# POSIX Command Line Utilities Just A Glimpse

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Prologue

Shell Basic

Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

Prologue

**Shell Basics** 

Basic Utilities

Intermidiate Utilities

Wonderful Tools



Prologue

Terminology

Shell Basic

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**Basic Utilities** 

Intermidia

Wonderful Tools

Conclusion

► POSIX: Portable Operating System Interface



# POSIX Command Line Utilities

Siyuan Liu

Prologue Terminology

Shell Basic

Basic Utilities

Intermidia

Wonderful Tools

Conclusion

► POSIX: Portable Operating System Interface

► CLI: Command Line Interface



Prologue Terminology

Shell Basic

Basic Utilities

Intermidia

Wonderful Tools

Conclusion

► POSIX: Portable Operating System Interface

► CLI: Command Line Interface

► Part of **POSIX** are CLI utilities, the subject today.



Prologue

Shell Basic

Basic Utilities

Intermidiat

Wonderful Tools

Conclusion

► POSIX: Portable Operating System Interface

► CLI: Command Line Interface

► Part of **POSIX** are CLI utilities, the subject today.

▶ kernel: The kernel of OS is a program that manages resources and implement IPC.



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Shell Basic

Basic Utilities

Intermidiat

Wonderful Tools

- ► POSIX: Portable Operating System Interface
- ► CLI: Command Line Interface
- ► Part of **POSIX** are CLI utilities, the subject today.
- kernel: The kernel of OS is a program that manages resources and implement IPC.
- ▶ **shell**: Opposite of kernel. The machine/human interface.



Prologue Terminology

Motivation

Shell basic

Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

► Solve various tasks efficiently.



Prologue Terminology Motivation

Shell Basic

Basic Utilities

Utilities

Wonderful Tools

- ► Solve various tasks efficiently.
- ► Solve programming-needed tasks, without programming.



Prologue Terminology Motivation

Shell Basic

Basic Utilities

Intermidiat

Utilities

Wonderful Tools

- Solve various tasks efficiently.
- ► Solve programming-needed tasks, without programming.
- ► Functional programming like experience: simple utilities pipelined to solve complex problems.



Prologue Terminology Motivation

Shell Basi

**Basic Utilities** 

Intermidiat

Wonderful Tools

- ► Solve various tasks efficiently.
- ► Solve programming-needed tasks, without programming.
- ► Functional programming like experience: simple utilities pipelined to solve complex problems.
- ► Most servers don't have a GUI, so CLI may be your only choice.



Prologue Terminology Motivation

Shell Basi

Basic Utiliti

Intermidiat

Wonderful Tools

- Solve various tasks efficiently.
- ► Solve programming-needed tasks, without programming.
- ► Functional programming like experience: simple utilities pipelined to solve complex problems.
- ► Most servers don't have a GUI, so CLI may be your only choice.
- ► Bigger than bigger.



Terminology Motivation

Shell Basi

Basic Utiliti

Intermidiat

Wonderful Tools

- ► Solve various tasks efficiently.
- ► Solve programming-needed tasks, without programming.
- ► Functional programming like experience: simple utilities pipelined to solve complex problems.
- ► Most servers don't have a GUI, so CLI may be your only choice.
- ► Bigger than bigger.
- ► ... Just bacause it's a lot of fun :-)



Prologue

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Basics of Basics

Arguments

Key Binding

Pipes

Special Files

/dev/null

General Usage

**Basic Utilities** 

Intermidiate

Wonderful Tools

Conclusion

Microsoft Student Technology Club Sun Yat-sen University ► cd, pwd, ls



Prologue

Basics of Basics

**Basic Utilities** 

Wonderful Tools

► cd, pwd, ls

► cp, mv, rm



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Shell Basics

Basics of Basics

Arguments

Key Bindin

Glob

Pipes

IO Redire

Special File

General Usag

Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

- ► cd, pwd, ls
- ► cp, mv, rm
- ► echo



# Prologue

#### Shell Basics

#### Basics of Basics

Arguments

Key Bindi

Glob

Pipes

IO Redirection Special Files

/dev/null

General Usage

# **Basic Utilities**

Intermidiate

Wonderful Tools

Conclusion

- ► cd, pwd, ls
- ► cp, mv, rm
- ► echo
- ► Running an executable.



# Prologue

#### Basics of Basics

# Basic Utilities

Wonderful Tools

- ► cd, pwd, ls
- cp, mv, rm
- ▶ echo
- ► Running an executable.
- ► Interruptting a running command: Ctrl+C.



# Prologue

### Shell Basics

#### Basics of Basics

Arguments

Key Bindir

Glob

Pipes

IO Redirect

Special File

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General Usag

Basic Utilitie

Intermidiate Utilities

Wonderful Tools

Conclusion

- ► cd, pwd, ls
- ► cp, mv, rm
- ► echo
- Running an executable.
- ► Interruptting a running command: Ctrl+C.
- ► Input an End Of File: Ctrl+D.



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Intermidiate

Wonderful Tools

Conclusion

► cd, pwd, ls

► cp, mv, rm

► echo

Running an executable.

▶ Interruptting a running command: Ctrl+C.

▶ Input an End Of File: Ctrl+D.

► Suspending a running command: Ctrl+Z.



# Prologue

# Shell Basic

#### Basics of Basics

Arguments Key Bindings

Glob

Pipes

Special Files

/dev/null

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#### Basic Utilitie

#### Intermidiate Utilities

Wonderful Tools

- ► cd, pwd, ls
- ► cp, mv, rm
- ► echo
- Running an executable.
- ▶ Interruptting a running command: Ctrl+C.
- ▶ Input an End Of File: Ctrl+D.
- ► Suspending a running command: Ctrl+Z.
- ▶ ... and resuming: fg.



Prologue

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## Arguments

Key Bindir

Glob

Pipes

Special Files

Opecial Files

General Usage

# Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

Utilities

► 1s /etc lists the contents of /etc



# Prologue

#### Shell Basic

Basics of Basics

#### Arguments

Key Binding

Glob

Pipes

IO Redired

Special File

/dev/null

General Usage

Basic Utilities

# Intermidiate

Wonderful Tools

Conclusion

▶ 1s /etc lists the contents of /etc

 $\blacktriangleright$  ... where 1s is the name of the command,



# Prologue

### Shell Basic

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#### Arguments

Glob Pipes

IO Redirecti Special File

Special Files /dev/null

General Usage

#### Basic Utilities

#### Intermidiate Utilities

Wonderful Tools

Conclusion

- ▶ 1s /etc lists the contents of /etc
- ▶ ... where ls is the name of the command,
- ▶ ... and /etc is the **SECOND** argument (argv[1]).



# Prologue

### Shell Basic

Basics of Ba

#### Arguments

Key Binding

Glob

Pipes

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Special File

/dev/null

# Intermidiate

Wonderful Tools

Conclusion

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- ▶ 1s /etc lists the contents of /etc
- ▶ ... where ls is the name of the command,
- ▶ ... and /etc is the **SECOND** argument (argv[1]).
- ► Where has the **FIRST** argument gone?



Prologue

Shell Basic

Basics of Ba

Arguments

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Special File

/dev/null

General Usa

Basic Utilities

Intermidiate Utilities

Wonderful Tools

Conclusion

- ▶ 1s /etc lists the contents of /etc
- ▶ ... where ls is the name of the command,
- ▶ ... and /etc is the **SECOND** argument (argv[1]).
- ► Where has the **FIRST** argument gone?
- ► It's the name of the executable: here, the first argument is 1s.



Prologue

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Special File

General Usag

# Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

► Completion: Tab



Prologue

Key Bindings

**Basic Utilities** 

Wonderful Tools

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► Fast cursor movement:

Ctrl/Alt+F, Ctrl/Alt+B, Ctrl+A/E



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Basics of Basic

Key Bindings

Glob

Pipes

IO Redir

Special Fil

General Usag

Basic Utilities

Intermidiate Utilities

Wonderful Tools

Conclusion

Microsoft Student Technology Club Sun Yat-sen University ► Completion: Tab

► Fast cursor movement: Ctrl/Alt+F, Ctrl/Alt+B, Ctrl+A/E

► Repeat: Alt+A.



Prologue

Shell Basic

Basics of Basic Arguments

Key Bindings

Glob

Pipes

IO Redi

Special Files

General Usag

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Intermidiate Utilities

Wonderful Tools

Conclusion

- ► Completion: Tab
- ► Fast cursor movement: Ctrl/Alt+F, Ctrl/Alt+B, Ctrl+A/E
- ► Repeat: Alt+A.
- ► Clear: Ctrl+L



Prologue

Shell Basics

Basics of Basic

Key Bindings

Glob

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Pipes

IO Redir

Special Fi

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Basic Utilitie

Intermidiate Utilities

Wonderful Tools

Conclusion

► Completion: Tab

► Fast cursor movement:

Ctrl/Alt+F, Ctrl/Alt+B, Ctrl+A/E

► Repeat: Alt+A.

► Clear: Ctrl+L

► Fast line editing:

Alt+D / Ctrl+W, Alt+W / Ctrl+K, Ctrl+H/D



Prologue

Key Bindings

Wonderful Tools

► Completion: Tab

► Fast cursor movement: Ctrl/Alt+F. Ctrl/Alt+B. Ctrl+A/E

► Repeat: Alt+A.

► Clear: Ctrl+L

► Fast line editing:

Alt+D / Ctrl+W. Alt+W / Ctrl+K. Ctrl+H/D

► Reverse search: Ctrl+R

– it is awesome!



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Glob

# **Basic Utilities**

Wonderful Tools

\*: matches anything, greedily.



# Prologue

Glob

#### **Basic Utilities**

Wonderful Tools

Microsoft Student Technology Club Sun Yat-sen University \*: matches anything, greedily.

**▶** {}: abc{1, 2} expands into abc1 abc2 abc{1..10} expands into abc1 abc2 abc3 abc4 ... abc10



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#### Shell Basic

Basics of Basics Arguments Key Bindings

#### Glob

Pipes
IO Redirection
Special Files
/dev/null
General Usage

#### **Basic Utilities**

Intermidiate Utilities

Wonderful Tools

Conclusion

- ► Example: echo 1 2 | ./a.out
- ► Example: ./a.out and then input 1 2



# Prologue

# Shell Basic

Basics of Basics

Arguments Key Bladlage

Glob

Pines

# IO Redirection

Special Files

/dev/null

General Usage

# Basic Utilities

Intermidiate Utilities

Wonderful Tools

Conclusion

- **▶** >, >>
- **>** <
- ► Special: <<.



Prologue

### Shall Basic

Basics of Basics

Key Bindings

Glob

Pipes

Pipes IO Rodi

Special Files

General Usag

### **Basic Utilities**

Intermidiate Utilities

Wonderful Tools

Conclusion

Microsoft Student Technology Club Sun Yat-sen University ► /dev/stdin: stdin. Any explanation needed?



Prologue

Shell Basics

Basics of Basics

Arruments

Vau Bindin

Glob

Dinos

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IO Redir

Special Files

General Hear

Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

► /dev/stdin: stdin. Any explanation needed?

► /dev/stdout: stdout. ?



# Prologue

### Shell Basic

Basics of Basic

Arguments

Key Bindings

Glob

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Pipes

IO Redire

### Special Files

/dev/null

General Usag

**Basic Utilities** 

Intermidiate

Wonderful Tools

Conclusion

- ► /dev/stdin: stdin. Any explanation needed?
- ► /dev/stdout: stdout. ?
- ► /dev/zero, /dev/one: zero and one.



Prologue

Shell Basics

Basics of Basic

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Key Bindings

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Pipes

IO Redirecti

Special Files

/dev/null

General Usag

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Intermidiate Utilities

Wonderful Tools

Conclusion

- ► /dev/stdin: stdin. Any explanation needed?
- ► /dev/stdout: stdout. ?
- ► /dev/zero, /dev/one: zero and one.
- ► /proc/meminfo, /proc/cpuinfo: Memory/CPU information.



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Special Files

Wonderful Tools

► /dev/stdin: stdin. Any explanation needed?

► /dev/stdout: stdout.?

► /dev/zero. /dev/one: zero and one.

► /proc/meminfo, /proc/cpuinfo: Memory/CPU information.

► /proc/<id:int>: Information of the process with pid id.



# Prologue

### Shell Basic

Basics of Basic

Key Rindings

Glob

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Pipes

IO Redire

Special Files

/dev/null

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Basic Utiliti

Intermidiate

Wonderful Tools

Conclusion

- ► /dev/stdin: stdin. Any explanation needed?
- ► /dev/stdout: stdout. ?
- ► /dev/zero, /dev/one: zero and one.
- ► /proc/meminfo, /proc/cpuinfo: Memory/CPU information.
- /proc/<id:int>:
   Information of the process with pid id.
- ► /dev/null: BLACK HOLE.



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### Shell Basic

Basics of Basics

Arguments

Key Bir

Glob

Pipes

Special Files

/dev/null

Basic Utilities

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Utilities

Wonderful Tools

Conclusion

Microsoft Student Technology Club Sun Yat-sen University ► What black hole?



# Prologue

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Basics of Basic

Arguments

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Special File

/dev/null

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Basic Utilities

Intermidiate Utilities

Wonderful Tools

Conclusion

- ▶ What black hole?
- ► Why black hole?



# Prologue

## Shell Basic

Basics of Basics

Arguments

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Glob

Dinon

IO Redire

Special Fil

/dev/null

General Usage

### Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

- ▶ What black hole?
- ► Why black hole?
- ► Example: cat > /dev/null



# Prologue

## Shell Basic

Basics of Basic

Arguments

Key Bindings

Glob

Pines

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Special F

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Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

- ▶ What black hole?
- ► Why black hole?
- ► Example: cat > /dev/null
- ► Jokes:



# Prologue

/dev/null

Wonderful Tools

- ▶ What black hole?
- ► Why black hole?
- ► Example: cat > /dev/null
- ▶ Jokes:
- ► Please send complains to /dev/null.



# Prologue

/dev/null

Wonderful Tools

- ▶ What black hole?
- ▶ Why black hole?
- ► Example: cat > /dev/null
- ▶ Jokes:
- ► Please send complains to /dev/null.
- ▶ I've learned all my courses and remembered them using my /dev/null.



# Proloque

/dev/null

Wonderful Tools

- ▶ What black hole?
- ▶ Why black hole?
- ► Example: cat > /dev/null
- ▶ Jokes:
- ► Please send complains to /dev/null.
- ▶ I've learned all my courses and remembered them using my /dev/null.
- ▶ I surely saved my money from 11.11. I put them in my /dev/null.



Prologue

### Shall Basia

Basics of Basic

Arguments Key Bindings

Glob

Pipes

IO Redirection

/dev/null

General Usage

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Basic Utilities

Intermidiate Utilities

Wonderful Tools

Conclusion

Microsoft Student Technology Club Sun Yat-sen University ▶ man: Read manual for the command.



# Prologue

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Basics of Basic

Arguments Key Bindings

Glob

IO Redired

Special File

General Usage

Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

- ▶ man: Read manual for the command.
- ▶ apropos: Search manual page title and description.



## Prologue

### Shall Basic

Basics of Basic

Arguments Key Bindings

Glob

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Pipes

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General Usage

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Intermidiate

Wonderful Tools

Conclusion

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- ▶ man: Read manual for the command.
- ▶ apropos: Search manual page title and description.
- ▶ awesome-command --help: Show help for awesome-command.

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Prologue

Shell Basic

Basic Utilitie

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head/tail

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Practice: Problem

Intermidiate Utilities

Wonderful Tools

Conclusion

Microsoft Student Technology Club Sun Yat-sen University ► Example: cat 1.txt



Prologue

Shell Basic

Basic Utilitie

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Practice: Probler

Intermidiate Utilities

Wonderful Tools

Conclusion

► Example: cat 1.txt

► Example: cat 1.txt 2.txt



Prologue

cat

Wonderful Tools

► Example: cat 1.txt

► Example: cat 1.txt 2.txt

► Use case: stay tuned.



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Shell Basic

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Practice: Probler

Intermidiat

Wonderful Tools

Conclusion

► Example: paste 1.txt 2.txt



Prologue

paste

Wonderful Tools

► Example: paste 1.txt 2.txt

▶ Use case: paste accounts passwords



Prologue

head/tail

Utilities

Wonderful Tools

► Example: head longlongfile.log



Prologue

head/tail

Wonderful Tools

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► Example: head longlongfile.log

► Example: head -n 20 longlongfile.log

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Prologue

head/tail

Wonderful Tools

► Example: head longlongfile.log

► Example: head -n 20 longlongfile.log

► Example: tail -f takeslongtime.log



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Shell Basics

Basic Utilitie

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Practice: Problem

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Intermidiate Utilities

Wonderful Tools

Conclusion

► Example: sort accounts



Prologue

Shell Basics

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cat

paste

head/tail

sort

uniq

Practice: Problem

Intermidiate Utilities

Wonderful Tools

Conclusion

► Example: sort accounts

► Example: sort -n nums



Prologue

Shell Basic

Rasic I Itilitie

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paste

head/ta:

sort

uniq

Practice: Problem

Intermidiate Utilities

Wonderful Tools

Conclusion

► Example: sort accounts

► Example: sort -n nums

► Practice:

 ${\tt du}\ {\tt -d}\ 1$  can be used to find disk usage of every subdirectory in current working directory.

So, how can I find out the most space-consuming folder?



Prologue

Shell Basic

Basic Utilitie

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head/tai

sort

uniq

Practice: Problem

Intermidiat

Wonderful Tools

Conclusion

► Example: sort accounts

► Example: sort -n nums

► Practice:

 ${\tt du}\,\,{\tt -d}\,\,{\tt 1}$  can be used to find disk usage of every subdirectory in current working directory.

So, how can I find out the most space-consuming folder?

► Answer: du -d 1 | sort -n | tail -n 2



Prologue

Shell Basic

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Basic Utiliti

paste

head/ta

sort

uniq

Practice: Problem

Intermidiat Utilities

Wonderful Tools

Conclusion

- ► Example: sort accounts
- ► Example: sort -n nums
- ► Practice:

 ${\tt du}\,\,{\tt -d}\,\,{\tt 1}$  can be used to find disk usage of every subdirectory in current working directory.

So, how can I find out the most space-consuming folder?

- ► Answer: du -d 1 | sort -n | tail -n 2
- ► How can you achieve the same using GUI, for instance, on Windows?



Prologue

Shell Basic

Racio I Itilitio

Basic Utiliti

cat

paste

head/ta

sort

uniq

Practice: Problem

Intermidia Utilities

Wonderful Tools

Conclusion

► Example: sort accounts

► Example: sort -n nums

► Practice:

 ${\tt du}\,\,{\tt -d}\,\,{\tt 1}$  can be used to find disk usage of every subdirectory in current working directory.

So, how can I find out the most space-consuming folder?

- ► Answer: du -d 1 | sort -n | tail -n 2
- ▶ How can you achieve the same using GUI, for instance, on Windows?
- ► Maybe **grouping**? *O*(1) vs *O*(*logn*) :-)



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uniq

Utilities

Wonderful Tools

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Utilities

Wonderful Tools

► Example: wc -1 cool.cpp



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Practice: Problem 1

Wonderful Tools

▶ Problem Statement:

I'm in a folder, which contains numerous C++ source files. I want to know how many lines of C++ code reside in this folder.



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Practice: Problem 1

Wonderful Tools

▶ Problem Statement: I'm in a folder, which contains numerous C++ source files. I want to know how many lines of C++ code reside in this folder.

► Answer: wc -l \*.cpp



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Practice: Problem 2

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Microsoft Student Technology Club Sun Yat-sen University ► Problem Statement:

For some reason (explained later), I want to concatenate all the c++ files in the current folder into a single file.



Prologue

Practice: Problem 2

Wonderful Tools

▶ Problem Statement:

For some reason (explained later), I want to concatenate all the c++ files in the current folder into a single file.

► Answer: cat \*.cpp > total.cpp



Prologue

Basic Utilities

xargs

Wonderful Tools

► Example: echo 1 2 3 | xargs echo



Prologue

Shell Basic

Basic Utilities

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Utilities

xargs

find

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sed

Wonderful Tools

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► Example: echo 1 2 3 | xargs echo

► Example: echo 1 2 3 | xargs -n 1 echo

Prologue

Shell Basic

**Basic Utilities** 

Intermidiate

Utilities

xargs

find

sed

diff

Wonderful Tools

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Conclusion

► Example: echo 1 2 3 | xargs echo

► Example: echo 1 2 3 | xargs -n 1 echo

► Example: echo 1 2 3 | xargs -P 2 -n 1 echo



Prologue

Shell Basics

Basic Utilities

Intermidiate

Utilities

xargs

find

sed

diff

Wonderful Tools

Conclusion

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Prologue

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Basic Utilities

Intermidiate

Utilities

xargs

find

sed

diff patch

Wonderful Tools

Conclusion

ightharpoonup Example: find . -type f -name \\*.cpp

► Example: find . -type d -iname \\*a\\* -exec ls {}



## Intermidiate Utilities

find - search for files in a directory hierarchy

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Prologue

Shell Basics

Basic Utilities

Daoio Otintic

Intermidia

Utilities

xargs

find

sed

diff patch

Wonderful Tools

Conclusion

- ► Example: find . -type f -name \\*.cpp
- ► Example: find . -type d -iname \\*a\\* -exec ls {}
- ► Practise:

I want to know how many lines of python code I wrote for a project.

Now I'm in /, and the project is in

~/Documents/project/SYSU-Software-2015/.

What should I do?



## Intermidiate Utilities

find - search for files in a directory hierarchy

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Proloque

Basic Utilities

find

Wonderful Tools

- ► Example: find . -type f -name \\*.cpp
- ► Example: find . -type d -iname \\*a\\* -exec ls {}
- Practise: I want to know how many lines of python code I wrote for a project. Now I'm in /, and the project is in ~/Documents/project/SYSU-Software-2015/.
  - What should I do?
- ► Answer: find ~/Documents/project/SYSU-Software-2015/ -type f -name \\*.pv |xargs wc -l



Prologue

Shell Basics

Basic Utilities

Intermidiate

Utilities

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Wonderful Tools

Conclusion

► Example: grep iostream a.cpp



Prologue

Basic Utilities

Wonderful Tools

► Example: grep iostream a.cpp

► Example: grep -n vector a.cpp



Prologue

Basic Utilities

Wonderful Tools

- ► Example: grep iostream a.cpp
- ► Example: grep -n vector a.cpp
- ► Example: find . -type f -name \\*.py | xargs grep -ni taskhall



Prologue

Shell Bas

Basic Utilities

Intermidiate

Utilities

xargs find

grep

diff

patch

Wonderful Tools

Conclusion

- ► Example: grep iostream a.cpp
- ► Example: grep -n vector a.cpp
- ► Example: find . -type f -name \\*.py | xargs grep -ni taskhall
- ► Example: grep --include=\*.py -rni taskhall



Prologue

Basic Utilities

Wonderful Tools

- ► Example: grep iostream a.cpp
- ► Example: grep -n vector a.cpp
- ► Example: find . -type f -name \\*.py | xargs grep -ni taskhall
- ► Example: grep --include=\*.py -rni taskhall
- ► Example: grep -rne '\d+'



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Basic Utilities

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Wonderful Tools

► Example: sed -i -- 's/127.0.0.1/10.1.10.1/g' \*.conf



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Shell Basic

**Basic Utilities** 

Intermidiate

Utilities

xargs find

grep

diff

Wonderful Tools

Conclusion

```
► Example: sed -i -- 's/127.0.0.1/10.1.10.1/g' *.conf
```

► Example: sed -- '/^##/a\%666' posix\_cli\_tools.md



Prologue

Shell Basi

Basic Utilities

Intermidiate

Utilities

xargs

find grep

sed

diff patch

Wonderful Tools

Conclusion

- ► Example: sed -i -- 's/127.0.0.1/10.1.10.1/g' \*.conf
- ► Example: sed -- '/^##/a\%666' posix\_cli\_tools.md
- ► Example: sed -- '/^##/i\%%%%%' posix\_cli\_tools.md



Prologue

Shell Basic

Basic Utilities

Intermidiate

Utilities

xargs

find

gre

sed

difi

patcl

Wonderful Tools

Conclusion

► Example: diff a.txt b.txt

► Example: diff 1.dir 2.dir



Prologue

Basic Utilities

patch

Wonderful Tools

► Example: patch orig patch



Prologue

Shell Basi

Basic Utilities

Intermidiate

Wonderful Tools

Foreword

Editor LATEX

pandoc

Conclusion

- ► The tools I am going to introduce to you are not part of POSIX.
- ► These great tools are not \*nix-limited. Windows have them too!
- ► They all require some time to learn. Fear not, the time you spent on them will pay.



Prologue

Shell Rasi

Basic Utilities

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Intermidiate Utilities

Wonderful Tools

Foreword

Editor

MEX

pand

Conclusion

► Among numerous choices of editors, vim and emacs have distinguished themselves from the others.



Prologue

Shell Basi

Basic Utilities

Intermidiate

Wonderful Tools

Forewoo

Editor

**LATEX** 

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► Among numerous choices of editors, vim and emacs have distinguished themselves from the others.

▶ vim: The God of Editor.



Prologue

Basic Utilities

Wonderful Tools

Editor

▶ Among numerous choices of editors, vim and emacs have distinguished themselves from the others.

▶ vim: The God of Editor.

emacs: The Editor of God.



Prologue

Shell Basi

Basic Utilities

Intermidiate

Wonderful Tools

Forewor

Editor

**LATEX** 

git

Conclusion

► Among numerous choices of editors, vim and emacs have distinguished themselves from the others.

- ▶ vim: The God of Editor.
- ► emacs: The Editor of God.
- Demostration.



Prologue

Shell Bas

Basic Utilities

Intermidiate

Wonderful Tools

Foreword

Editor

pando

Conclusior

- ► T<sub>E</sub>X is the most widespread, most advanced and most professional typesetting system.
- ► LATEX handles content side of document, while TEX handles the layout side.

Together, marvelous documents are made.



Prologue

Shell Basi

Basic Utilities

Intermidiate

Wonderful Tools

Foreword

Editor

Pandoc

git

► Ever fancied conversion between docx and html, markdown and latex, even markdown and h5 slides?



Prologue

Shell Basi

Basic Utilities

Intermidiate

Wonderful Tools

Foreword

LATEX.

pandoc

Conclusion

► Ever fancied conversion between docx and html, markdown and latex, even markdown and h5 slides?

▶ pandoc comes to rescue!



Prologue

Shell Basi

Basic Utilitie

Intermidiate

Wonderful Tools

Foreword Editor

**E**TEX

pandoc git

Conclusion

- ► Ever fancied conversion between docx and html, markdown and latex, even markdown and h5 slides?
- ▶ pandoc comes to rescue!
- ► These slides are converted from markdown :-)



Prologue

Shell Basic

Basic Utilities

Intermidiate

Wonderful Tools

Foreword

Editor

pandoc

► Use git, use git, use git!



Prologue

Basic Utilities

Wonderful Tools

git

▶ Use git, use git, use git!

▶ Demonstration.



Prologue

Shell Basic

**Basic Utilities** 

Intermidiate

Wonderful Tools

Conclusion

► To learn them, use them to solve real problems (and for fun).



Prologue

Shell Basi

**Basic Utilities** 

Intermidiate

Wonderful Tools

Conclusion

► To learn them, use them to solve real problems (and for fun).

► Never feel ashamed for forgetting the command line options of a command. Just use -help or man when you need reference.



Prologue

Shell Basi

**Basic Utilities** 

Intermidiate

Wonderful Tools

Conclusion

- ► To learn them, use them to solve real problems (and for fun).
- ► Never feel ashamed for forgetting the command line options of a command. Just use -help or man when you need reference.
- ► Have fun with CLI!



Prologue

Shell Basic

Basic Utilities

Intermidiate

Wonderful Tools

Conclusion

## Thank you!

Brought to you by Siyuan Liu, MSTC, SYSU. Nov  $22^{\rm nd}$ , 2015

Microsoft Student Technology Club Sun Yat-sen University

(33