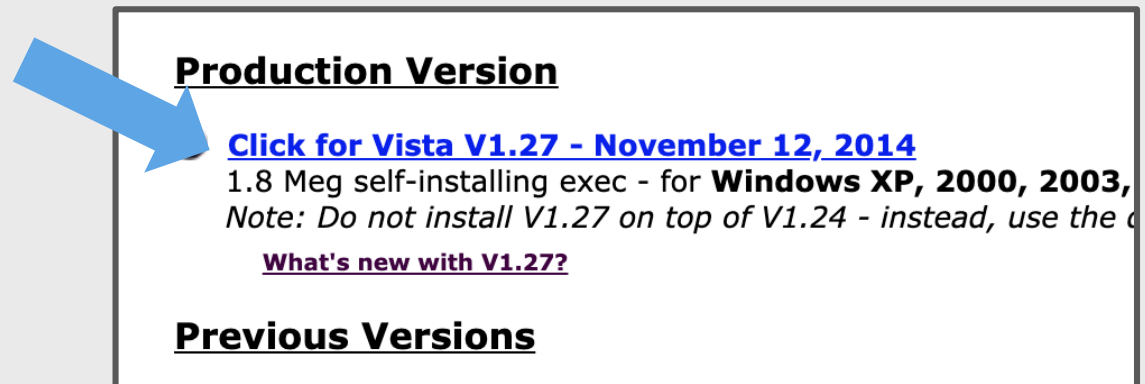
## Access with 3270: Windows

2. Navigate to **Download** in the left side menu.



2. Click the download link and you'll find received an exe file. Run this to install your new emulator.

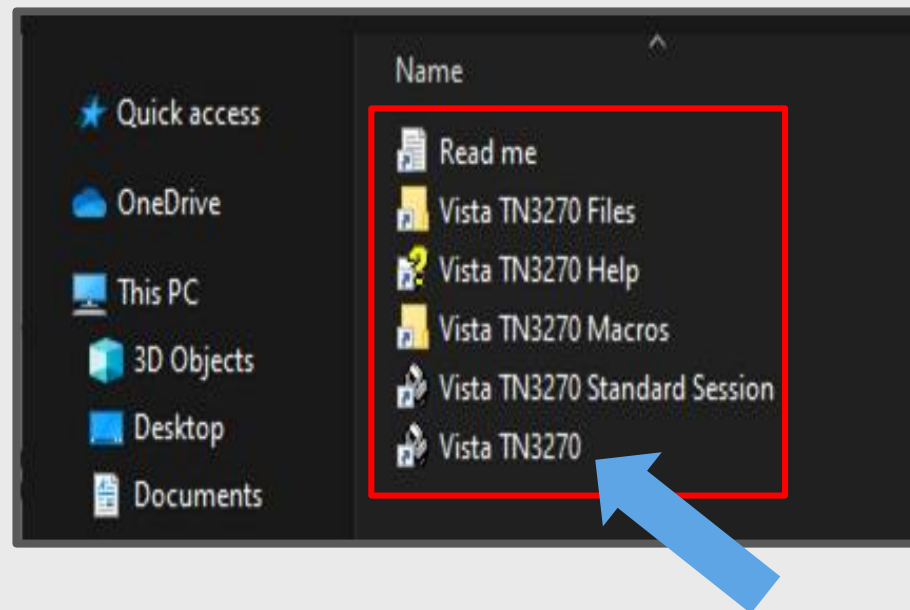
2. Follow the installation instructions.



## Access with 3270: Windows

You will see a few shortcuts have been created with the installation.

5. The installation will generate several shortcuts - you are going to need **Vista TN3270**, and **Vista TN3270 Standard**.



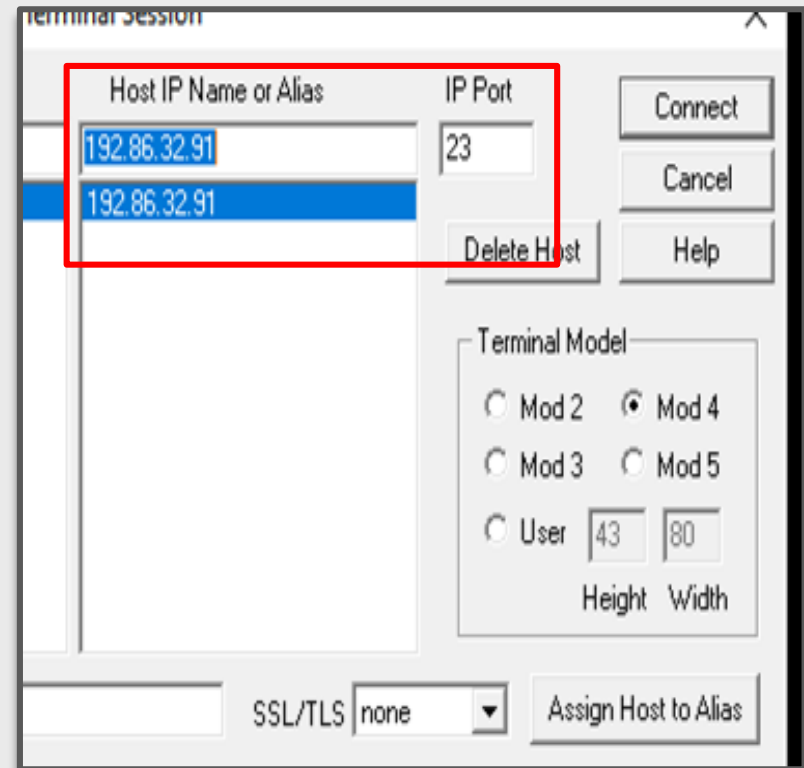
5. Let's move on by clicking & opening **Vista TN3270**.



## Access with 3270: Windows

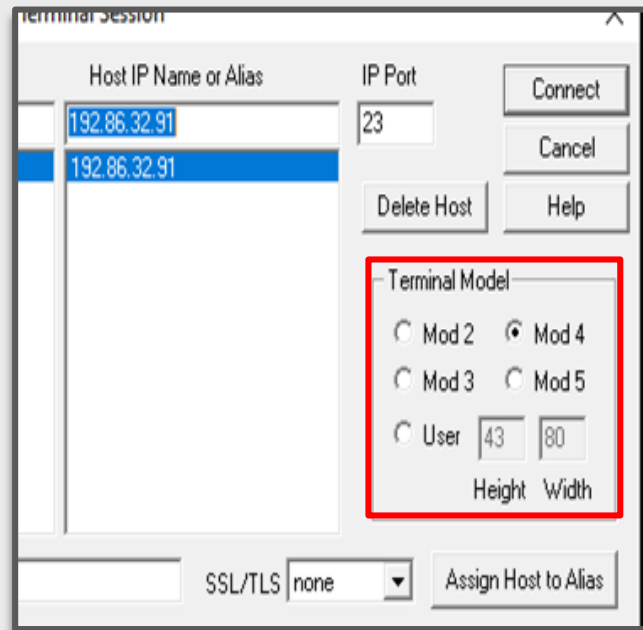
This will prompt a new terminal session.

7. Enter the provided IP for your Mainframe if the field “**Host IP Name or Alias**”. Enter this IP Address for the host name **192.86.32.91**
7. The default port to use is **23**. Make sure your **IP Port** field contains **23**.



## Access with 3270: Windows

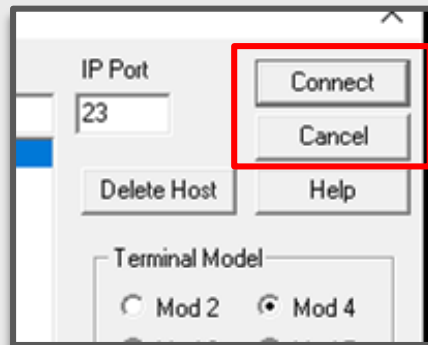
9. **Terminal Model** represents the size of the terminal screen when you connect. Selecting Mod 4 will create a nice, visible interface for you.



You can select a custom terminal **Height** and **Width** if you have a preference.

## Access with 3270: Windows

10. Click **Connect**. Once you click connect the emulator will load and will connect to an IBM Mainframe.



# Welcome to z/OS!

```
Enterprise Computing                               Local IP Address = 185.159.158.100
Enterprise Thinking                               http://mtm2019.mybluemix.net

15th Annual Master the Mainframe Contest

      // 00000000 SSSSSSS
      // 00 00 SS
zzzzzz // 00 00 SS
      zz // 00 00 SSSS
      zz // 00 00 SS
      zz // 00 00 SS
zzzzzz // 00000000 SSSSSSS

      IBM Z, The Next Generation

z/OS Runs the Economy of the World

===> Enter "logon" followed by the TSO userid. Example "logon userid" or
===> Enter TSO
```

*Time to become the Mainframe Guru you  
always wanted to be!*

# **Awesome! You're connected to the Mainframe!**

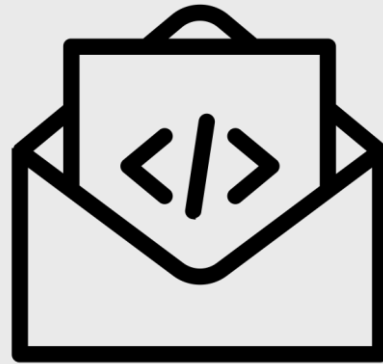
Now the connection is established, what's next?

Now we will

1. Successfully log in
2. Change passwords
3. Explore the Z/OS file system!

## z/OS Credentials

In order to complete this workshop you need to Register for the **Master the Mainframe Contest** in order to get your z/OS credentials!

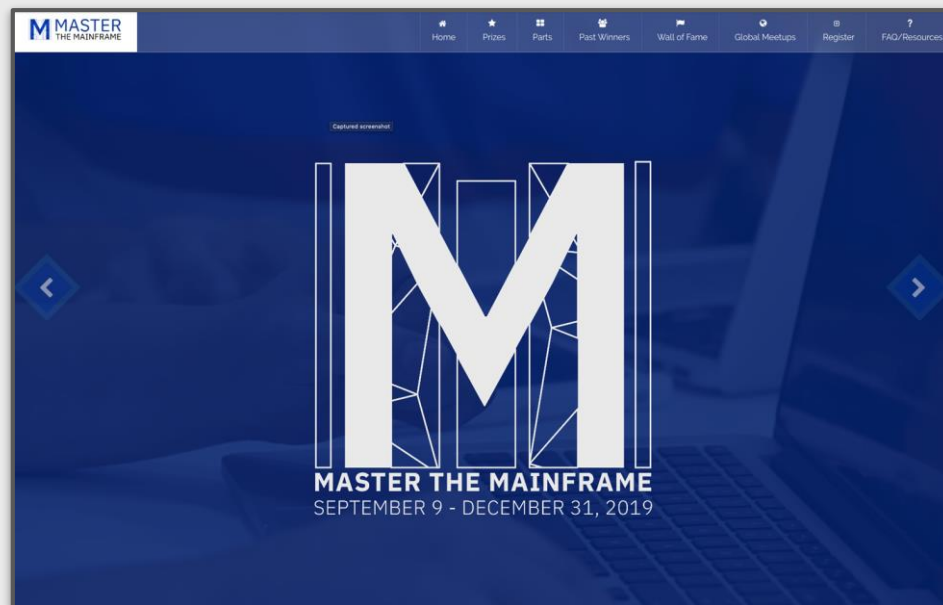


The credentials needed to access the z/OS mainframe are the [Username](#) and [Password](#). Which will be provided to you via email after signing up.

## z/OS Credentials

To register for the contest. Go to the following link and complete the sign-up.

[mlhlocal.host/master-the-mainframe](http://mlhlocal.host/master-the-mainframe)



# z/OS Credentials

**IBM Master the Mainframe Registration**

Please complete the following registration form

The fields indicated with an asterisk (\*) are required to complete this transaction; other fields are optional. If you do not want to provide us with the required information, please use the "Back" button on your browser to return to the previous page, or close the window or browser session that is displaying this page.

---

**Information**

First Name:*	<input type="text"/>
Last Name:*	<input type="text"/>
E-mail Address:*	<input type="text"/>
Confirm E-mail Address:*	<input type="text"/>
Country:*	<div>Select</div>
Street Address:*	<input type="text"/>
City:*	<input type="text"/>
Postal Code:*	<input type="text"/>
School:*	<div>Select</div>
Social Media Profile:	<input type="text"/>

Once you complete the registration process, you will receive an email within 15 minutes with your z/OS credentials that will allow you to access the mainframe!

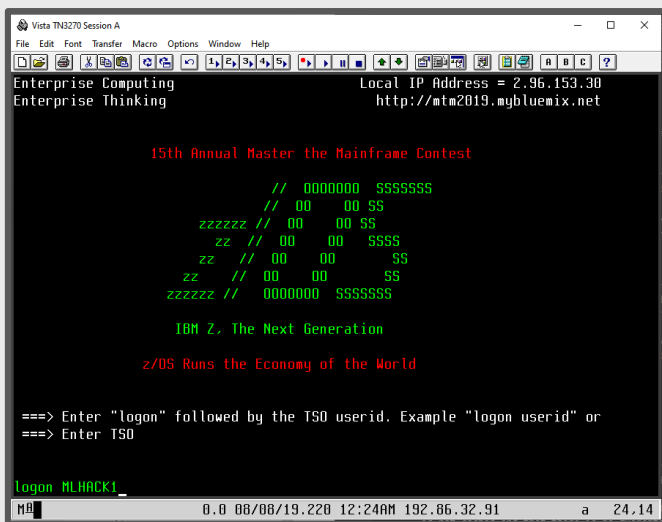
Go back to your 3270 Emulator and let's explore the interface.



# 3270 Interface

First! Let's get to know what you are now looking at.

You just connected to a remote machine, with a new tool you downloaded. What is going on!



The screenshot shows a terminal window titled "Vista TN3270 Session A". The window contains the following text:

```
Enterprise Computing      Local IP Address = 2.96.153.30
Enterprise Thinking       http://mtm2019.mybluemix.net

15th Annual Master the Mainframe Contest

      // 0000000 SSSSSSS
      // 00 00 SS
zzzzzz // 00 00 SS
zz // 00 00 SSSS
zz // 00 00 SS
zz // 00 00 SS
zzzzzz // 0000000 SSSSSSS

IBM Z, The Next Generation

z/OS Runs the Economy of the World

==> Enter "logon" followed by the TSO userid. Example "logon userid" or
==> Enter TSO

logon MLHACK1
```

The status bar at the bottom of the window displays: 0.0 08/08/19.220 12:24AM 192.86.32.91 a 24.14

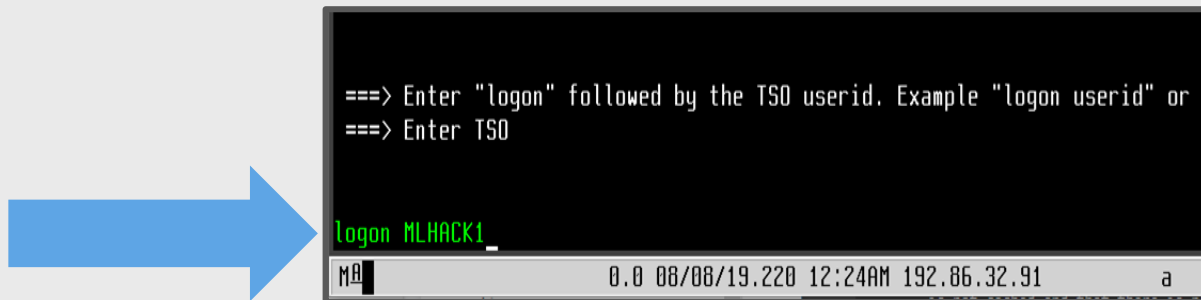
This is the user interface for the z/OS Operating System running on an IBM Mainframe.

It's a text based interface, that you control entirely by typing commands.

## 3270 Interface

What you are seeing isn't a greeting screen.  
This **IS** the z/OS interface!

Let's get better acquainted and log in!

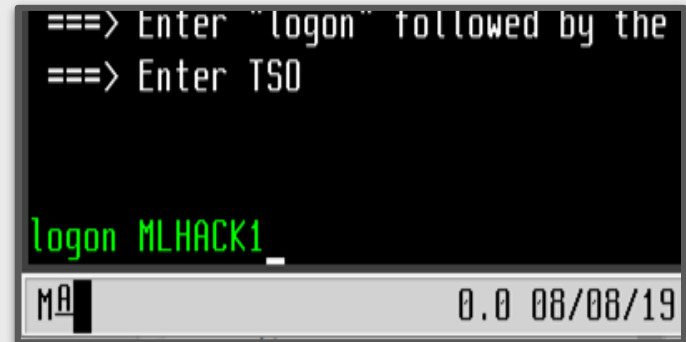


At the bottom, you are able to type into the interface.

Here you are able to enter the logon command to proceed.

# Logging in

1. Type **logon** followed by your provided username!
1. Hit the **ENTER** key to submit.

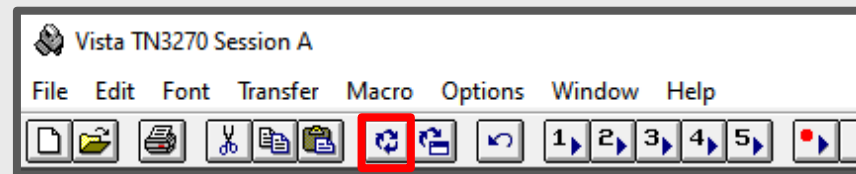


```
===> Enter "logon" followed by the  
===> Enter TSO  
  
logon MLHACK1  
MA 0.0 08/08/19
```

**Notice:** *Hitting the backspace does not delete your previously typed character. It only moves your flashing caret back 1 space. To clear a character, you need to enter **SPACE** when the flashing caret has moved onto the character you need to remove.*

# Resetting and Reconnecting

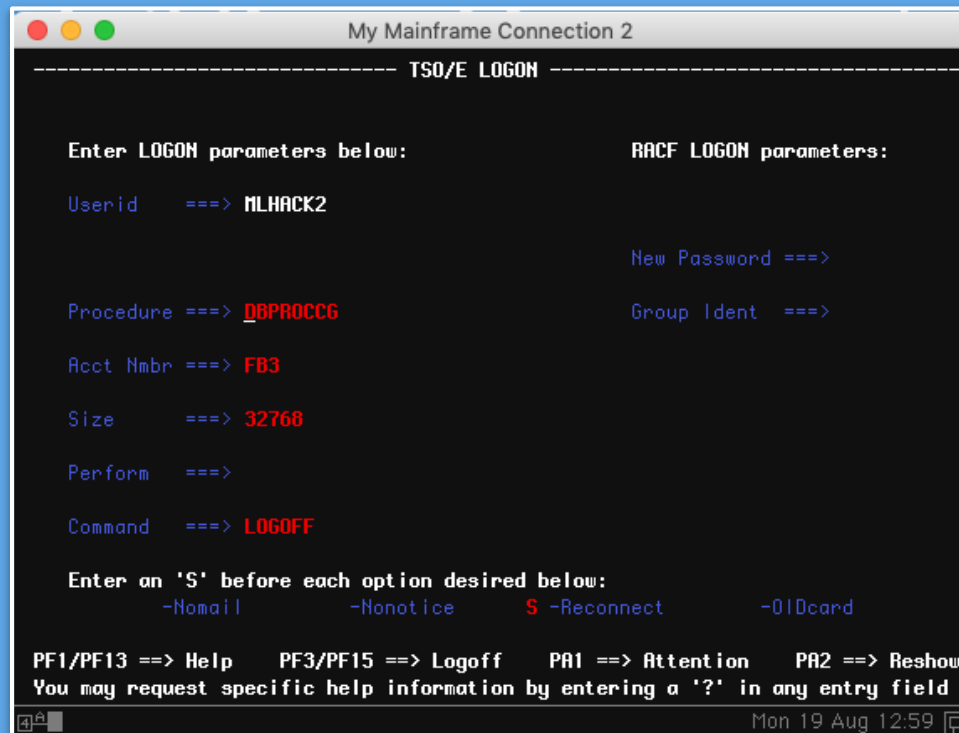
If you make a mistake, don't worry! You are able to completely restart your session by clicking the **Reconnect** button in the emulator toolbar, or just close the emulator and restart



# You logged into the Mainframe!

Now you're looking at the interface of your very own user environment, running on an **IBM Mainframe**.

Let's go over what you're looking at.



The screenshot shows a terminal window titled "My Mainframe Connection 2" with a black background and white and red text. The window displays the "TSO/E LOGON" interface. It prompts the user to enter LOGON parameters, including Userid (MLHACK2), Procedure (DBPROCCG), Acct Nbr (FB3), Size (32768), and Command (LOGOFF). It also prompts for RACF LOGON parameters, such as New Password and Group Ident. At the bottom, it lists options for PF1/PF13 (Help), PF3/PF15 (Logoff), PA1 (Attention), and PA2 (Reshow), along with a note about requesting specific help information by entering a '?'. The date and time "Mon 19 Aug 12:59" are displayed in the bottom right corner.

```
----- TSO/E LOGON -----

Enter LOGON parameters below:                RACF LOGON parameters:

Userid   ==> MLHACK2

                                           New Password ==>

Procedure ==> DBPROCCG                    Group Ident  ==>

Acct Nbr ==> FB3

Size     ==> 32768

Perform  ==>

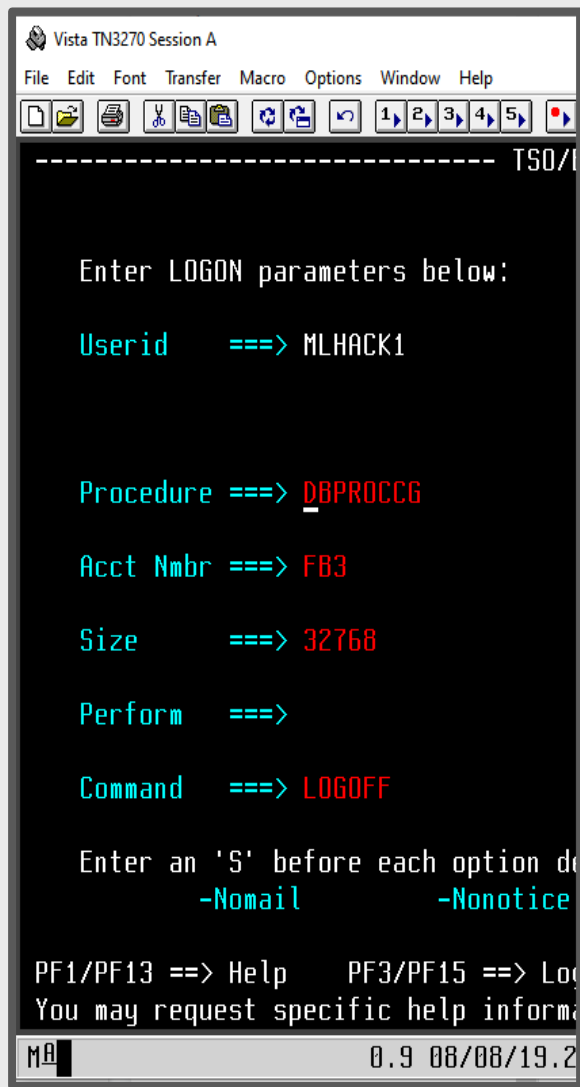
Command  ==> LOGOFF

Enter an 'S' before each option desired below:
        -Nomail      -Nonotice    S -Reconnect      -Oldcard

PF1/PF13 ==> Help   PF3/PF15 ==> Logoff   PA1 ==> Attention   PA2 ==> Reshow
You may request specific help information by entering a '?' in any entry field

Mon 19 Aug 12:59
```

## On the left



The screenshot shows a terminal window titled "Vista TN3270 Session A". The menu bar includes File, Edit, Font, Transfer, Macro, Options, Window, and Help. The toolbar contains various icons for file operations and navigation. The terminal text is as follows:

```
----- TSO/I

Enter LOGON parameters below:

Userid    ==> MLHACK1

Procedure ==> DBPROCCG

Acct Nmbr ==> FB3

Size      ==> 32768

Perform   ==>

Command   ==> LOGOFF

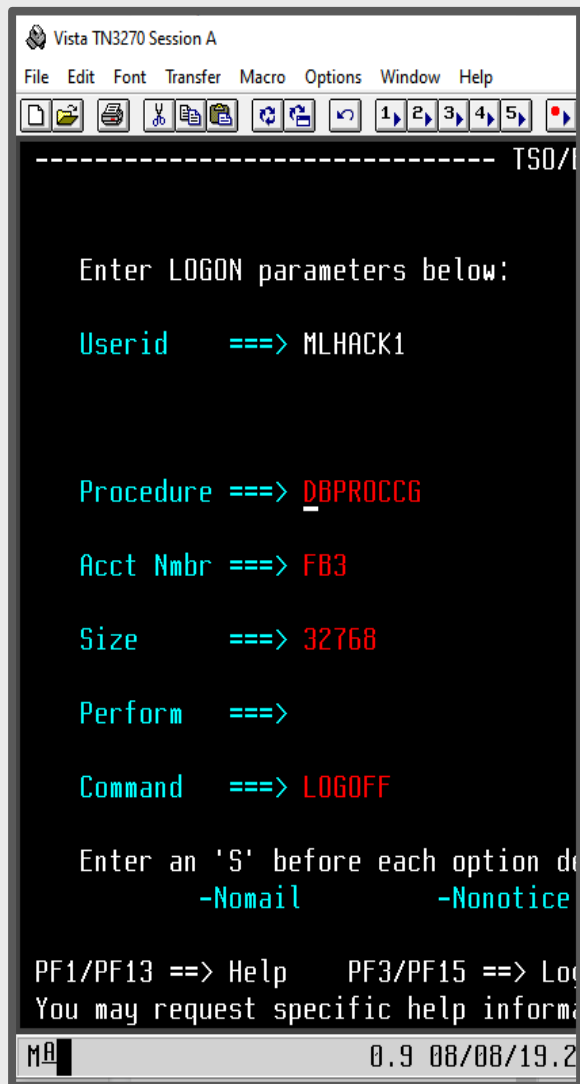
Enter an 'S' before each option d
      -Nomail      -Nonotice

PF1/PF13 ==> Help    PF3/PF15 ==> Log
You may request specific help informa

M0 0.9 08/08/19.2
```

- The **Userid** field displays the User ID for logging in.
- The **Procedure** field displays the method used to log on the Mainframe. (If you were to configure your own mainframe you would choose, or write a procedure for this).
- The **Size** indicated the amount of space that will be allocated to you in your isolated time sharing environment (in KiloBytes/KB).

## On the left



The screenshot shows a terminal window titled "Vista TN3270 Session A". The menu bar includes File, Edit, Font, Transfer, Macro, Options, Window, and Help. The toolbar contains icons for file operations and navigation. The main display area shows a TSO/RECFM session with the following text:


```
----- TSO/RECFM -----  
  
Enter LOGON parameters below:  
  
Userid    ==> MLHACK1  
  
Procedure ==> DBPROCCG  
Acct Nmbr ==> FB3  
Size      ==> 32768  
Perform   ==>  
Command   ==> LOGOFF  
  
Enter an 'S' before each option displayed:  
-Nomail      -Nonnotice  
  
PF1/PF13 ==> Help    PF3/PF15 ==> Logon  
You may request specific help information by typing the number of the option.
```

The status bar at the bottom shows "M0" and "0.9 08/08/19.2".

- The **Perform** field indicates your Performance Group, which level of administrator access you have.
- The **Command** field indicates what command will be executed **AFTER** z/OS is finished running all administrator specified commands.

## On the right

- The **New Password** field allows you to type in and confirm a new password for your TSO User ID.
- The **Group Ident** field could specify your security access group, if you had one.



A screenshot of a terminal window with a standard OS/390 or z/OS interface. The window has a title bar with minimize, maximize, and close buttons. Below the title bar is a toolbar with various icons for file operations and editing. The main area of the window is a black screen with white and cyan text. The text displays 'RACF LOGON parameters:' followed by two prompts: 'New Password ==>' and 'Group Ident ==>'. At the bottom, there is a status line with 'low:' and 'Reconnect -OIDcard'. Below that, a message reads 'A1 ==> Attention PA2 ==> Reshow entering a '?' in any entry field'. The very bottom of the window shows a command line with 'M 192.86.32.91 a 10,20'.

```
RACF LOGON parameters:

New Password ==>

Group Ident ==>

low:
Reconnect          -OIDcard

A1 ==> Attention    PA2 ==> Reshow
entering a '?' in any entry field

M 192.86.32.91      a  10,20
```



## At the bottom

Command ==> LOGOFF

Enter an 'S' before each option desired below:

**-Nomail**

**-Nonotice**

-Reconnect

**-OIDcard**

PF1/PF13 ==> Help    PF3/PF15 ==> Logoff    PA1 ==> Attention    PA2 ==> Reshow  
You may request specific help information by entering a '?' in any entry field

- **-Nomail** and **-Nonotice** allow users to enable/disable personal and group-wide notice messages that the Mainframe Time Sharer display.
- **-OIDcard** is used to perform operations from a magnetic ID card through a physical reader. (Cool!)

## Reconnecting to the mainframe

```
Command ==> LOGOFF
```

```
Enter an 'S' before each option desired below:
```

```
-Nomail
```

```
-Nonotice
```

```
-Reconnect
```

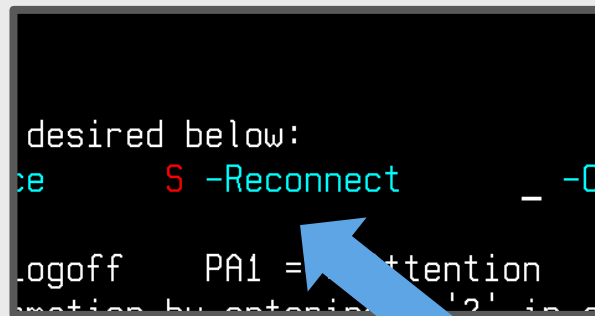
```
-OIDcard
```

```
PF1/PF13 ==> Help    PF3/PF15 ==> Logoff    PA1 ==> Attention    PA2 ==> Reshow  
You may request specific help information by entering a '?' in any entry field
```

**-Reconnect** is important. This command lets users re-establish connections to the Mainframe incase of an accidental disconnection and were unable to log out completely. The TSO may refuse to log you in until your session ends.

# Reconnecting to the mainframe

You activate this by navigating to -Reconnection, typing **S** and pressing **Enter**.



A terminal window with a black background and white text. The text displayed is: "desired below:", "ce S -Reconnect -0", "logoff PA1 = attention", and "action by entering '2' in a". A blue arrow points from the bottom right towards the "S" in the second line.

```
desired below:
ce S -Reconnect -0
logoff PA1 = attention
action by entering '2' in a
```

# Navigating the Mainframe

Navigation on a Mainframe with 3270 is done by using **arrow keys** and/or **TAB** and then selecting options using **ENTER**, or by typing directly on the user interface.

```
----- TSO/E LOGON -----

Enter LOGON parameters below:

Userid   ==> MLHACK1
Procedure ==> DBPROCCG
Acct Nmbr ==> FB3
Size     ==> 32768
Perform  ==>
Command  ==> LOGOFF

RACF LOGON parameters:

New Password ==>
Group Ident  ==>

Enter an 'S' before each option desired below:
-Nomail      -Nonotice    -Reconnect    -OIDcard

PF1/PF13 ==> Help   PF3/PF15 ==> Logoff  PA1 ==> Attention  PA2 ==> Reshow
You may request specific help information by entering a '?' in any entry field

ML  0.9 08/08/19.220 12:32AM 192.86.32.91 a 10.20
```

So let's begin!

1. Move your caret around using the arrow keys **up, down, left and right**. However, to avoid errors it's **highly recommended** to use the **TAB** key to traverse whole sections of the interface.

# Changing your Password

As a first task, Let's learn to manually change your password.

Spend a moment coming up with a new password for your account.

## It must:

- *Be equal to or less than 8 characters*
- *contain at least one letter*
- *Contain at least one number.*
- *not be the same as a previously z/OS password.*

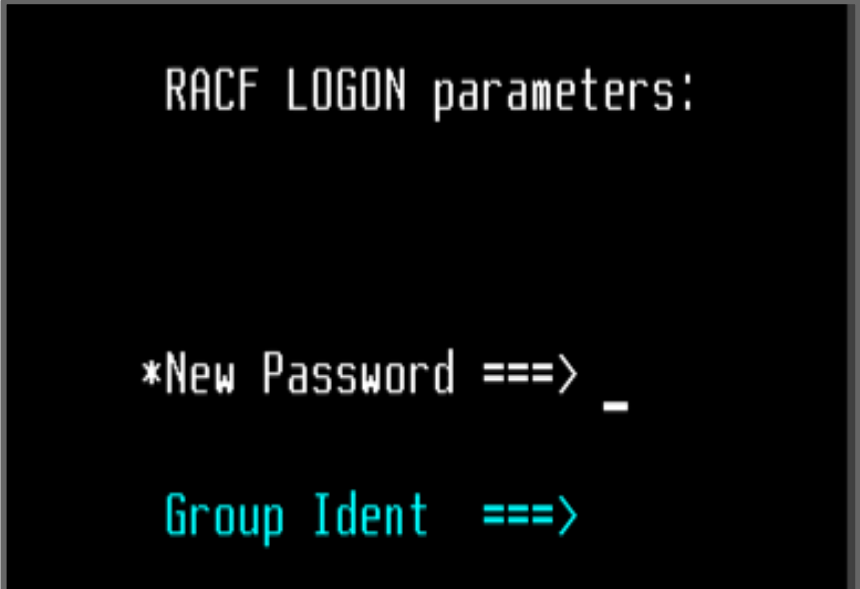
## Manual password reset

To use the **New Password** ability, simply hit **ENTER** and you'll be prompted to type the new password you wish to use.

Any text input will be stored as a new password.

You will be asked to input the password twice. Then you will have successfully changed passwords.

As you type your password, no characters will appear. This is to maintain security. So take care with what you type.

A screenshot of a mainframe terminal window with a black background and white text. The text reads: 'RACF LOGON parameters:' followed by a blank line. Then '\*New Password ==>' followed by a single underscore character '\_'. Below that, 'Group Ident ==>' is displayed in green text.

```
RACF LOGON parameters:  
  
*New Password ==> _  
Group Ident ==>
```

# Manual password reset

If at any stage you input your password incorrectly.

**DON'T PANIC.**

You can simply repeat the process until you successfully change the password for your account.

```
----- TSO/E LOGON -----
IKJ56415I CURRENT PASSWORD HAS EXPIRED - PLEASE ENTER NEW PASSWORD
IKJ56429A REENTER -
Enter LOGON parameters below:                                RACF LOGON parameters:

Userid    ==> MLHACK1

*New Password ==> _

Procedure ==> DBPROCCG                                Group Ident ==>

Acct Nmbr ==> FB3

Size      ==> 32768

Perform   ==>

Command   ==> LOGOFF

Enter an 'S' before each option desired below:
-Nomail      -Nonotice    -Reconnect    -OIDcard

PF1/PF13 ==> Help  PF3/PF15 ==> Logoff  PA1 ==> Attention  PA2 ==> Reshow
You may request specific help information by entering a '?' in any entry field

MA 1.5 08/09/19.221 10:06PM 192.86.32.91 a 8,71
```

# Navigation Basics? Check!

You're doing great!

Logging on and navigating the ISPF is a great achievement and the first in many steps to mastering the art of working an IBM Mainframe.

Let's move onto TSO, short for Time Sharing Option. This is what allows for multiple users to access the system at once without slowing things down.



# z/OS Time Sharing Option

So what is Time Sharing?

**Time Sharing Option (TSO)** is a dedicated environment allocated for you, in real time, on the z/OS system.

This allows you to get access to resources, and use them as if you have full dedicated access, even though they are being used by others at the same time.

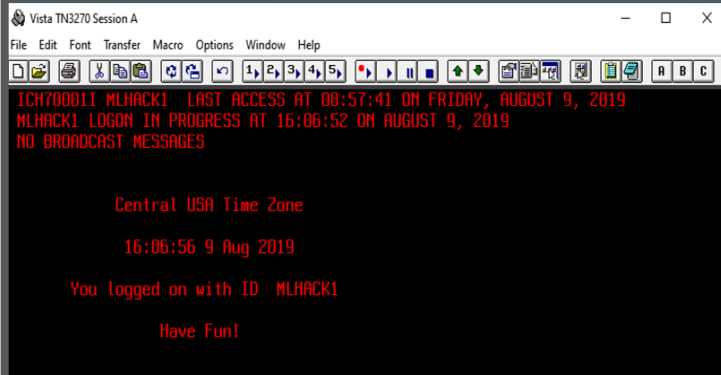
It's essentially your own private computer session to run your applications or code!

# Time Sharing Option

1. Once you enter a new password successfully you will automatically be logged on to **TSO**.

1. This will take approximately 10 seconds. It will feel like the system has stalled, but it hasn't.

Don't worry!



```

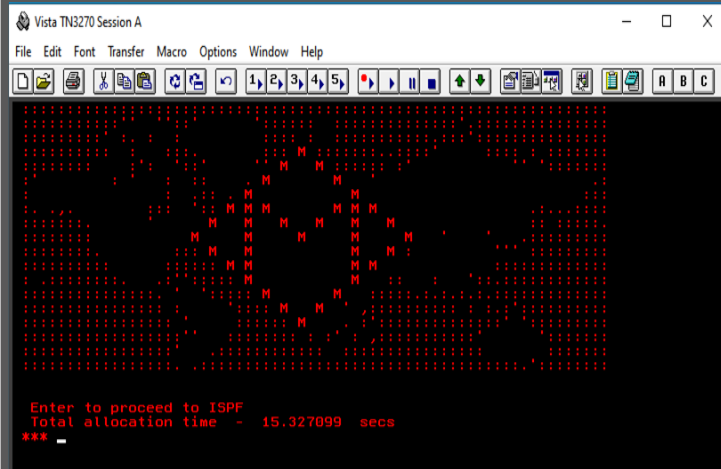
Vista TN3270 Session A
File Edit Font Transfer Macro Options Window Help
[Icons] 1 2 3 4 5 [Icons] A B C
ICHT00011 MLHACK1 LAST ACCESS AT 08:57:41 ON FRIDAY, AUGUST 9, 2019
MLHACK1 LOGIN IN PROGRESS AT 16:06:52 ON AUGUST 9, 2019
NO BROADCAST MESSAGES

Central USA Time Zone

16:06:56 9 Aug 2019

You logged on with ID MLHACK1

Have Fun!
    
```

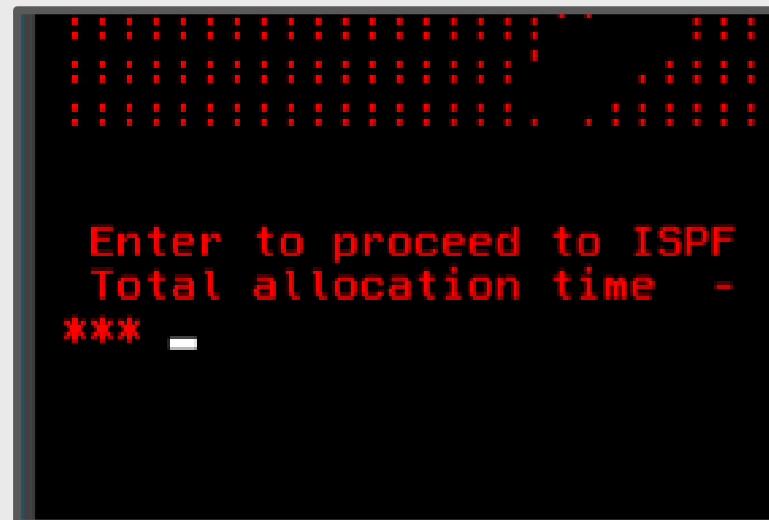


```

Vista TN3270 Session A
File Edit Font Transfer Macro Options Window Help
[Icons] 1 2 3 4 5 [Icons] A B C
Enter to proceed to ISPF
Total allocation time - 15.327099 secs
***
    
```

## Time Sharing Option

To access the **ISPF** menu from the **TSO** screen we don't need any direct input. Just the **ENTER** key.



### Tip



The "\*\*\*" is a prompt for user input. It means the screen is being held until you hit Enter to continue.

# Enjoy this ISPF

Take a breather!

The screenshot shows a terminal window titled "Vista TN3270 Session A" with a menu bar (File, Edit, Font, Transfer, Macro, Options, Window, Help) and a toolbar. The main content is the "ISPF Primary Option Menu" with a list of options (0-11) and their descriptions. To the right, system parameters are displayed. Below the main menu is a section for "Other Functions" with codes and descriptions. At the bottom, there is a line for "Option ==>" with function key shortcuts (F1-F12) and a status bar at the very bottom showing session details.

```
Vista TN3270 Session A
File Edit Font Transfer Macro Options Window Help

Menu Utilities Compilers Options Status Help
-----
ISPF Primary Option Menu

0 Settings      Terminal and user parameters      User ID . . : MLHACK1
1 View          Display source data or listings   Time . . . : 17:03
2 Edit          Create or change source data      Terminal . : 3278
3 Utilities     Perform utility functions        Screen . . : 1
4 Foreground   Interactive language processing   Language . : ENGLISH
5 Batch        Submit job for language processing Appl ID . : ISR
6 Command      Enter TSO or Workstation commands TSO logon : DBPROCCG
7 Dialog Test  Perform dialog testing           TSO prefix: MLHACK1
8 LM Facility  Library administrator functions  System ID : S0W1
9 IBM Products IBM program development products MVS acct. : FB3
10 SCLM        SW Configuration Library Manager Release . : ISPF 7.3
11 Workplace   ISPF Object/Action Workplace

----- Other Functions -----

SD SDSF        View output
U  Unix         Unix Shell Prompt
UF Unix Files  Unix Services
D2 DB2I        DB2 Interactive functions
DM DB2ADM      DB2 Administration
F  File Manager File Manager for z/OS
IS ISMF        Disk Storage Management
SM SMP/E       Software Installation and Management
IP IPCS        Debug System Dumps and Traces
HC HCD         System Device Management
FD FM/DB2      File Manager/DB2
FI FM/IMS      File Manager/IMS

Enter X to Terminate using log/list defaults

Option ==>
F1=Help      F2=Split      F3=Exit      F7=Backward  F8=Forward  F9=Swap
F10=Actions  F12=Cancel

MB 0.2 08/09/19.221 11:04PM 192.86.32.91 a 41,14
```

# ISPF

These are the primary ISPF options. We will spend most of our time manipulating the Mainframe with these.

```

0 Settings      Terminal and user parameters      User ID . : MLHACK1
1 View          Display source data or listings   Time. . . : 16:08
2 Edit          Create or change source data      Terminal. : 3278
3 Utilities     Perform utility functions         Screen. . : 1
4 Foreground    Interactive language processing   Language. : ENGLISH
5 Batch         Submit job for language processing Appl ID . : ISR
6 Command       Enter TSO or Workstation commands TSO logon : DBPROCCG
7 Dialog Test   Perform dialog testing           TSO prefix: MLHACK1
8 LM Facility   Library administrator functions   System ID : S0W1
9 IBM Products  IBM program development products MVS acct. : FB3
10 SCLM         SW Configuration Library Manager  Release . : ISPF 7.3
11 Workplace    ISPF Object/Action Workplace
  
```

ISPF stands for

**Interactive System Productivity Facility**

It is the core of how users like you, control Mainframes.

## Key Term

**ISPF:** Stands for Interactive System Productivity Facility, is a full panel application navigated by keyboard which includes a text editor, browser, and functions for locating and listing files and performing other utility functions.

## Let's Explore

To get a better understanding of this system and its total usage, let's take a look at **SDSF**.

```

----- Other Functions -----
SD SDSF          View output
U  Unix          Unix Shell Prompt
UF Unix Files    Unix Services
D2 DB2I          DB2 Interactive functions
DM DB2ADM        DB2 Administration
F  File Manager  File Manager for z/OS
IS ISMF          Disk Storage Management
SM SMP/E         Software Installation and Management
IP IPCS          Debug System Dumps and Traces
HC HCD          System Device Management
FD FM/DB2        File Manager/DB2
FI FM/IMS        File Manager/IMS

Enter X to Terminate using log/list defaults

```

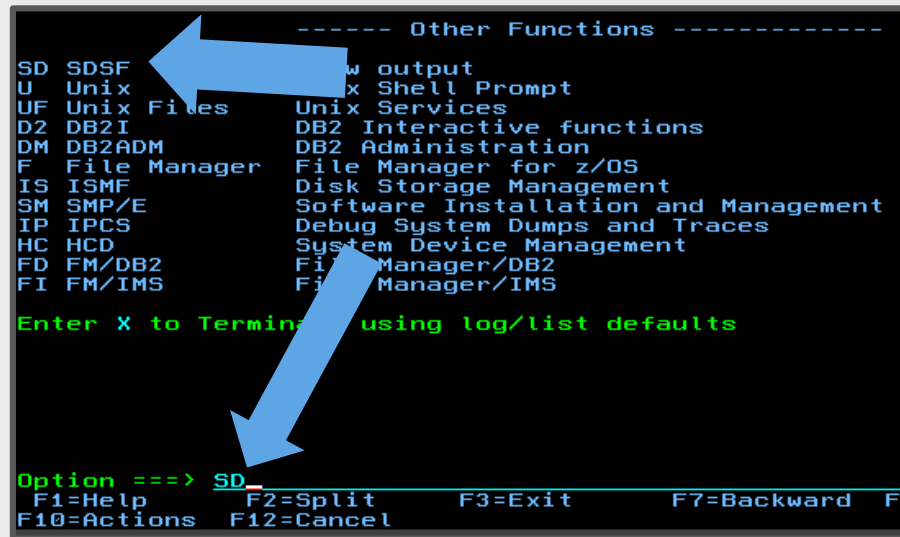
This stands for **System Display and Search Facility**, and it is one of the supplementary options in **ISPF**.

### Key Term

**SDSF**: Stands for System Display and Search Facility, is a utility that allows you to monitor, control, and view the output of jobs in the system.

# Let's Explore

1. To enter SDSF, type the command **SD**.
2. Press **ENTER**.



```
----- Other Functions -----
SD SDSF          View output
U  Unix          Unix Shell Prompt
UF Unix Files    Unix Services
D2 DB2I          DB2 Interactive functions
DM DB2ADM        DB2 Administration
F  File Manager  File Manager for z/OS
IS ISMF          Disk Storage Management
SM SMP/E         Software Installation and Management
IP IPCS          Debug System Dumps and Traces
HC HCD           System Device Management
FD FM/DB2        File Manager/DB2
FI FM/IMS        File Manager/IMS

Enter X to Terminate using log/list defaults

Option ==> SD
F1=Help      F2=Split      F3=Exit      F7=Backward  F8=
F10=Actions  F12=Cancel
```

SD is described at the top of the '**Other Functions**' list. It will allow you to View the Output of events taking place on the system.

# Let's Explore

You will be presented with a system management screen with a lot of new options.

The commands are in the *Menu column*, the command descriptions are in *Description column*.

To execute these commands, you type in the command name and hit **ENTER**.

💡
Tip
💡

To go back from any current position, press **F3**.

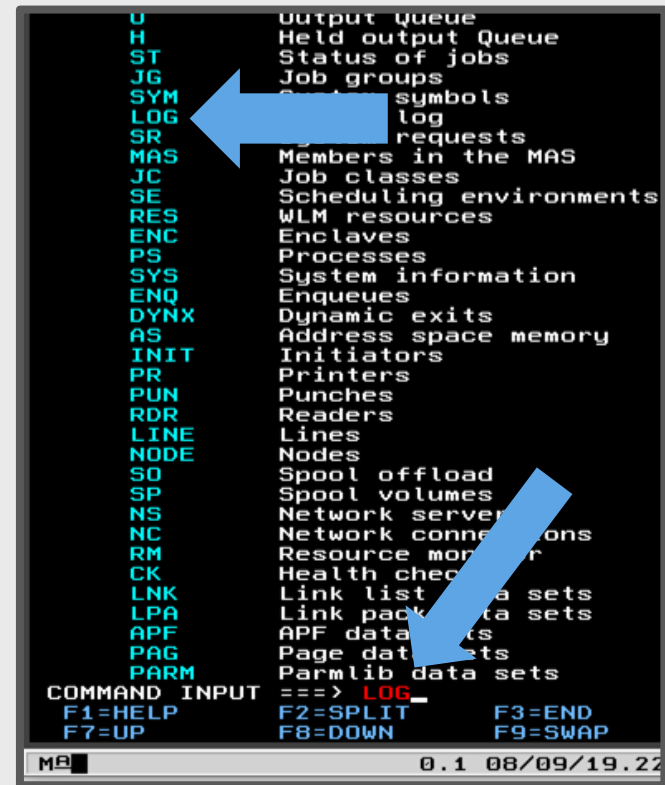




# Let's Explore

1. Type **LOG** and hit **ENTER**.
1. Begin to look around! See if you recognise any events listed. Use the **F7** & **F8** keys to scroll up and down the logs. Use the **F10** & **F11** keys to scroll up and down.

Since you have been poking around the Mainframe for a while now. Let's look inside the system logs. Perhaps you have generated some events that have been recorded.



```
U      Output Queue
H      Held output Queue
ST     Status of jobs
JG     Job groups
SYM    symbols
LOG    log
SR     requests
MAS    Members in the MAS
JC     Job classes
SE     Scheduling environments
RES    WLM resources
ENC    Enclaves
PS     Processes
SYS    System information
ENQ    Enqueues
DYNX   Dynamic exits
AS     Address space memory
INIT   Initiators
PR     Printers
PUN    Punches
RDR    Readers
LINE   Lines
NODE   Nodes
SO     Spool offload
SP     Spool volumes
NS     Network server
NC     Network connections
RM     Resource monitor
CK     Health checker
LNK    Link list data sets
LPA    Link pack data sets
APF    APF data sets
PAG    Page data sets
PARMLIB Parmlib data sets
COMMAND INPUT ==> LOG
F1=HELP  F2=SPLIT  F3=END
F7=UP    F8=DOWN  F9=SWAP
MA 0.1 08/09/19.22
```

# Let's Explore

Feel free to take some time investigating the logs. It may take a few minutes before some of it makes sense.

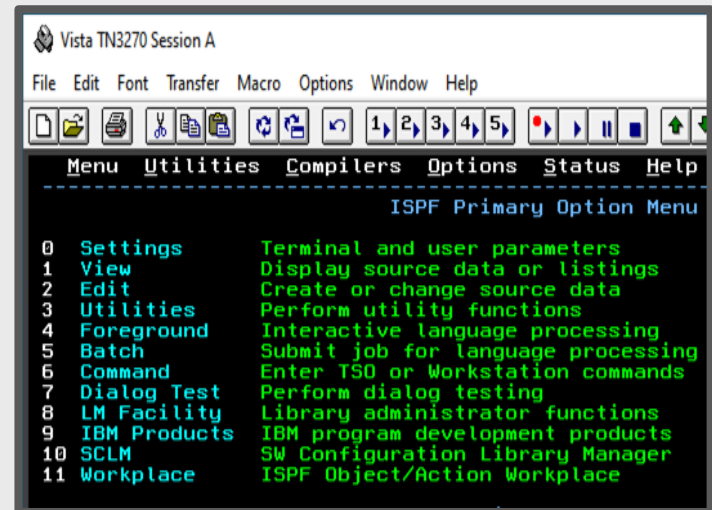
When you are ready, navigate back to the main ISPF screen by hitting **F3** twice.

# Customizing Your Environment

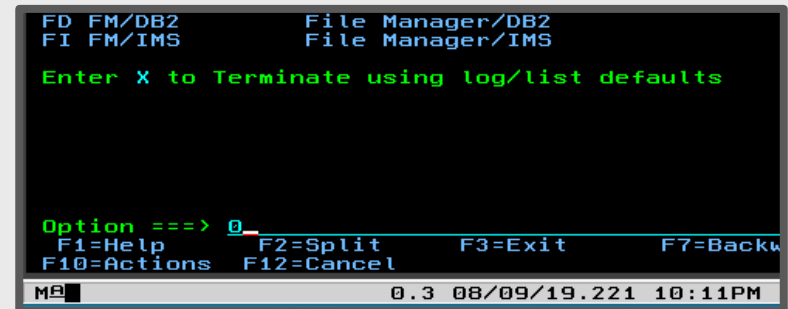
## Moving the Command Line

The primary options menu indicates everything available within this ISPF for you. Option 0 is settings.

1. Type **0** to select the Settings menu in the command prompt at the bottom.



1. Press **ENTER** to access to Settings ISPF.



# Customizing Your Environment

## Moving the Command Line

1. Navigate to the option  
*Command line at bottom.*
1. Typing in the `/` symbol in the empty space (shown in screenshot) acts like a **True** or **False** statement.
1. Uncheck this setting by typing **SPACE** over the `/` symbol.

```
ISPFS Settings

Options
Enter "/" to select option
/ Command line at bottom
/ Panel display CUA mode
/ Long message in pop-up
/ Tab to action bar choices
/ Tab to point-and-shoot fields
/ Restore TEST/TRACE options
/ Session Manager mode
/ Jump from leader dots
/ Edit PRINTDS Command
/ Always show split line
/ Enable EURO sign

Print Graphics
Family print
Device name
Aspect ratio

General
Input field
Command deli

Member list options
Enter "/" to select option
/ Scroll member list
- Allow empty member list
- Allow empty member list (nomatch)
/ Empty member list for edit only

Terminal Characteristics
```



### Tip



Slash (/) = True  
no slash(\_) = False.

# Customizing Your Environment

## Moving the Command Line

4. Once unchecked, navigate back using the **F3** button.



```
Log/List  Function keys  Colo
-----
Options
Enter "/" to select option
/ Command line at bottom
/ Panel display CUA mode
/ Long message in pop-up
/ Tab to action bar choices
/ Tab to point-and-shoot fie
/ Restore TEST/TRACE options
Session Manager mode
```

# Customizing Your Environment

## Resizing the Console

You may want to resize your 3270 Terminal to fit more characters on the screen or to increase/decrease the font size.

You may have also tried to drag your screen larger and noticed that it didn't behave the way you expected it to. To change the dimensions and appearance of your terminal, we will need to head into the Screen Format option of your 3270 emulator.

# Customizing Your Environment

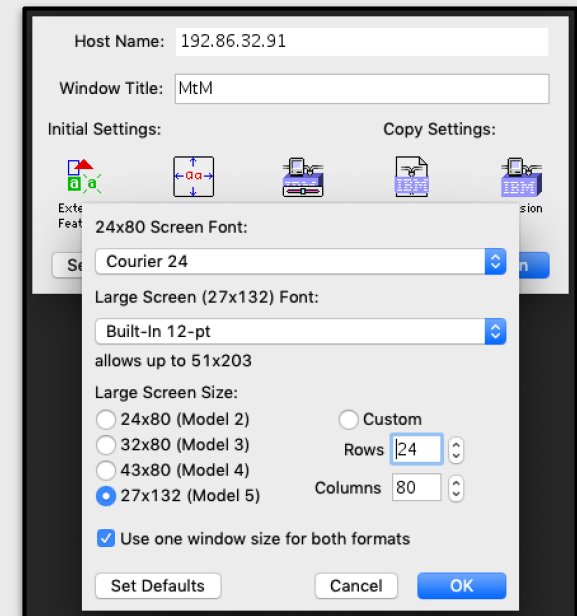
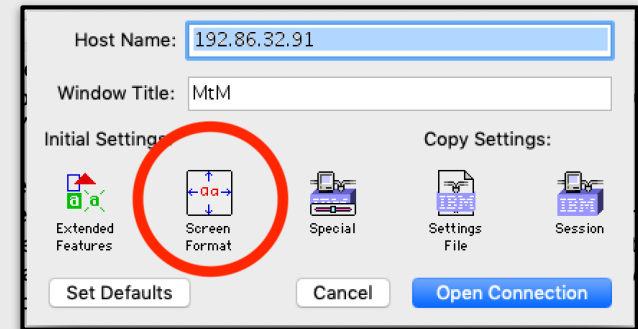
## Resizing the Console

**Screen Size:** When you are first connecting to the system, you can set up the Screen Format.

There are different screen “modes”, which determine the number of characters that fit on the screen at once.

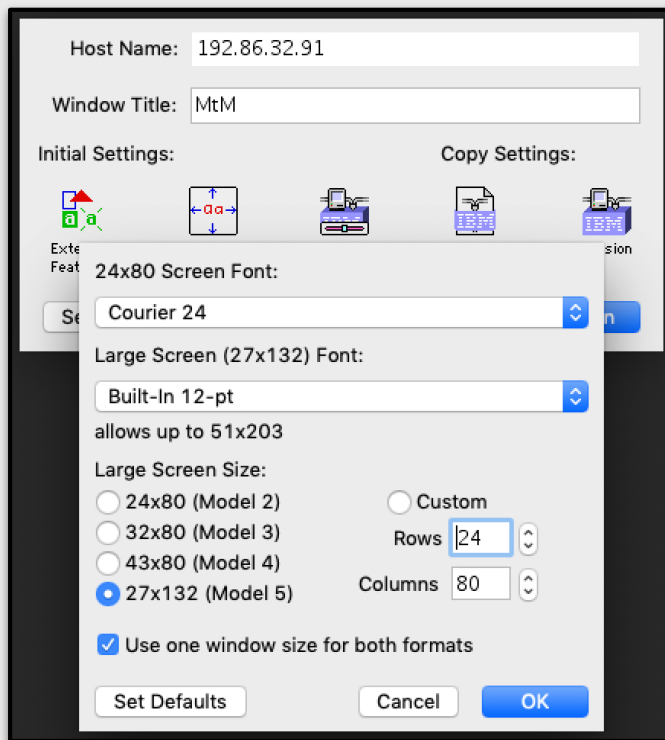
The default, **Mode 1**, can fit 24 rows (down) and 80 columns (across), while **Mode 5** supports 27 rows and 132 columns.

*(Note: The screenshots are from TN3270 on Mac. For Vista 3270, these options appear on the connection panel, and in x3270 for Linux, they are under the Option menu, though the wording is slightly different)*



# Customizing Your Environment

## Resizing the Console

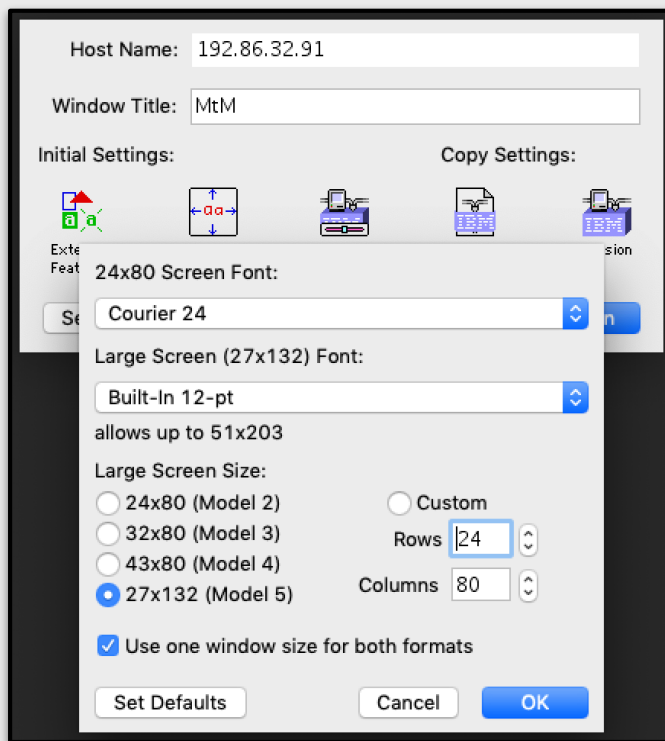


Setting a larger number of rows and/or columns will allow you to fit more text on the screen, which means less scrolling and paging around, but may make certain panels harder to read, so you may want to spend some time experimenting, but changing screen sizes typically requires re-connecting to the system, so be sure you're ready to disconnect and log back in before making changes.



# Customizing Your Environment

## Changing the Font



**Font:** You can change the typeface and size used for the terminal. For optimum readability, try to stick to standard monospaced fonts such as Courier, Lucidia Console, Menlo, Monaco, or pretty much anything with “Mono” in the name or description. You should be able to switch font size without restarting your connection.

# Hacking Customizations

Check it out! Your command line is now at the top, your screen is larger, and you may have changed your font!

```
Vista TN3270 Session A
File Edit Font Transfer Macro Options Window Help
-----
Menu Utilities Compilers Options Status Help
-----
ISPF Primary Option Menu
Option ==>
0 Settings      Terminal and user parameters      User ID . : MLHACK1
1 View          Display source data or listings    Time . . : 16:08
2 Edit          Create or change source data       Terminal. : 3278
3 Utilities     Perform utility functions         Screen . : 1
4 Foreground    Interactive language processing   Language. : ENGLISH
5 Batch         Submit job for language processing Appl ID . : ISR
6 Command       Enter TSO or Workstation commands  TSO logon : DBPROCCG
7 Dialog Test   Perform dialog testing            TSO prefix: MLHACK1
8 LM Facility   Library administrator functions   System ID : S0W1
9 IBM Products  IBM program development products  MVS acct. : FB3
10 SCLM         SW Configuration Library Manager  Release . : ISPF 7.3
11 Workplace    ISPF Object/Action Workplace

----- Other Functions -----
SD SDSF        View output
U Unix         Unix Shell Prompt
UF Unix Files  Unix Services
D2 DB2I        DB2 Interactive functions
DM DB2ADM      DB2 Administration
F File Manager File Manager for z/OS
IS ISMF        Disk Storage Management
SM SMP/E       Software Installation and Management
IP IPCS        Debug System Dumps and Traces
HC HCD         System Device Management
FD FM/DB2      File Manager/DB2
FI FM/IMS      File Manager/IMS

Enter X to Terminate using log/list defaults

F1=Help      F2=Split      F3=Exit      F7=Backward  F8=Forward  F9=Swap
F10=Actions   F12=Cancel

MA 0.1 08/09/19.221 10:09PM 192.86.32.91 a 4,14
```

## Logging off TSO

When you want to exit your Mainframe time sharing option, you will need to log out.

You **do not** need to still be connected via your 3279 terminal for a TSO to remain active.

A TSO will stay up and running for several minutes if you **haven't** explicitly logged off.

After approximately 3 minutes, it will deactivate automatically and free up Mainframe resources.

## Logging off TSO

Logging off is quick and simple.

Let's do it from the main ISPF screen inside your TSO.

1. Make sure you navigate back to your TSO ISPF.
1. Press **F3** on your keyboard.
1. You will log out, and receive a message telling you so.

```
LOGOFF  
MLHACK1 LOGGED OFF TSO AT 10:58:33 ON AUGUST 11, 2019  
*****  
_
```

# What happens if I forget?

If you don't remember to manually log off

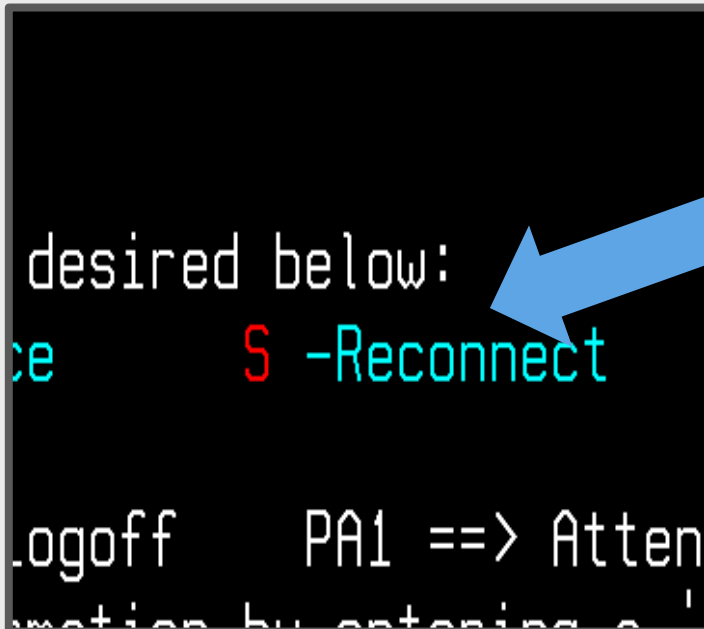
- Your TSO environment will eventually be deallocated and your account logged off.
- This will happen after 3 minutes of being inactive in your TSO. This helps you avoid using up unintentional Mainframe resources.

## Key Term

**Deallocated:** to remove from a set of resources. In the mainframe, when logging out the dedicated environment that was given to you is removed.

## Using TSO -Reconnect

If you forget to log off before closing the emulator **after** your TSO environment has been allocated, you may need to select the **-Reconnect** option on the TSO logon screen when attempting to get back into TSO.



```
desired below:
ce      S -Reconnect

logoff   PA1 ==> Atten
ution by entering a
```

Remember this  
setting we saw  
previously?

# What is a checkpoint?

**Checkpoints** are logical restart points in a job which help in restarting a step from a point instead of restarting from the beginning.

When you set up checkpoints for individual steps, the status of the executing program is recorded periodically in a data set assigned for that purpose.

You can think of them similarly to checkpoints in a video game, they are like micro saves at certain points to save you the effort of having to do everything again.

# Submitting The First Checkpoint

1. Log back in to **TSO** and start up ISPF.
2. Navigate to the command line and enter:  
`tso submit 'zos.public.jcl(part1)'`
1. What this will do is trigger a job (program) to run, that will prepare some Datasets for the next stage!

```
Menu  Utilities  Compilers  Options  Status  Help
-----
                                ISPF Primary Option Menu
Option ==> tso submit 'zos.public.jcl(part1)'
```

0	Settings	Terminal and user parameters	User ID . : MLHACK1
1	View	Display source data or listings	Time. . . : 16:14
2	Edit	Create or change source data	Terminal. : 3278
3	Utilities	Perform utility functions	Screen. . : 1
4	Foreground	Interactive language processing	Language. : ENGLISH



# You submitted your first checkpoint!

You will be prompted to enter jobname character(s) - enter: **a**

```
ISPF system data set allocation error - press Enter to continue.  
Log file allocation error - ISPF will operate without a log data set.  
Already cataloged, VSAM protected, or other - 'MLHACK1.S0W1.SPFLOG1.LIST'.  
ENTER JOBNAME CHARACTER(S) -
```

```
a_
```

And you'll get an acknowledgement of your submittal. Nice work!

```
ISPF system data set allocation error - press Enter to continue.  
Log file allocation error - ISPF will operate without a log data set.  
Already cataloged, VSAM protected, or other - 'MLHACK1.S0W1.SPFLOG1.LIST'.  
ENTER JOBNAME CHARACTER(S) -
```

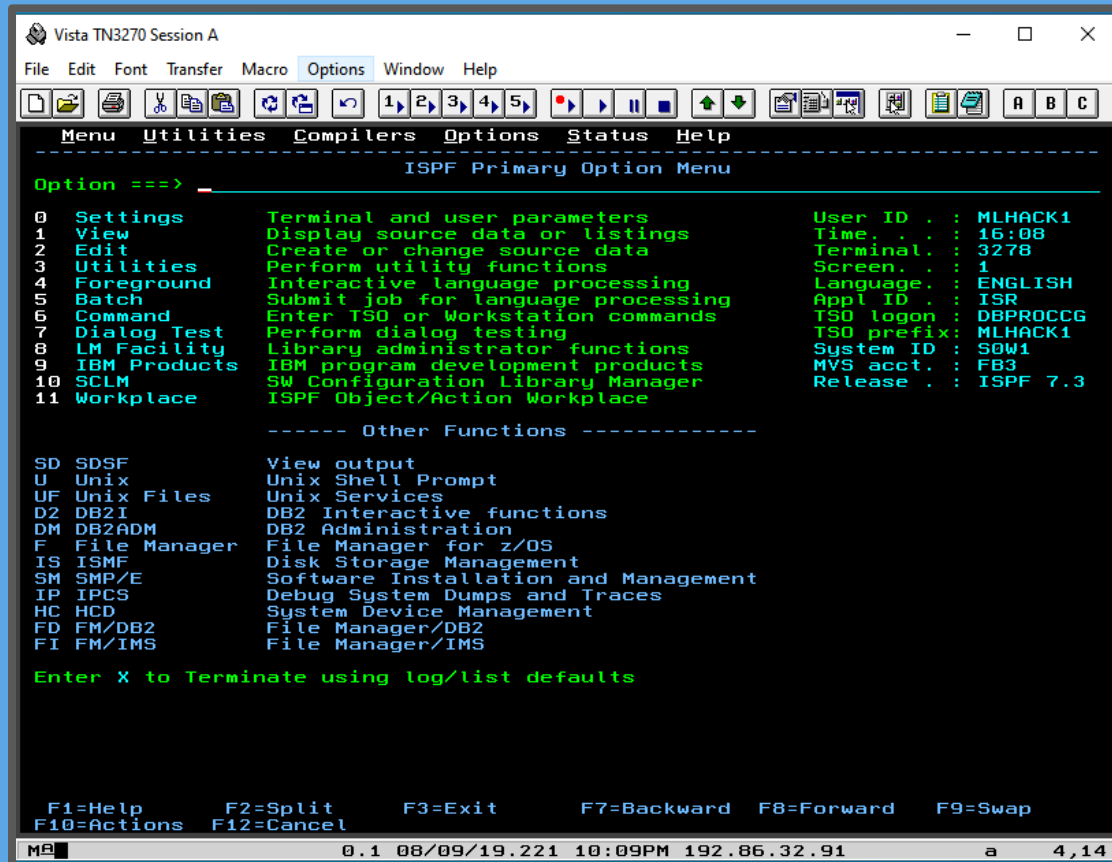
```
a
```

```
JOB MLHACK1A(JOB07234) SUBMITTED
```

```
*** _
```

# Now let's work with data

You covered some basic navigation and user input and environment modding. Now let's create something!



```
Vista TN3270 Session A
File Edit Font Transfer Macro Options Window Help
-----
Menu Utilities Compilers Options Status Help
-----
ISPFL Primary Option Menu

Option ==>

0 Settings          Terminal and user parameters      User ID . : MLHACK1
1 View             Display source data or listings    Time . . : 16:08
2 Edit            Create or change source data   Terminal. : 3278
3 Utilities        Perform utility functions      Screen. . : 1
4 Foreground      Interactive language processing    Language. : ENGLISH
5 Batch           Submit job for language processing  Appl ID . : ISR
6 Command         Enter TSO or Workstation commands  TSO logon : DBPROCCG
7 Dialog Test     Perform dialog testing          TSO prefix: MLHACK1
8 LM Facility     Library administrator functions   System ID : SOW1
9 IBM Products   IBM program development products   MVS acct. : FB3
10 SCLM           SW Configuration Library Manager  Release . : ISPF 7.3
11 Workplace      ISPF Object/Action Workplace

----- Other Functions -----

SD SDSF          View output
U Unix           Unix Shell Prompt
UF Unix Files    Unix Services
D2 DB2I          DB2 Interactive functions
DM DB2ADM        DB2 Administration
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HC HCD           System Device Management
FD FM/DB2        File Manager/DB2
FI FM/IMS        File Manager/IMS

Enter X to Terminate using log/list defaults

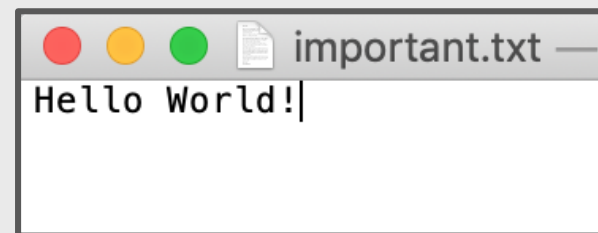
F1=Help      F2=Split      F3=Exit      F7=Backward  F8=Forward  F9=Swap
F10=Actions  F12=Cancel

MA 0.1 08/09/19.221 10:09PM 192.86.32.91 a 4,14
```

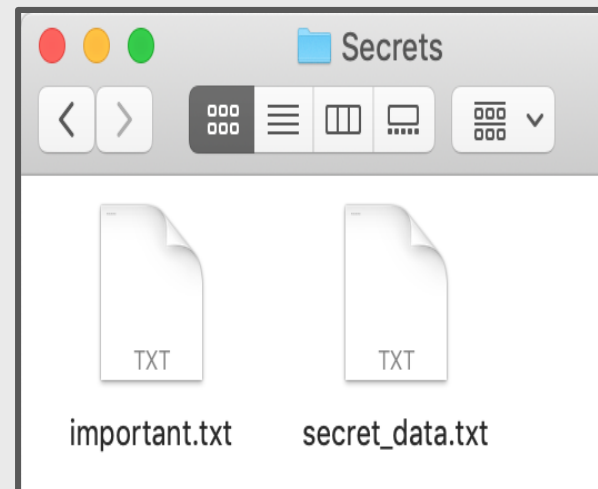
# Storing Data on a Mainframe

If you use a computer regularly, you are already familiar with how files work!

Files contain data =



Folders can contain files =



# Data Sets

A file in z/OS is called a **Data Set**.

There are two types of data sets we will encounter today, and they have a slightly different functions from each other. But they are both used for collecting or storing information of some type.

We have:

- **Sequential** Data Set
- **Partitioned** Data Sets

## Sequential Data Set

- Stored items of data that can consist of anything! Much like cooking instructions, or a simple text file with your favorite movies inside.
- The data must be parsed *sequentially*. This means if 20 items exist in a sequential data set, and you want item 11. You must pass the preceding 10 items to access it first.
- Records inside data sets typically match in length. This level of definition makes for very efficient and high performing dataset access.

# Partitioned Data Set

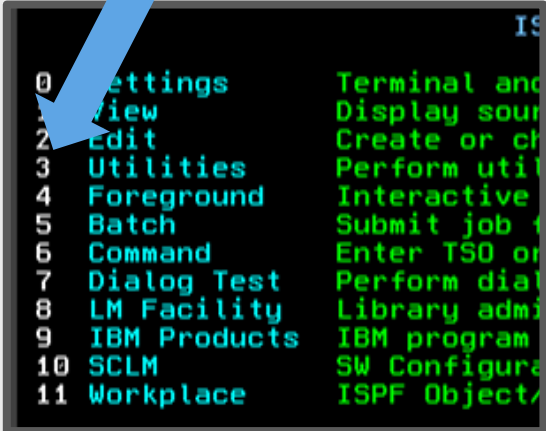
- These data sets are more representative of **files** inside of a **folder**.
- Keeps an **index** (detailed record) of all the members inside, and let's users reference and access them by their reference name.
- The members inside a partitioned dataset are often **sequential data sets**.

## Browsing Data Sets

ISPF provides a facility to browse and inspect data sets on the z/OS filesystem.

Let's navigate the ISPF and take a look inside!

1. Log back on to ISPF.
1. In the primary options, identify the option **Utilities**. It is item 3 in the command menu. Type '3' in the input field and press **ENTER**.



```

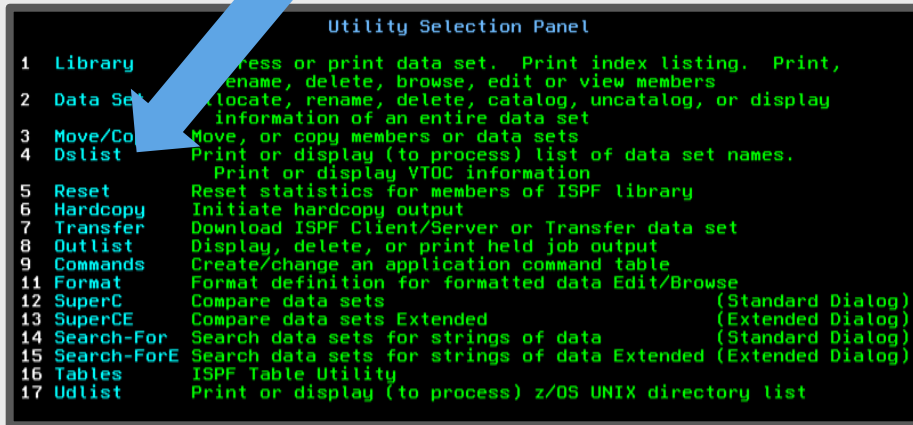
ISPF
0 Settings      Terminal and
1 View         Display sour
2 Edit         Create or ch
3 Utilities     Perform uti
4 Foreground   Interactive
5 Batch        Submit job
6 Command      Enter TSO or
7 Dialog Test  Perform dial
8 LM Facility  Library admi
9 IBM Products IBM program
10 SCLM        SW Configura
11 Workplace   ISPF Object/
  
```



```

Option ==> 3
F1=Help      F2=Split      F3=Exit
F10=Actions  F12=Cancel
  
```

# Browsing Data Sets



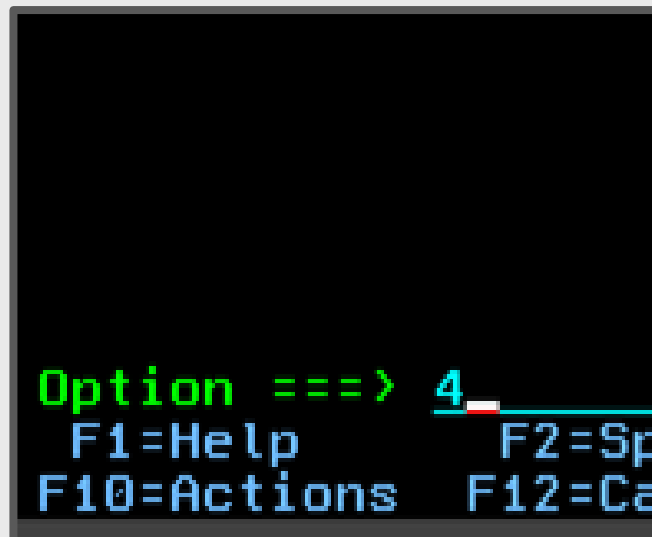
```
Utility Selection Panel

1  Library      Access or print data set. Print index listing. Print,
2  Data Set     Allocate, rename, delete, catalog, uncatalog, or display
3  Move/Copy    Move, or copy members or data sets
4  Dslist       Print or display (to process) list of data set names.
5  Reset        Reset statistics for members of ISPF library
6  Hardcopy     Initiate hardcopy output
7  Transfer     Download ISPF Client/Server or Transfer data set
8  Outlist      Display, delete, or print held job output
9  Commands     Create/change an application command table
11 Format       Format definition for formatted data Edit/Browse
12 SuperC       Compare data sets (Standard Dialog)
13 SuperCE      Compare data sets Extended (Extended Dialog)
14 Search-For   Search data sets for strings of data (Standard Dialog)
15 Search-ForE Search data sets for strings of data Extended (Extended Dialog)
16 Tables       ISPF Table Utility
17 Udlist       Print or display (to process) z/OS UNIX directory list
```

You will be presented with another similar menu of utilities. Here you can access several tools for **filtering** and **searching datasets by a term**.

1. The one we are interested now is **Dslist**, which stands for **Data Set List**. You will notice it is option 4.

1. Enter **4** and press **ENTER**.



```
Option ==> 4
F1=Help      F2=Sp
F10=Actions  F12=Ce
```



## z/OS Utilities

Instead of using a mouse and cursor to move from utility to utility, we use numbers and letters to navigate around. This may seem cumbersome at first, but with familiarity, you will be able to navigate around very quickly.

The **utilities** menus provide an amazing way of performing many simple and complex actions.

```
1  Library
2  Data Set
3  Move/Copy
4  Dslist

5  Reset
6  Hardcopy
7  Transfer
8  Outlist
9  Commands
11 Format
12 SuperC
13 SuperCE
14 Search-For
15 Search-ForE
16 Tables
17 Udlist
```

```
0  Settings
1  View
2  Edit
3  Utilities
4  Foreground
5  Batch
6  Command
7  Dialog Test
8  LM Facility
9  IBM Products
10 SCLM
11 Workplace
```

# Dataset naming convention

- On z/OS, the names of datasets are comprised of several small strings, separated by a '.' character.
- Each of these small strings can **not** be longer than 8 characters.
- In this environment, you will generally see your username as the first string in the sequence of strings that make up a dataset name.

# Dataset naming convention

## Example:

If your username was **MLHACK**.

You would find your datasets to be named such as

**MLHACK.SEQ.DATA.**

This would represent the user **MLHHACK** has access.  
The dataset they have access to is a **sequential dataset**.

## Browsing Data Sets

```


Menu  RefList  RefMode  Utilities  Help
                                     Data Set List Utility

blank Display data set list          P F
      V Display VTOC information      PV F

Enter one or both of the parameters below:
Dsname Level . . . 
Volume serial . . . 

Data set list options
Initial View
1 1. Volume
2 2. Space
3 3. Attribute

Enter "/" to select
/ Confirm Data
/ Confirm Member
/ Include Additional
    
```



Let's investigate any data sets that are associated with your user ID.

1. Start by locating the field titled **Dsname Level**.
1. Enter your User ID in the empty **Dsname** field.

```


Enter one or both of the parameters below:
Dsname Level . . . MLHACK1
Volume serial . . . 
    
```

*Reminder, your User ID is the one you logged into the Mainframe with!*

## Browsing Files

At the top of the interface the **Data Set List Utility** indicates that we should *leave* the command input **blank** to show a list of data sets.

3. Once your userID is typed in Dsname field, press **ENTER** to proceed.



```
Menu  RefList  RefMode  Utilit
Data
blank Display data set list
V Display VTOC informatio
Enter one or both of the paramet
Dsname Level . . . MLHACK1
Volume serial . . .
Data set list options
Initial View
1 1. Volume
2 2. Space
3 3. Attrib
4 4. Total
When the data set list is displa
"/" on the data set list comma
an ISPF line command, the name
"=" to execute the previous co
```

## Browsing Data Sets

As the ISPF changes you will see a list of data sets.

```
Menu Options View Utilities Compilers Help
DSLIST - Data Sets Matching MLHACK1                               Row 1 of 4
Command - Enter "/" to select action                               Message          Volume
-----
      MLHACK1                                                       *ALIAS
      MLHACK1.PDS.DATA                                              MTM003
      MLHACK1.SEQ.DATA                                              MTM001
      MLHACK1.SOW1.ISPF.ISPPROF                                     MTM002
***** End of Data Set list *****
```

The list can be recognised as the green text with items prefixed with **MLHACK1**. Yours will look slightly different!

The first item in the list is just our account **ALIAS**. But let's look below!

## Browsing Data Sets

We have two readily accessible datasets!

Let's think back to the dataset naming conventions mentioned before.


```
-----  
MLHACK1  
MLHACK1.PDS.DATA  
MLHACK1.SEQ.DATA  
MLHACK1.S0W1.ISPF.ISPPROF  
***** End of Data
```

**MLHACK1.PDS.DATA** - this name suggests that it is a **Partitioned Data Set**.

**MLHACK1.SEQ.DATA** - this name suggests that it is a **Sequential Data Set**.

## Sequential Data Sets

```
Menu Options View Utilities Comp
DSLIST - Data Sets Matching MLHACK1
Command - Enter "/" to select action
-----
MLHACK1
MLHACK1.PDS.DATA
MLHACK1.SEQ.DATA
MLHACK1.SQW1.ISPF.ISPPROF
***** End of Data Set List *****
```



We can open and look inside these datasets inside our the ISPF we're using now.

1. Navigate to the input field on the left side of the **USERID.SEQ.DATA** dataset.

```
Command - Enter "/" to select action
-----
MLHACK1
MLHACK1.PDS.DATA
b_ MLHACK1.SEQ.DATA
MLHACK1.SQW1.ISPF.ISPPROF
***** End of Data Set List *****
```

2. Type in **b** and press **ENTER**.

The '**b**' command represents a '**browse**' function.



# It's the Simpsons!

[illegible]

## Sequential Data Sets

- This is the inside of a **Sequential Data Set**. It is the closest representation of a conventional 'file' on z/OS. It is just a block of data, with a predefined length.
- Every **Sequential Data Set** is made of **RECORDS** of predefined length. Think of **RECORDS** as the lines of text. In this dataset, each line is arbitrary symbols that build an image of the Simpsons characters. But it can be anything, from medical to banking data!



# Simpsons ASCII

This Simpsons artwork inside a dataset is comprised of characters found entirely on a computer, just like the ones you're using to control the ISPF and utilities.

This art style is called **ASCII-Art**.

```
BROWSE      MLHACK1.SEQ.DAT                      Line 000000000 Col 001 080
***** Top of Data *****
I completed Master the Mainframe Part 1

I am working on Master the Mainframe Part 2

ISPF editor primary commands used to make image recognizable

c '(o)(o)' x'00' all;c | x'01' all;c / x'02' all;c \ x'03' all
-----

              (####)
            (#####)
          (#####)
        (#####)
       (#####)
      (#####)
     (#####)
    (#####)
   (#####)
  (#####)
 (#####)
(#####)
_#_
c _c_ (#)
_#_ (#)
_#_ (#)
_#_
000000
Homer           Marge

V
<
>
(c_) <

Command ==>>> Scroll ==>>> PAGE
F1=Help      F2=Split    F3=Exit    F5=Rfind    F7=Up
F10=Left     F11=Right   F12=Cancel
```

## Sequential Data Sets



Inside this dataset, you can navigate using **F7** and **F8** to move Up and Down the document, just like we did with the **LOGS** earlier in the workshop.

The **Scroll** field indicates how many records the 'scroll' function moves up or down at once. You can change it from its default, which is **PAGE** to a number.



This number will show how many individual lines are moved up or down every time you press **F7** or **F8** to navigate.

## Control Keys



```
Command ===> Scroll ===> PAGE
_F1=Help   F2=Split  F3=Exit   F5=Rfind  F7=Up     F8=Down   F9=Swap
_F10=Left  F11=Right F12=Cancel
```

When navigating inside datasets, remember that the control panel is listed at the bottom of the ISPF.

After you have been inside a dataset, you will probably want to **Exit** the file eventually.

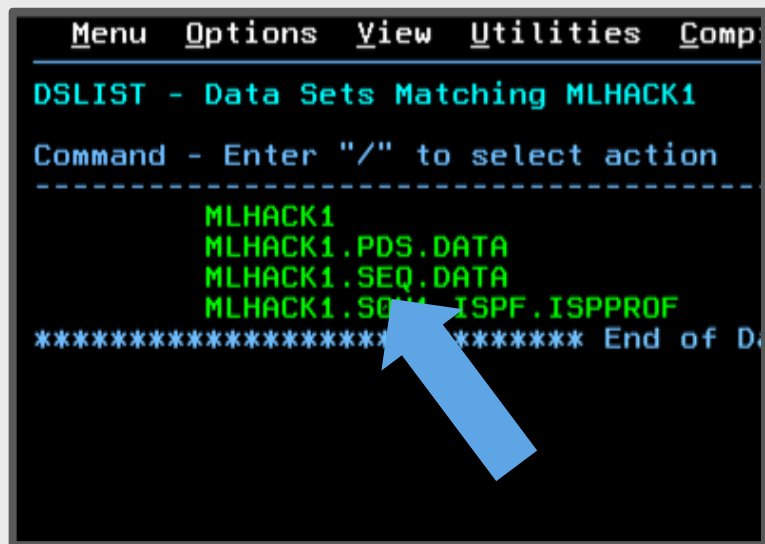
You can press **F3** for this.

# Partitioned Data Sets

**Partitioned Data Sets** are capable of containing many members, which can be treated like **Sequential sub-data sets**.

This might remind you of a folder from an operating system like Windows or Mac.

A key difference between **Partitioned Data Sets** and **folders** is that they cannot also contain another **Partitioned Data Set**. A **folder** can contain as many folders as it wants!



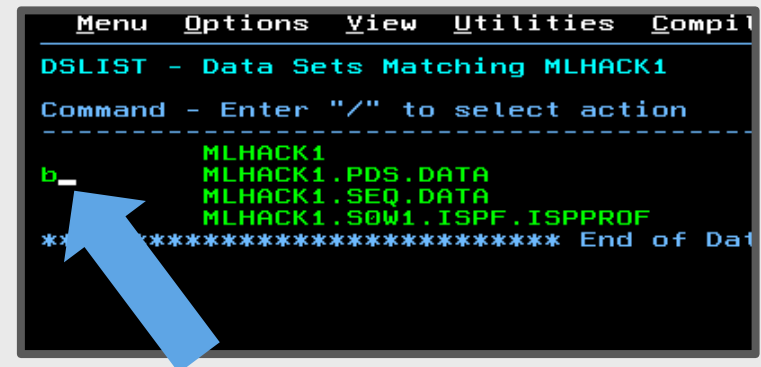
```
Menu Options View Utilities Comp
-----
DSLIST - Data Sets Matching MLHACK1
Command - Enter "/" to select action
-----
MLHACK1
MLHACK1.PDS.DATA
MLHACK1.SEQ.DATA
MLHACK1.SOME.ISPF.ISPPROF
***** End of Data Set List *****
```

## Partitioned Data Sets

Let's browse the **partitioned data set** too!

1. Navigate to the input field for **USERID.PDS.DATA**.

1. Type **b** in the field and press **ENTER**.



```
Menu Options View Utilities Compil
DSLIST - Data Sets Matching MLHACK1
Command - Enter "/" to select action
-----
b_      MLHACK1
        MLHACK1.PDS.DATA
        MLHACK1.SEQ.DATA
        MLHACK1.S0W1.ISPF.ISPPROF
**      ***** End of Data
```

## Partitioned Data Sets

Menu	Functions	Confirm	Utilities	Help
BROWSE	MLHACK1.PDS.DATA			
	Name	Prompt	Size	Created
	BINARY		28	2019/05/25
	COUNTRY			2019/05/25 17:24:52
	FUN		21	2019/05/24
	Z		23	2019/05/24
	**End**			

Inside the the sequential data set, we were presented with clear direct text contents. Inside a partitioned dataset it is **sub-structure** of **members**.

- Inside this partitioned dataset, every member inside can be browsed just like a sequential dataset.
- You can navigate in front of these members, type **b** and press **ENTER** to also navigate inside and view the contents.



## Check them out!

Take a moment to navigate around  
and just exit with

**F3**

when you're done!

# So many data sets!

```

Menu Utilities Computers Help
Browse MLHACK1.PDS.DATA(Z) - 01.00 Line 0000000000 Col 001 000
***** Top of Data *****

Zis an
enterprise
computer
system

***** Bottom of Data *****

Command ==> F3=Split F3=Exit F5=Rfind F7=Up Scroll ==> 4
F10=Left F11=Right F12=Cancel F8=Down F9=Swap

```

```

Menu Utilities Computers Help

BROWSE MLHACK1.PDS.DAT(BINARY) 01.00 Line 0000000000 Col 001 080
***** Top of Data *****
All computer data and programs are a string of 1's and 0's
at the lowest level. However, humans do not enter 1's and
0's to enter data or write programs.

The lowest level is known as binary.

Each binary position is a bit.

A bit is 1 (on) or 0 (off).

Humans enter characters translated to a string of bits.

Computers translate characters to a string of bits and vice versa.

Hexadecimal numerals are used by computers to provide a more
human-friendly representation of binary-coded values.

Hexadecimal numerals are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
-- A is decimal 10
-- B is decimal 11
-- C is decimal 12
-- D is decimal 13
-- E is decimal 14
-- F is decimal 15

Binary 0000 is hexadecimal 0 and decimal 0
Binary 1111 is hexadecimal F and decimal 15
***** Bottom of Data *****

Command ==>
F1=Help F2=Split F3=Exit F5=Find F7=Up F8=Down F9=Swap
F10=Left F11=Right F12=Cancel

```

```

Menu Utilities Compilers Help
BROWSE      MLHACK1.PDS.DAT(COUNTRY)      Line 0000000000 Col 001 080
***** Top of Data *****
AD Andorra
AE United Arab Emirates
AF Afghanistan
AG Antigua and Barbuda
AI Anguilla
AL Albania
AM Armenia
AN Netherlands Antilles
AO Angola
AQ Antarctica
AR Argentina
AS American Samoa
AT Austria
AU Australia
AW Aruba
AZ Azerbaijan
BA Bosnia and Herzegovina
BB Barbados
BD Bangladesh
BE Belgium
BF Burkina Faso
BG Bulgaria
BH Bahrain
BI Burundi
BJ Benin
BM Bermuda
BN Brunei
BO Bolivia
BR Brazil
BS Bahamas
BT Bhutan
BV Bouvet Island
BW Botswana
BY Belarus
DZ Belize
CA Canada
Command ==> F2=Split F3=Exit F5=Rfind F7=Up F8=Down ==> 4
F10=Left F11=Right F12=Cancel F9=Swap

```

```

Menu Utilities Compilers Help
BROWSE MLHACK1.PDS.DAT(FUN) - 01.02 Line 0000000000 Col 001 000
***** Top of Data *****
Welcome!
MEM 2019
Do you know the Effi Mail word below?
      (o o)      (o o)      o ~ ~ ~ o      o ~ ~ ~ o      H      { * }
      (o o)      (o o)      (o o)      (o o)      H      (o o)
000 ( _ ) - 000-000-000 ( _ ) - 000-000-000 ( _ ) - 000-000-000 ( _ ) - 000-
***** Bottom of Data *****
Command ==> -
F1=Help      F2=Split      F3=Exit      F5=Rfind      F7=Up      Scroll ==> 4
F10=Left     F11=Right     F12=Cancel  F8=Down      F9=Swap

```

# Hello, Unix Filesystem

So far, we've been using ISPF to interact with z/OS, but the z/OS Operating System also provides a UNIX interface so you can run UNIX commands and work within a UNIX filesystem.

Even better, you can manage z/OS datasets from within the UNIX environment and vice-versa.

In the next challenge, we are going to create a file on the **unix filesystem**, and manipulate it on the z/OS filesystem.

# What's a Unix File system?

- It is an alternate file system to z/OS
- It's a central component in the software of many desktop and server environments.
- It provides a specific format for organising **files** and **folders** into a tree structure hierarchy.
- It is very recognisable file structure in Linux and Mac computers.

## For example

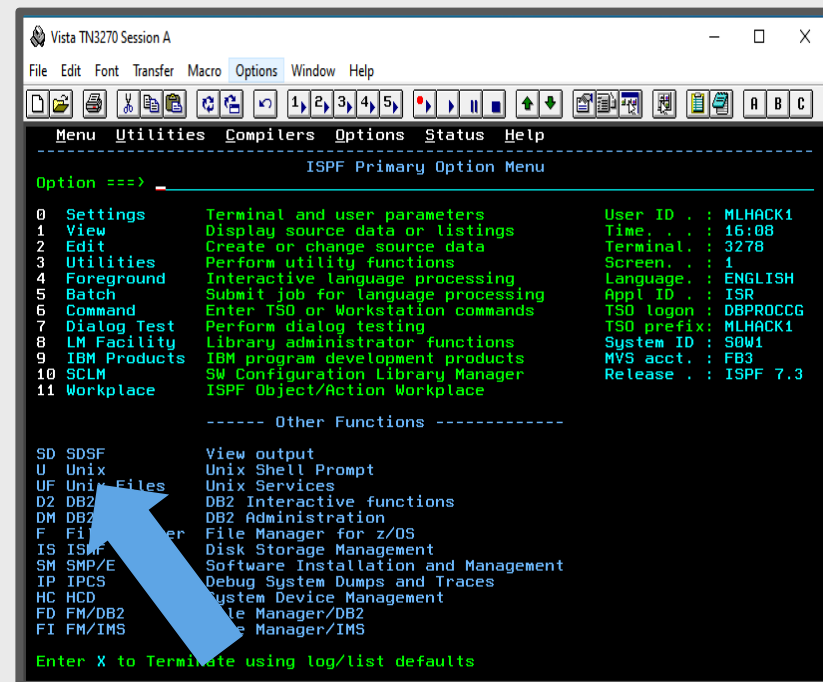
In a Unix environment:

*Personal files and folders would go into a folder called **/home**.  
Executable binaries would go into one folder called **/bin**.*

## Back to ISPF Main Menu

Let's navigate back in the ISPF Main Menu. Here you will find an option named **Unix (Unix Shell Prompt)** in Other Functions.

1. You can activate this by typing **U** and pressing **ENTER**.



```

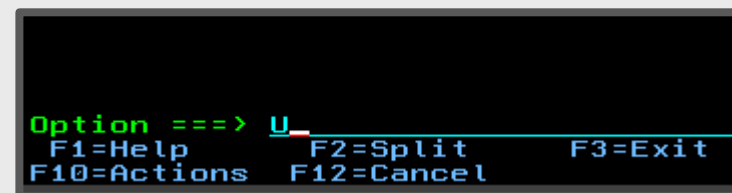
Vista TN3270 Session A
File Edit Font Transfer Macro Options Window Help
-----
Menu Utilities Compilers Options Status Help
ISPF Primary Option Menu

Option ==>

0 Settings      Terminal and user parameters      User ID . : MLHACK1
1 View          Display source data or listings    Time . . : 16:08
2 Edit          Create or change source data       Terminal.: 3278
3 Utilities     Perform utility functions        Screen . : 1
4 Foreground   Interactive language processing   Language.: ENGLISH
5 Batch        Submit job for language processing Appl ID . : ISR
6 Command      Enter TSO or Workstation commands TSO logon.: DBPROCCG
7 Dialog Test  Perform dialog testing           TSO prefix: MLHACK1
8 LM Facility  Library administrator functions   System ID.: SOW1
9 IBM Products IBM program development products MVS acct. : FB3
10 SCLM        SW Configuration Library Manager Release . : ISPF 7.3
11 Workplace   ISPF Object/Action Workplace

----- Other Functions -----
SD SDSF        View output
U Unix         Unix Shell Prompt
UF Unix Files  Unix Services
D2 DB2         DB2 Interactive functions
DM DB2         DB2 Administration
F File Manager File Manager for z/OS
IS ISMF        Disk Storage Management
SM SMP/E       Software Installation and Management
IP IPCS        Debug System Dumps and Traces
HC HCD         System Device Management
FD FM/DB2      File Manager/DB2
FI FM/IMS      File Manager/IMS

Enter X to Terminate using log/list defaults
  
```



```

Option ==> U
F1=Help      F2=Split      F3=Exit
F10=Actions  F12=Cancel
  
```

# Unix Shell and Filesystem

This interface is different from the ISPF one you've been using

This is a **Unix Shell** interface

You're going to use this to explore the *Interoperability* of z/OS and UNIX.

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/z/mlhack1 >
```

**Note:** You may need to press ENTER again as a response to a \*\*\* prompt in the input field.

# Unix Shell and Filesystem

When you activate UNIX, your terminal interface will open itself into a location of a UNIX Filesystem. The directory you are placed inside is in the format of **/z/userid**.


This is your home on the unix system.

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/z/mlhack1 >
```



# Unix Shell and Filesystem

To get started with the Unix file system, let's create a standard unix file next..

1. Make sure your cursor is in the input field.
1. Type in **date** and press ENTER.

This is going to display the **current date** and **time** *live* in your Terminal!

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/z/mlhack1 > date
Wed Aug 14 19:15:45 CDT 2019
/z/mlhack1 >
```





# Unix Shell and Filesystem

Often with files and computer processes we save the time and date somewhere to know when something happened!

We might store this in the file name to know *when it was created*, or inside to tell us *when the file was modified*. This is typically know as **Timestamping**.

What we will do next is save a timestamp, inside a file on the Unix system.



# Unix Shell and Filesystem

We need to create a file and fill a file with date and time as its contents.

1. Navigate to the input field.  
Type in `date > p1` and press **ENTER**.

This is going to print the **datetime** but will redirect it from the Terminal output to a file named **p1**. Since this file doesn't yet exist, Unix will create it for you!

```
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/z/mlhack1 > date  
Wed Aug 14 19:15:45 CDT 2019  
/z/mlhack1 > date > p1  
/z/mlhack1 >
```

# Unix Shell and Filesystem

A Unix command called **Cat** exists to read the contents of a file and print it in the Terminal. We can use this to check our file was created and the contents are inside!

```
z/mlhack1 > date  
ed Aug 14 19:15:45 CDT 2019  
z/mlhack1 > date > p1  
z/mlhack1 > cat p1  
ed Aug 14 19:18:13 CDT 2019  
z/mlhack1 >
```

1. Type in **cat p1**. 

The name **cat** derives from **concatenate**. Which is to join two strings together!

# Unix Shell and Filesystem

Let's get *moving*!

We have created an item in the Unix file system, it needs to be rehomed in the z/OS file system.

This can be done with more Unix commands, such as **Copy/CP**.

# Unix Shell and Filesystem

You are going to copy your timestamp file into a partitioned data set on z/OS.

This way we know where it's saved on the Mainframe. Inside **USERID.PDS.DATA**.

1. Type

```
cp p1 '//pds.data(p1)'
```

This will copy p1 through the shared space of the two filesystems!

```
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/z/mlhack1 > date
Wed Aug 14 19:15:45 CDT 2019
/z/mlhack1 > date > p1
/z/mlhack1 > cat p1
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 > cp p1 '//pds.data(p1)'
/z/mlhack1 >
```

# Unix Shell and Filesystem

It's also possible to access the dataset that is now inside the z/OS file system *from* the Unix file system. Unix tools will let us do this! We can use **Cat** again but with we can provide the syntax determine the file is in the z/OS system instead.

```
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/z/mlhack1 > date
Wed Aug 14 19:15:45 CDT 2019
/z/mlhack1 > date > p1
/z/mlhack1 > cat p1
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 > cp p1 '//pds.data(p1)'
/z/mlhack1 > cat '//pds.data(p1)'
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 >
```

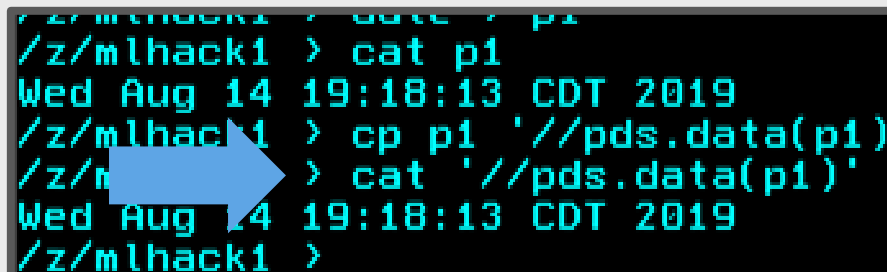
1. Type in **cat '//pds.data(p1)'**. This will display the contents of the p1 data set.

# Unix Shell and Filesystem

1. Type `cat '//pds.data(p1)'`.

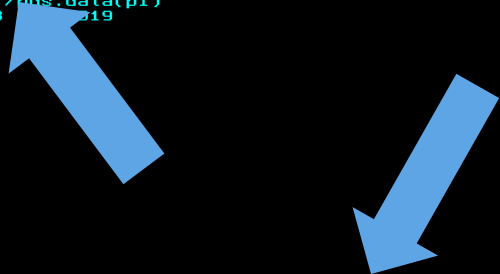
Notice this is slightly different from when we accessed files on z/OS and Unix.

The dataset we want to access is wrapped in single quotation marks and is prefixed with a `//`.



```
/z/mlhack1 > cat p1  
Wed Aug 14 19:18:13 CDT 2019  
/z/mlhack1 > cp p1 '//pds.data(p1)'  
/z/mlhack1 > cat '//pds.data(p1)'  
Wed Aug 14 19:18:13 CDT 2019  
/z/mlhack1 >
```

## Verify your Data Set



```
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/z/mlhack1 > date
Wed Aug 14 19:15:45 CDT 2019
/z/mlhack1 > date > p1
/z/mlhack1 > cat p1
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 > cp p1 '//pds.data(p1)'
/z/mlhack1 > cat '//pds.data(p1)'
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 > exit

>>> FSUM2331 The session has ended. Press <Enter> to end OMVS. RUNNING
```

We want to check the dataset we created **p1** actually exists in the z/OS file system, and that we didn't do anything wrong on the way!

Let's navigate back to z/OS.

1. To leave the Unix shell, type **exit** and press **ENTER**.



# Verify your Data Set

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```

```
/z/mlhack1 > date
Wed Aug 14 19:15:45 CDT 2019
/z/mlhack1 > date > p1
/z/mlhack1 > cat p1
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 > cp p1 '//pds.data(p1)'
/z/mlhack1 > cat '//pds.data(p1)'
Wed Aug 14 19:18:13 CDT 2019
/z/mlhack1 > exit
```

```
>>> FSUM2331 The session has ended. Press <Enter> to end OMVS.
```

RUNNING

A message appears below telling you the session has ended.

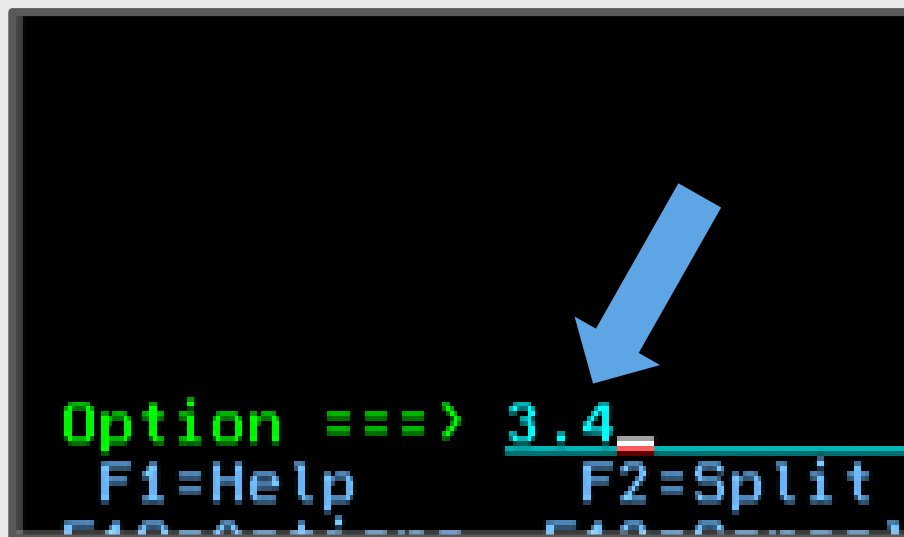
2. Press **ENTER** one more time and you will navigate back to ISPF.

## Quick shortcut!

Instead of finding the Utilities menu, entering a first option, then a second, we can go directly to the **Utility** we want, which is **Dslist**!

Since we know that **Utilities** is option number **3**, and **Dslist** is option number **4** in the menu after.

## Quick shortcut!



Let's try it!

3. Type **3.4** in the command input to be directly taken there.
3. Press **ENTER**.

## Verify your Data Set

```

RefList  RefMode  Utilities  Help


                                Data Set List Utility

Display data set list          P F
Display VTOC information      PV F

or both of the parameters below:
Level . . . MLHACK1
serial . . .

list options
l View
Volume
Space
Attrib
Total

Enter "/" to select
Confirm Data
Confirm Membe
Include Addit
Display Catal
Display Total
Prefix Dsname
    
```

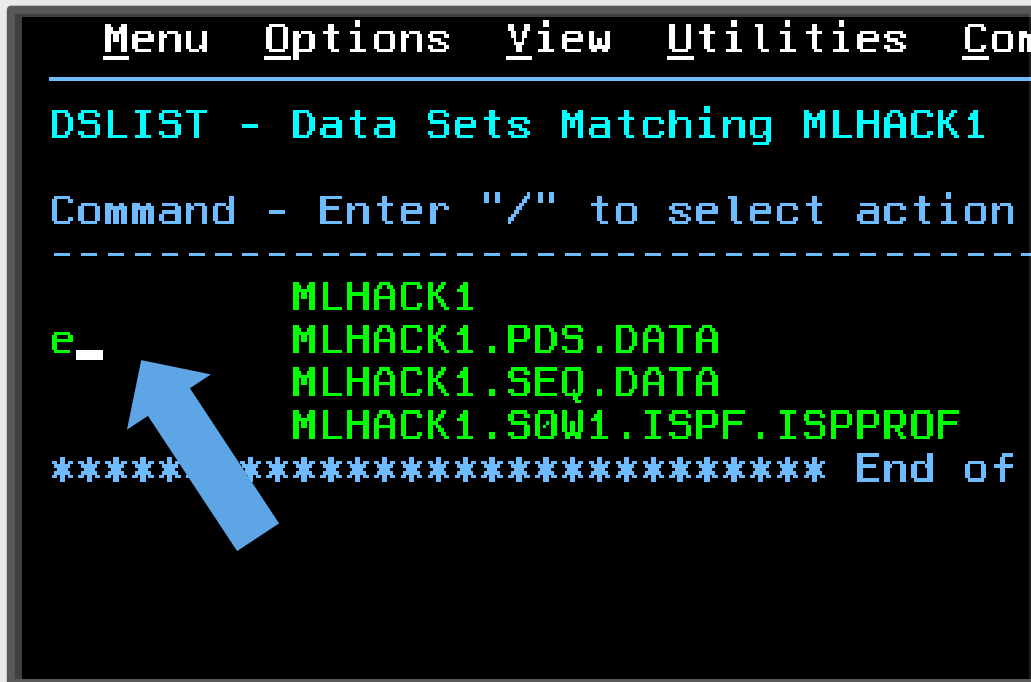


Now you're immediately taken to the **Data Set List Utility**!

1. Like before, enter your user identifier in the **Dsname field**.
1. Press **ENTER**!

## Verify your Data Set

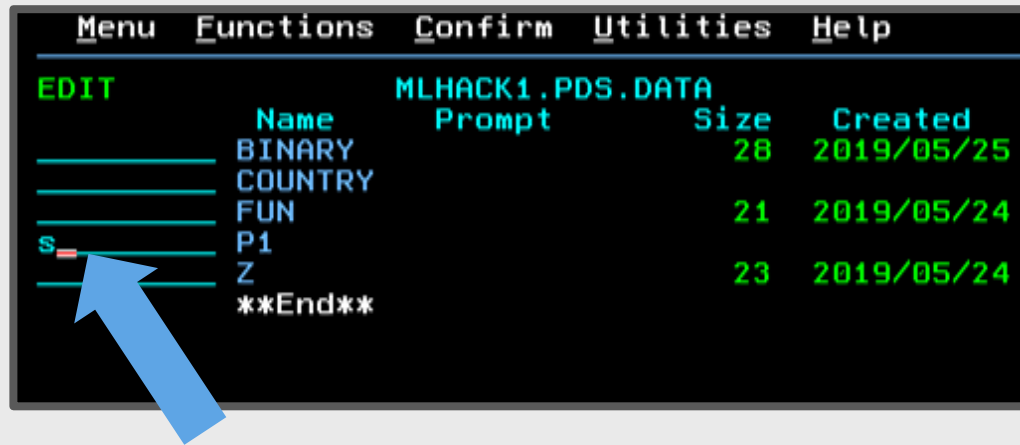
Let's use the **Edit** tool to try see the file we transferred from the Unix file system!



```
Menu Options View Utilities Command
-----
DS LIST - Data Sets Matching MLHACK1
Command - Enter "/" to select action
-----
e_      MLHACK1
        MLHACK1.PDS.DATA
        MLHACK1.SEQ.DATA
        MLHACK1.SOW1.ISPF.ISPPROF
***** End of
```

1. Type in **e** (for **Edit**) in the field in front of the Partitioned Dataset **USERID.PDS.DATA**.
1. Press **ENTER**!

## Verify your Data Set



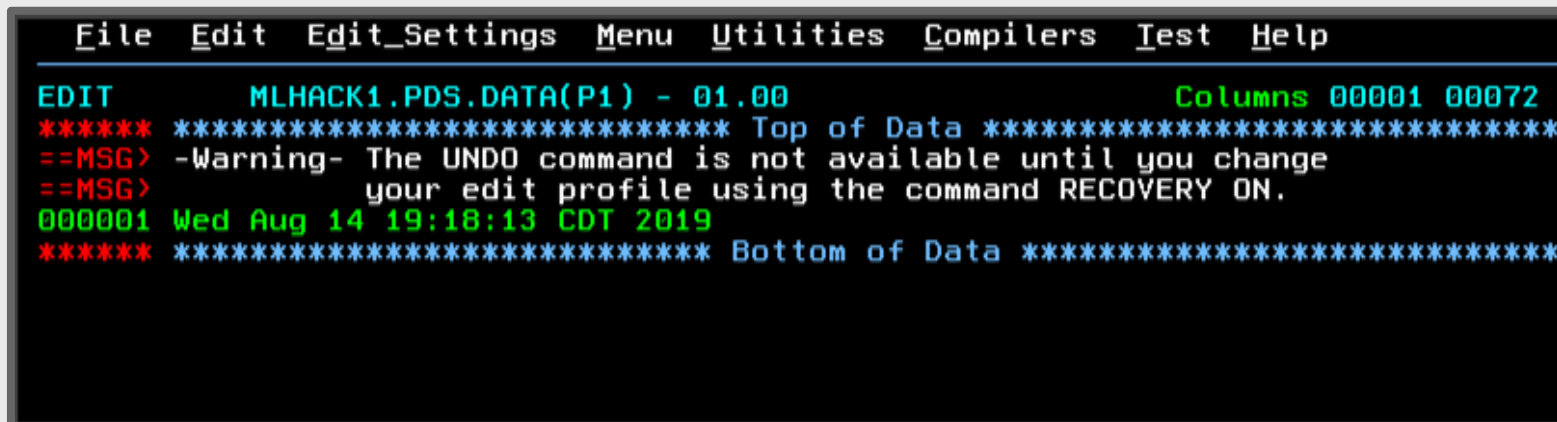
	Name	Prompt	Size	Created
	BINARY		28	2019/05/25
	COUNTRY			
	FUN		21	2019/05/24
s	P1		23	2019/05/24
	Z			
	**End**			

This is a partitioned data set, so the utility will not know which member you want to edit. It will present you with a list of members to select.

(Psst! Your **P1** dataset should be in here!)

1. Type **s** for **Select** in front of the **P1** data set and press **ENTER**.

## Verify the P1 Data Set



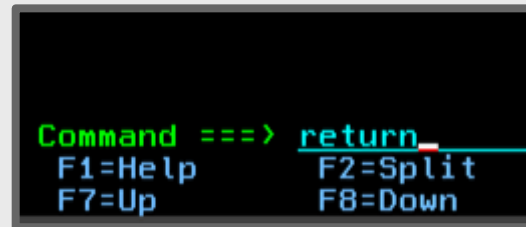
```
File Edit Edit_Settings Menu Utilities Compilers Test Help
EDIT      MLHACK1.PDS.DATA(P1) - 01.00      Columns 00001 00072
***** ***** Top of Data *****
==MSG> -Warning- The UNDO command is not available until you change
==MSG>          your edit profile using the command RECOVERY ON.
000001 Wed Aug 14 19:18:13 CDT 2019
***** ***** Bottom of Data *****
```

You should be looking at your **timestamp** in green.

This is the file you created in Unix and moved to z/OS.

You just transported a dataset between the two separate operating systems on an IBM Mainframe.

## Completing this Workshop



```
Command ==> return  
F1=Help      F2=Split  
F7=Up        F8=Down
```

1. Type `return` in the input field and press `ENTER`.

This will take you straight back to the ISPF Main Screen.

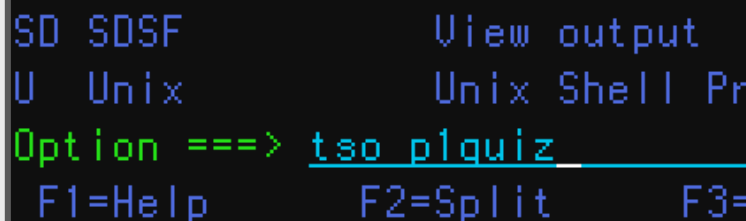


## Completing this Workshop

We have nearly completed the hands-on portion of the workshop! However, to fully complete Part 1 and move on to the rest of the contest, we have to pass a quick quiz about the mainframe.

You'll find the answers to these questions in the full Part 1 of the contest, located at: [mlhlocal.host/meet-the-mainframe](http://mlhlocal.host/meet-the-mainframe)

When you're ready to attempt the quiz and complete Part 1, enter **TSO P1QUIZ** in the **ISPF** menu.



```
SD SDSF          View output
U  Unix          Unix Shell Pr
Option ==> tso p1quiz
F1=Help      F2=Split      F3=
```

In the ISPF console type **tso p1quiz** and press **ENTER**.

# Mainframe Success!

\*\*\*\*\*

**Congratulations!**

**You successfully completed Part 1**

**Part 2 is waiting for you**

\*\*\*\*\*

\*\*\* \_

**Wow, we've learned a lot today.**  
**How about we put this all together?**

## Extra Challenges

### Challenge 1

Create a file on the **unix file system** that contains ASCII-Art of your choice. Try to do this from memory this time!

You can generate your own ASCII-Art online:

[mlhlocal.host/ascii-generator](http://mlhlocal.host/ascii-generator)

## *Where to go from here...*

- 1 Check your email after the workshop**  
For lots of resources to keep learning!
- 2 Complete the Master the Mainframe Contest**  
Take Part 2 and 3 of the MtM Contest and earn an official MtM Badge.
- 3 Sign-Up to Host your own MtM Workshop.**  
Host your own MtM workshop and become an recognized MtM Facilitator

## *Earn a Master the Mainframe Digital Badge*



By completing Parts 2 and 3 of the Master the Mainframe Contest, you can earn the Master the Mainframe Digital Badges

## ***Become a Recognized Master the Mainframe Facilitator***



Show leadership in bringing mainframe to the next generation. By becoming a facilitator you have demonstrated your knowledge of IBM Z by sharing your experience and ability to innovate on the mainframe to solve real life situations to participants throughout workshops.

Learn more about the Earning Criteria [mlhlocal.host/become-a-facilitator](https://mlhlocal.host/become-a-facilitator)

# Learning shouldn't stop when the workshop ends...

**Check your email for access to:**



- These workshop slides
- Practice problems to keep learning
- Deeper dives into key topics
- Instructions to complete the Master the Mainframe contest
- Instructions to become a recognized Master the Mainframe facilitator
- More opportunities from MLH!





Workshop

# What the Hack is the Mainframe?

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**mlh** localhost

**IBM Z**