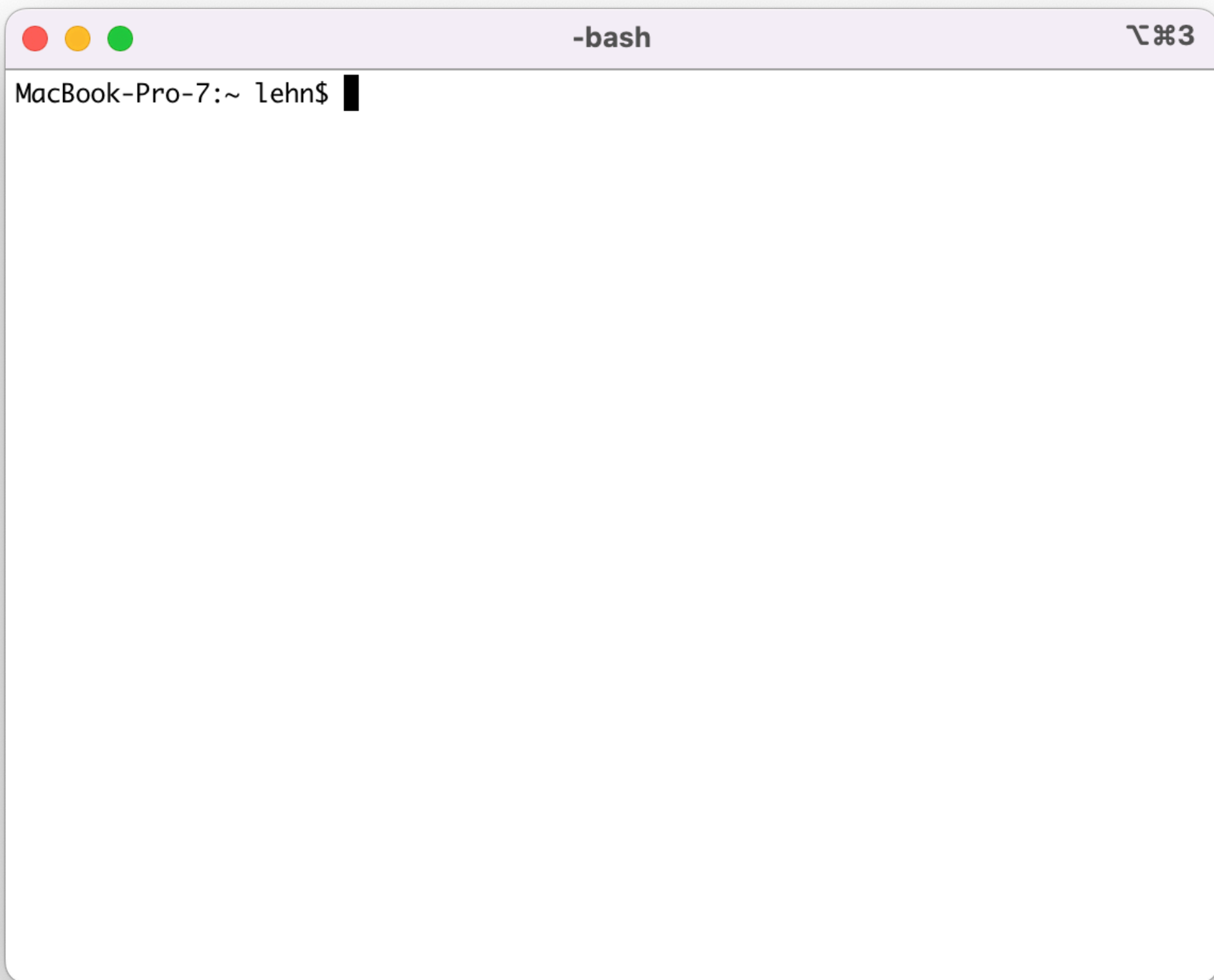


Working with the Unix Shell

Some crash course



What's a Unix Shell

- Interface to the operating system
- Works as a command line interpreter
- Users can use it interactively within a terminal

What's a Unix Shell

What's a Unix Shell

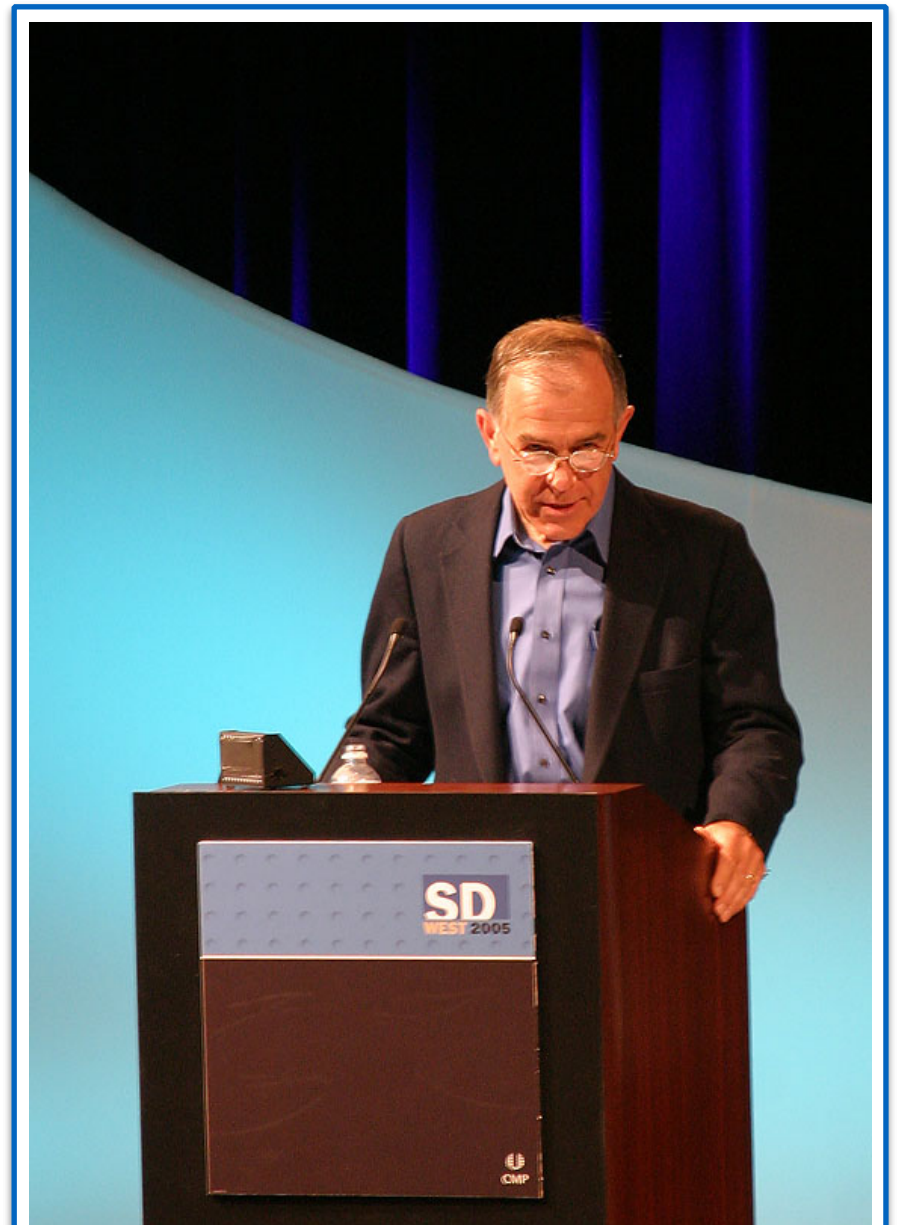
- More than one “Unix shell” out there:

What's a Unix Shell

- More than one “Unix shell” out there:
 - sh (Bourne shell)

What's a Unix Shell

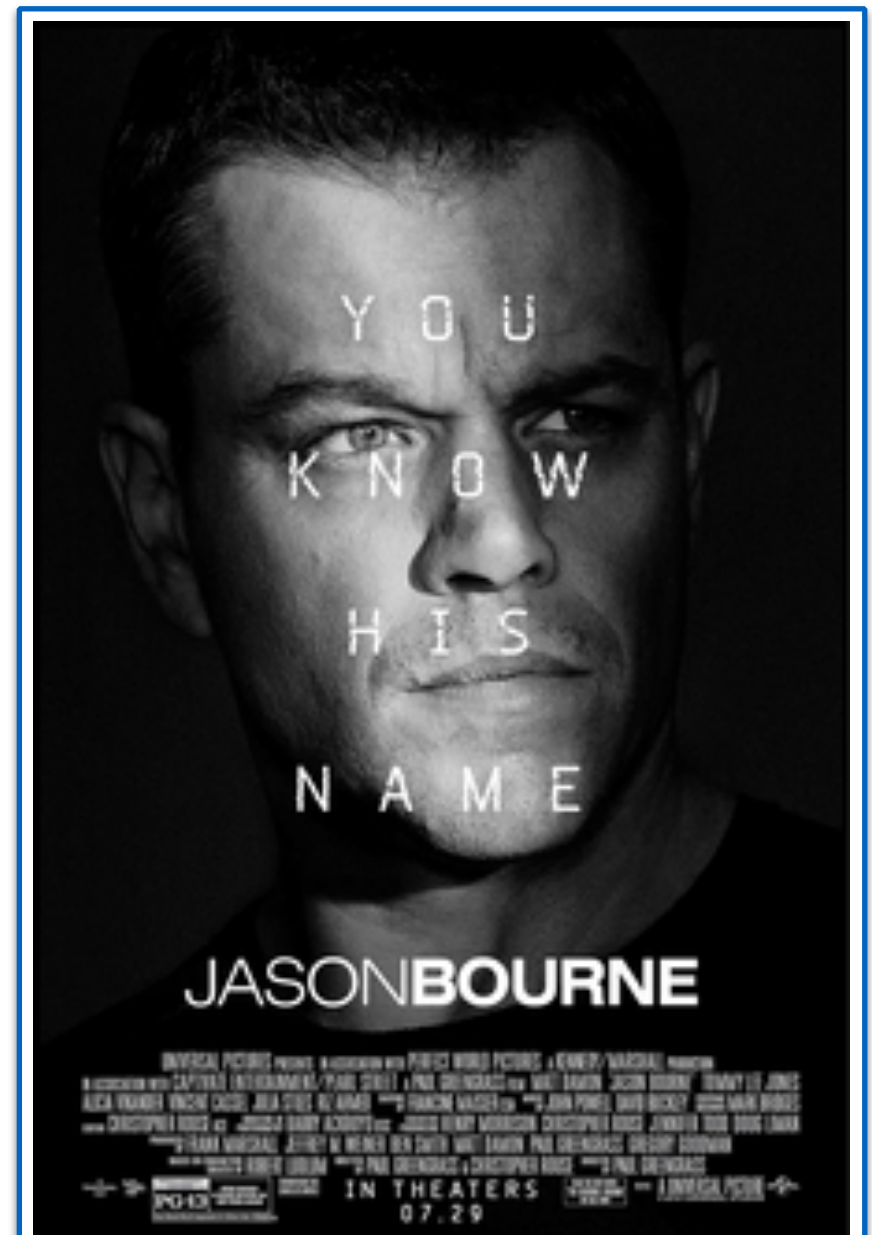
- More than one “Unix shell” out there:
 - sh (Bourne shell)



Stephan Bourne

What's a Unix Shell

- More than one “Unix shell” out there:
- sh (Bourne shell)



Jason Bourne

What's a Unix Shell

- More than one “Unix shell” out there:
 - sh (Bourne shell)
 - csh (C shell)

What's a Unix Shell

- More than one “Unix shell” out there:
 - sh (Bourne shell)
 - csh (C shell)
 - ksh (Korn shell)

What's a Unix Shell

- More than one “Unix shell” out there:
 - sh (Bourne shell)
 - csh (C shell)
 - ksh (Korn shell)
 - bash (Bourne again shell)

What's a Unix Shell

- More than one “Unix shell” out there:
 - sh (Bourne shell)
 - csh (C shell)
 - ksh (Korn shell)
 - bash (Bourne again shell)
 - zsh (Z shell)

What's a Unix Shell

- More than one “Unix shell” out there:

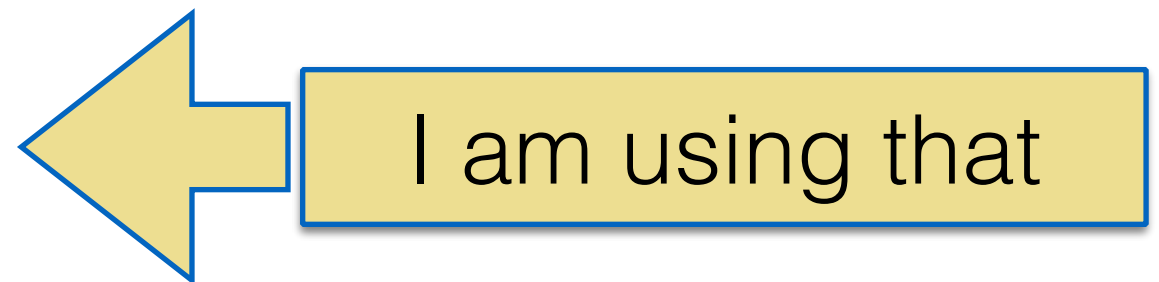
- sh (Bourne shell)

- csh (C shell)

- ksh (Korn shell)

- bash (Bourne again shell)

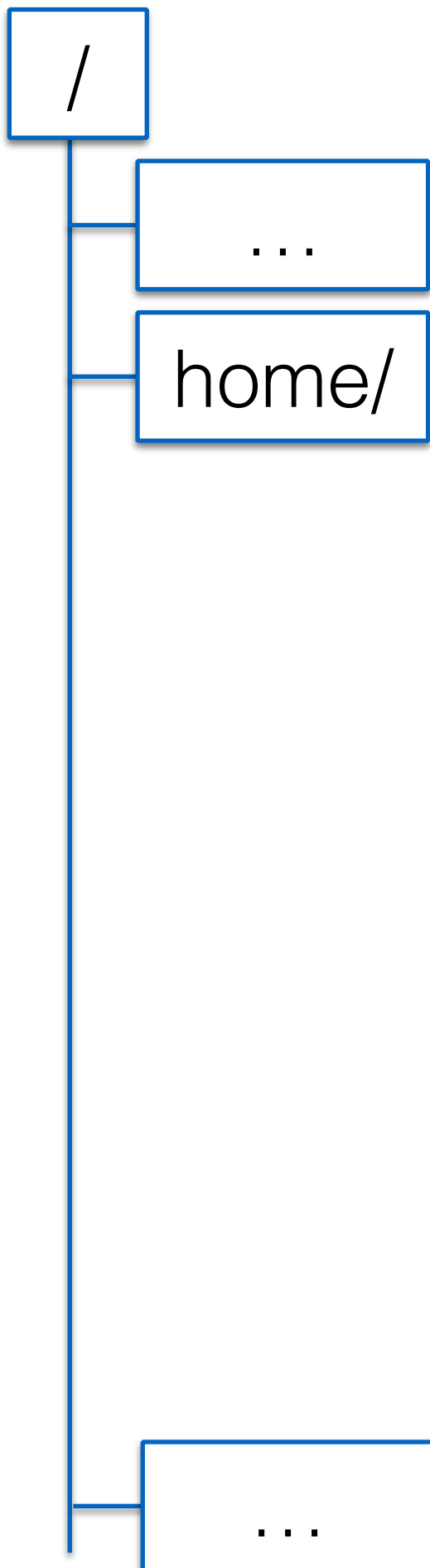
- zsh (Z shell)

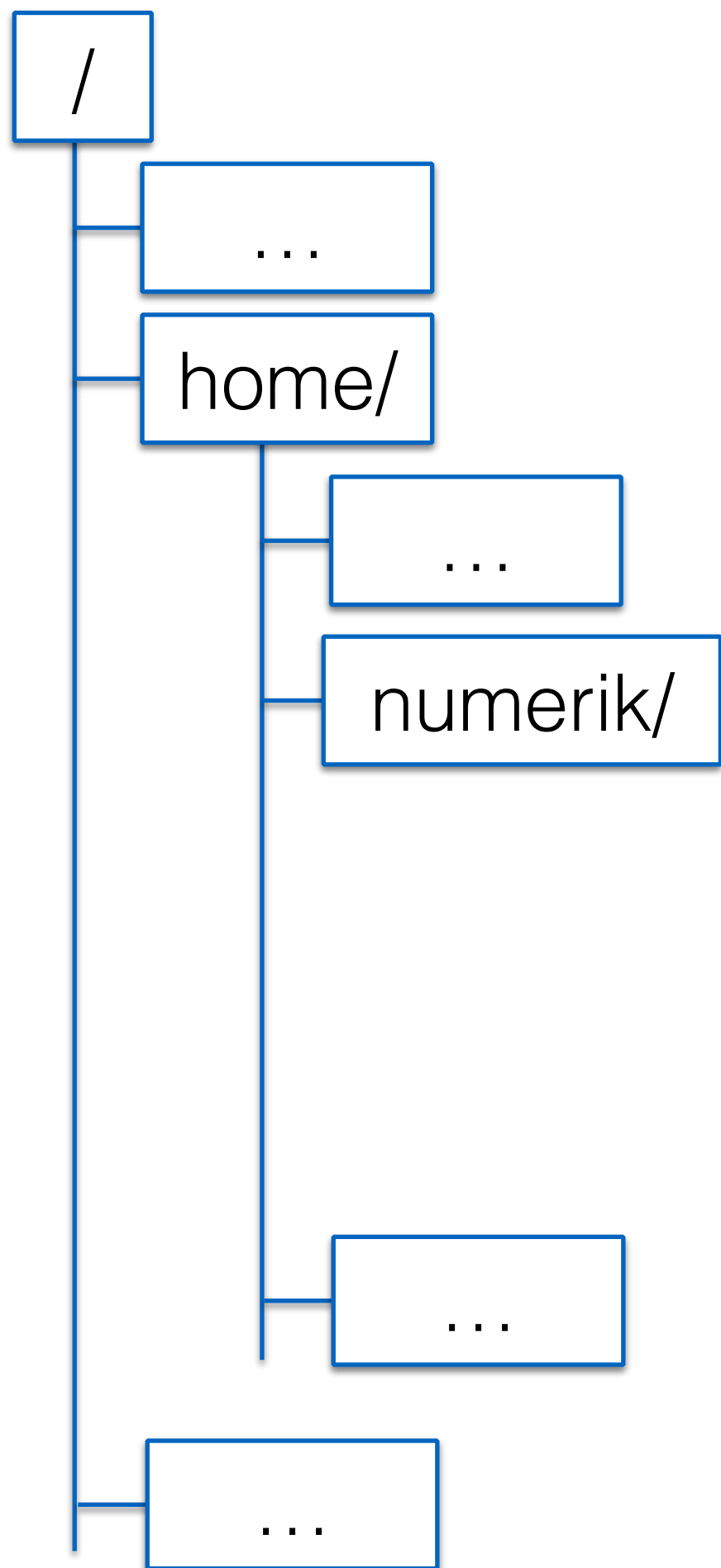


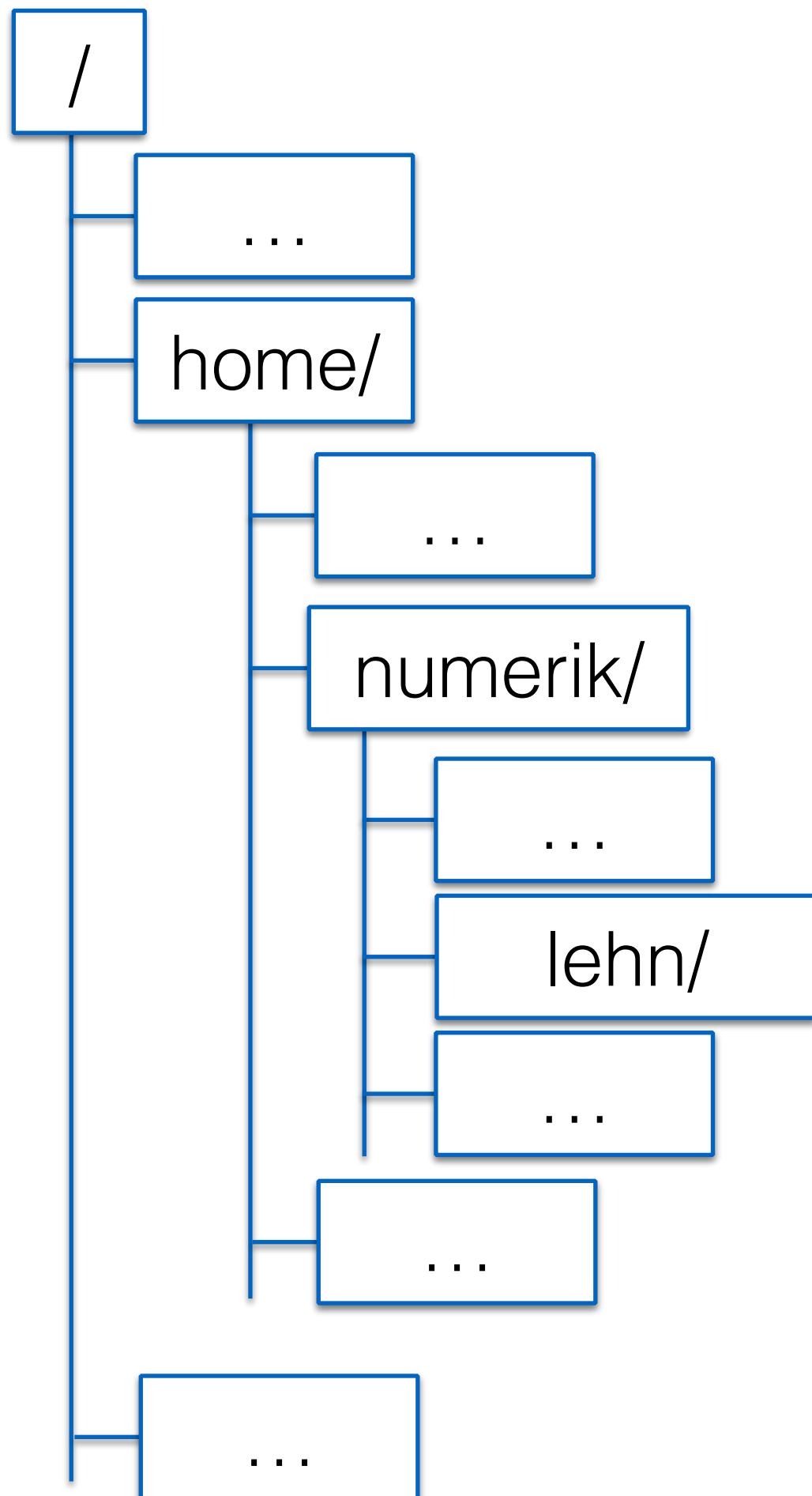
Filesystem

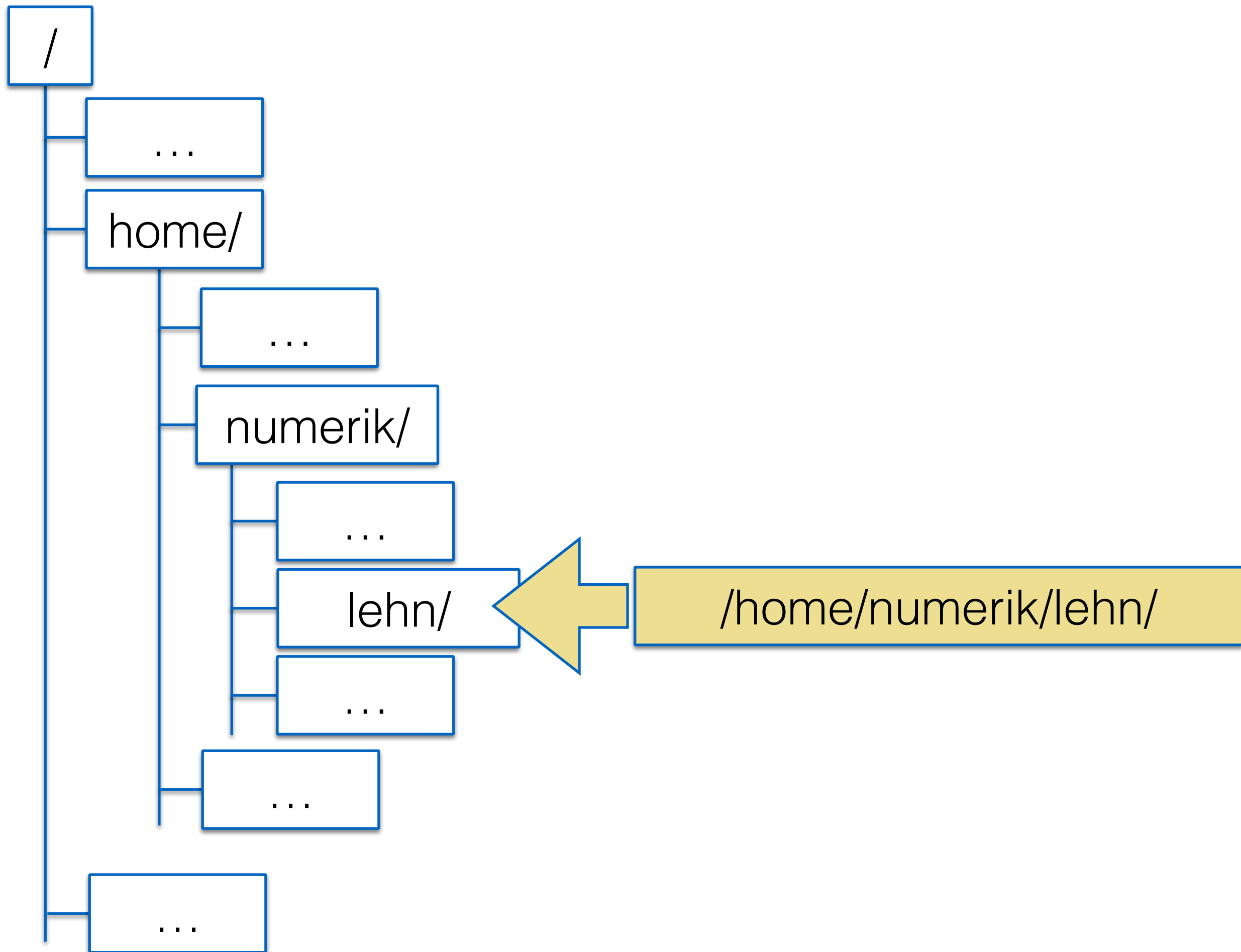
- Organized in a hierarchy
- Each file belongs to a directory
- Directories can contain subdirectories
- “Directories are just special files”
- All files appear under the root directory
- Every user has a “home directory”





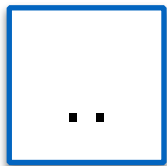




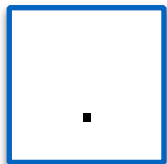


Filesystem

- Except for the root directory every directory contains a file

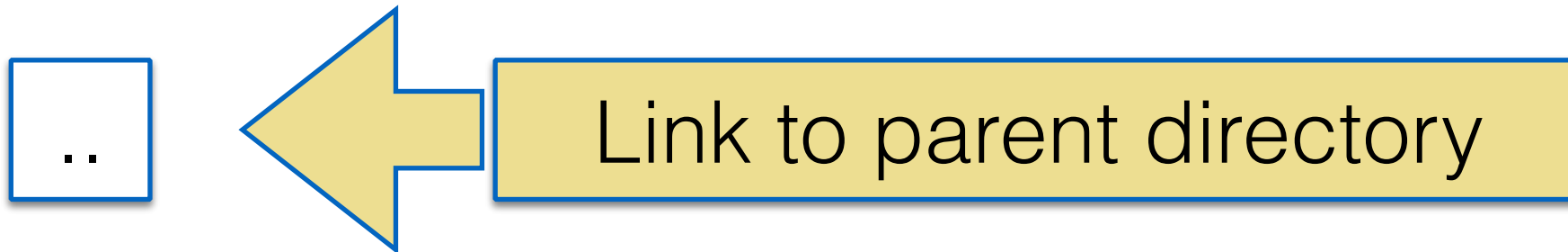


- Every directory contains a file

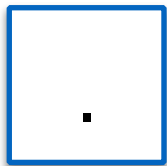


Filesystem

- Except for the root directory every directory contains a file

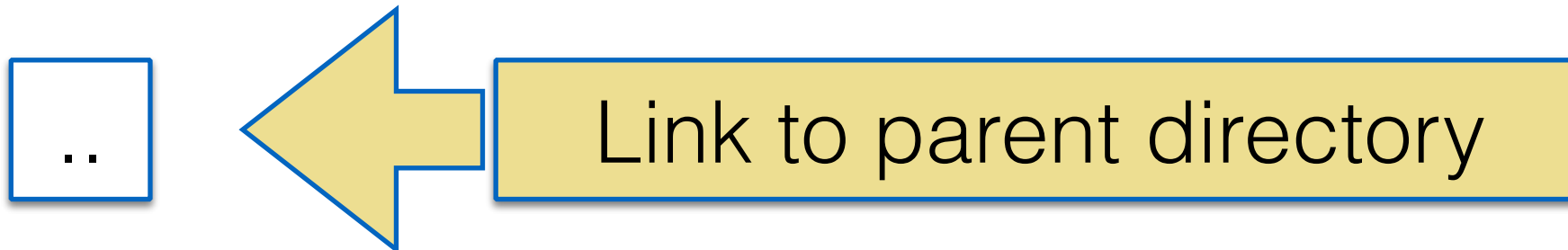


- Every directory contains a file

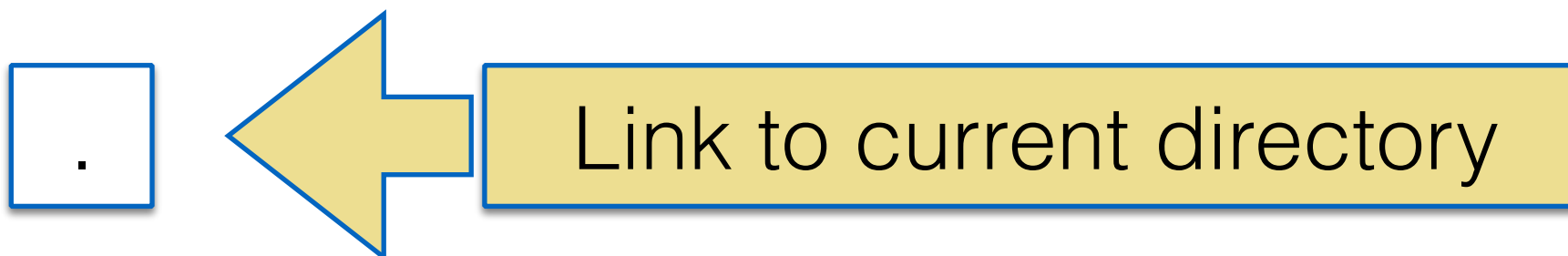


Filesystem

- Except for the root directory every directory contains a file



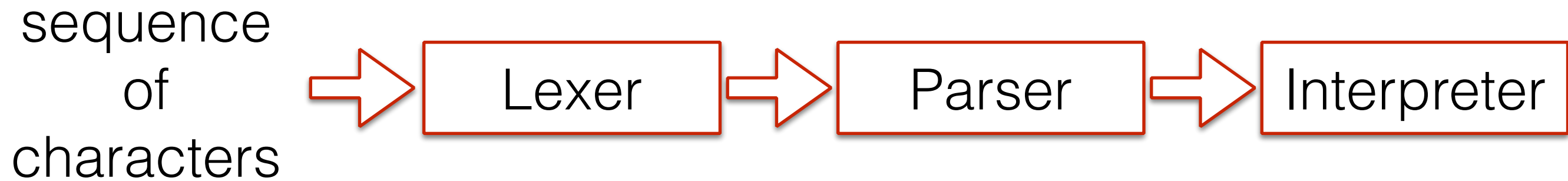
- Every directory contains a file



Filesystem

Command	Short for	Purpose
<code>ls</code>	list	List files in current directories
<code>pwd</code>	print working directory	Where am I? 🤔
<code>cd</code>	change directory	Navigate through file hierarchy
<code>mkdir</code>	make directory	Create a subdirectory within current directory

How Input is processed



Lexical Analysis



Lexical Analysis



rm foo bar

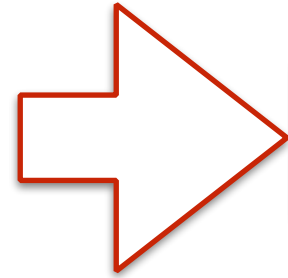
Lexical Analysis



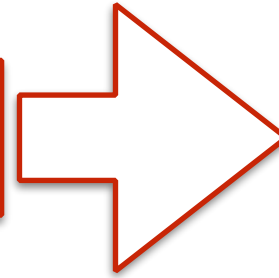
r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---

Lexical Analysis

sequence of
characters

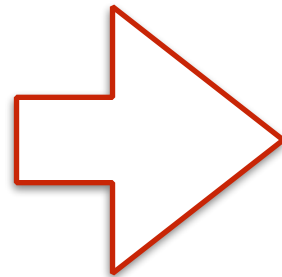


Lexer

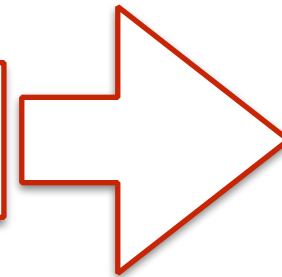


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---

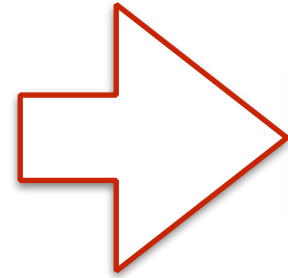


Lexer

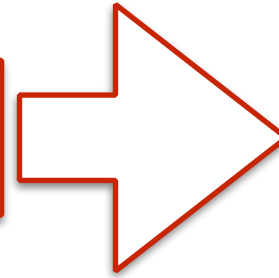


Lexical Analysis

sequence of
characters

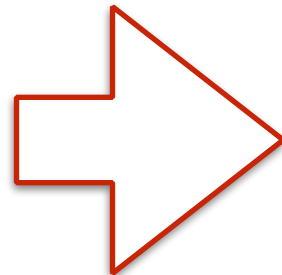


Lexer

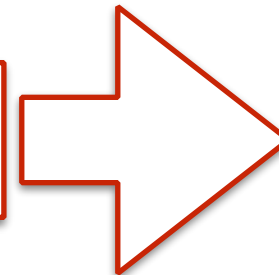


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



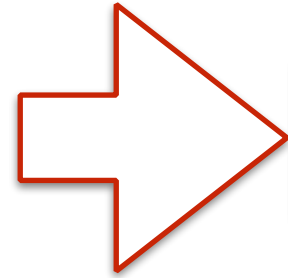
Lexer



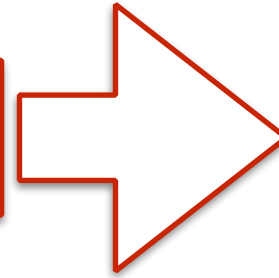
r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---

Lexical Analysis

sequence of
characters

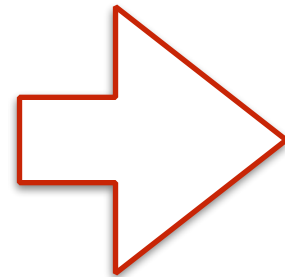


Lexer

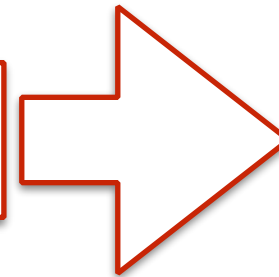


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer



r	m
---	---

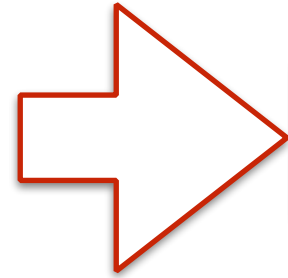
f	o	o
---	---	---

b	a	r
---	---	---

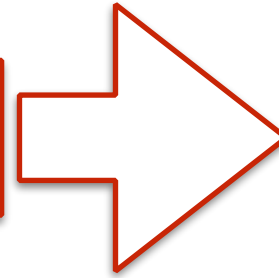
rm "foo bar"

Lexical Analysis

sequence of
characters

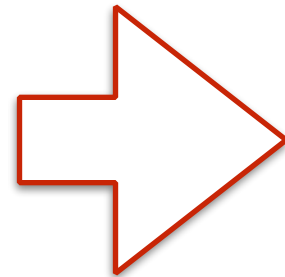


Lexer

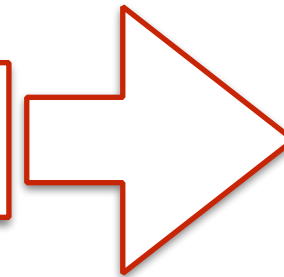


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer



r	m
---	---

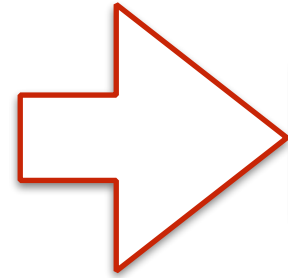
f	o	o
---	---	---

b	a	r
---	---	---

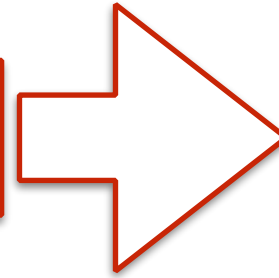
r	m		"	f	o	o		b	a	r	"
---	---	--	---	---	---	---	--	---	---	---	---

Lexical Analysis

sequence of
characters

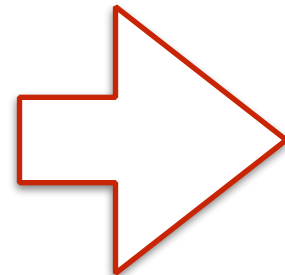


Lexer

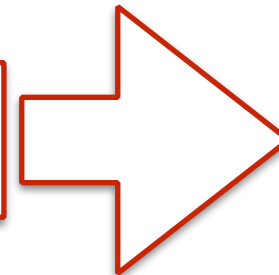


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer

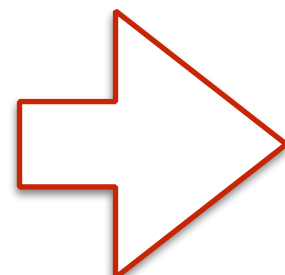


r	m
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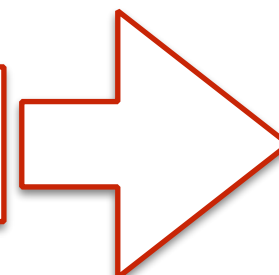
f	o	o
---	---	---

b	a	r
---	---	---

r	m		"	f	o	o		b	a	r	"
---	---	--	---	---	---	---	--	---	---	---	---

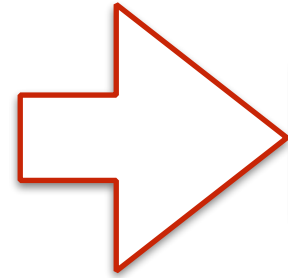


Lexer

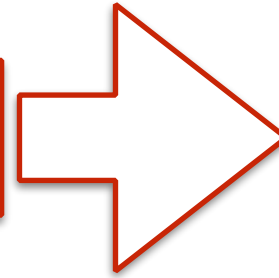


Lexical Analysis

sequence of
characters

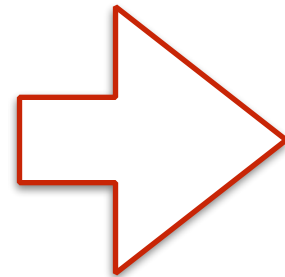


Lexer

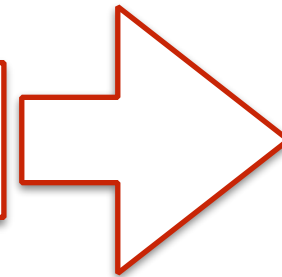


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer

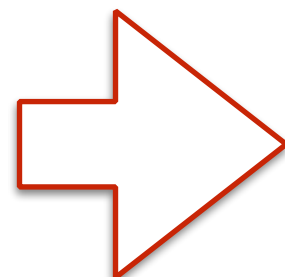


r	m
---	---

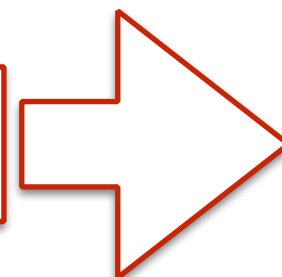
f	o	o
---	---	---

b	a	r
---	---	---

r	m		"	f	o	o		b	a	r	"
---	---	--	---	---	---	---	--	---	---	---	---



Lexer

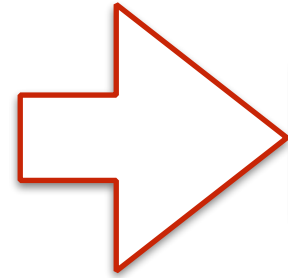


r	m
---	---

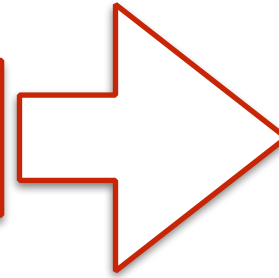
f	o	o	b	a	r
---	---	---	---	---	---

Lexical Analysis

sequence of
characters

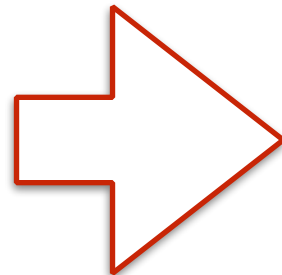


Lexer

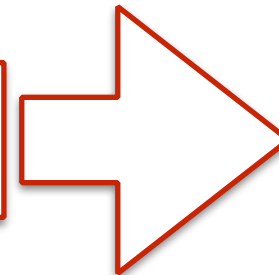


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer

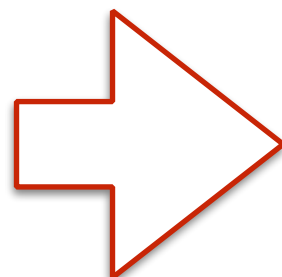


r	m
---	---

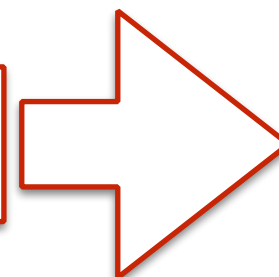
f	o	o
---	---	---

b	a	r
---	---	---

r	m		"	f	o	o		b	a	r	"
---	---	--	---	---	---	---	--	---	---	---	---



Lexer



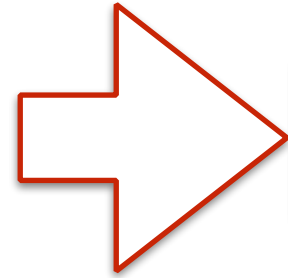
r	m
---	---

f	o	o		b	a	r
---	---	---	--	---	---	---

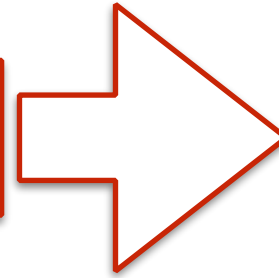
rm foo\ bar

Lexical Analysis

sequence of
characters

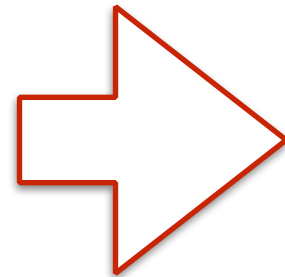


Lexer

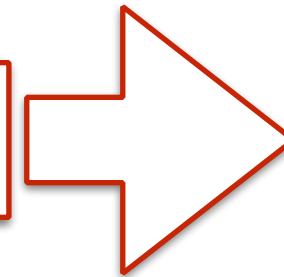


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer

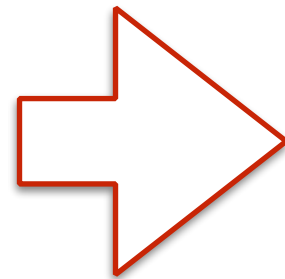


r	m
---	---

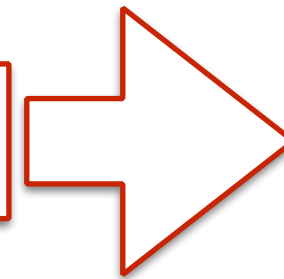
f	o	o
---	---	---

b	a	r
---	---	---

r	m		"	f	o	o		b	a	r	"
---	---	--	---	---	---	---	--	---	---	---	---



Lexer



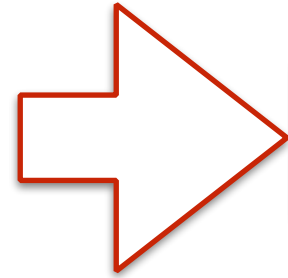
r	m
---	---

f	o	o		b	a	r
---	---	---	--	---	---	---

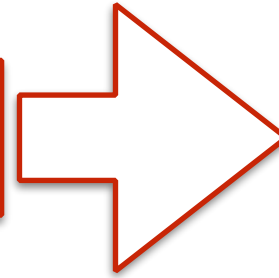
r	m		f	o	o	\		b	a	r
---	---	--	---	---	---	---	--	---	---	---

Lexical Analysis

sequence of
characters

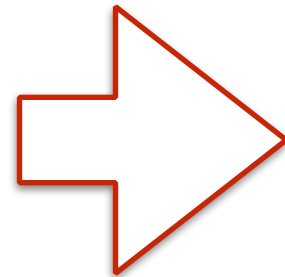


Lexer

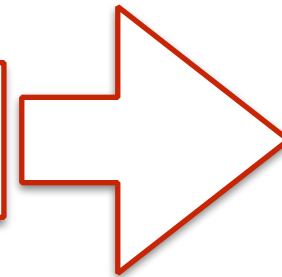


sequence of
tokens

r	m		f	o	o		b	a	r
---	---	--	---	---	---	--	---	---	---



Lexer

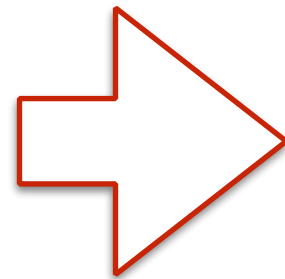


r	m
---	---

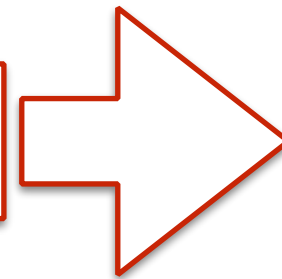
f	o	o
---	---	---

b	a	r
---	---	---

r	m		"	f	o	o		b	a	r	"
---	---	--	---	---	---	---	--	---	---	---	---



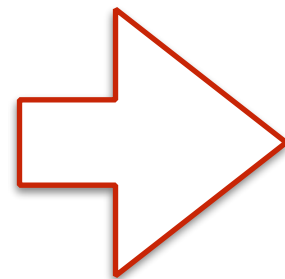
Lexer



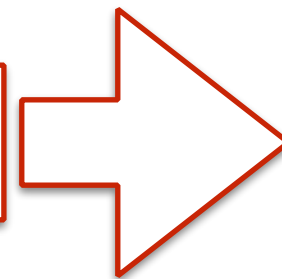
r	m
---	---

f	o	o	b	a	r
---	---	---	---	---	---

r	m		f	o	o	\		b	a	r
---	---	--	---	---	---	---	--	---	---	---

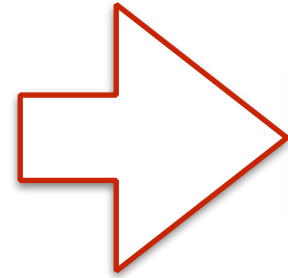


Lexer

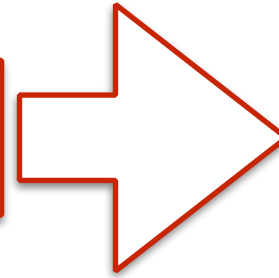


Lexical Analysis

sequence of
characters

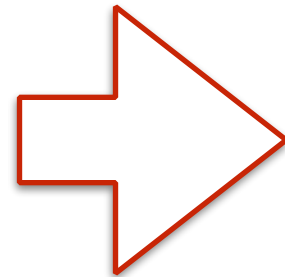


Lexer

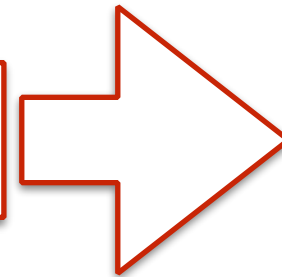


sequence of
tokens

rm		foo		bar
----	--	-----	--	-----

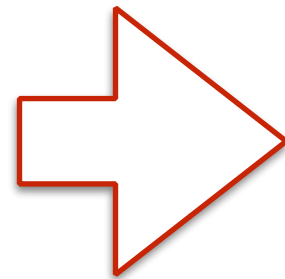


Lexer

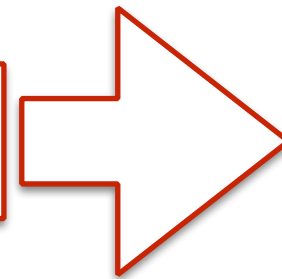


rm	foo	bar
----	-----	-----

rm		“	foo		bar	”
----	--	---	-----	--	-----	---

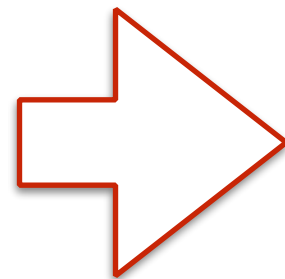


Lexer

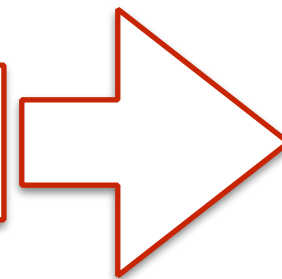


rm	foo bar
----	---------

rm		foo	\		bar
----	--	-----	---	--	-----

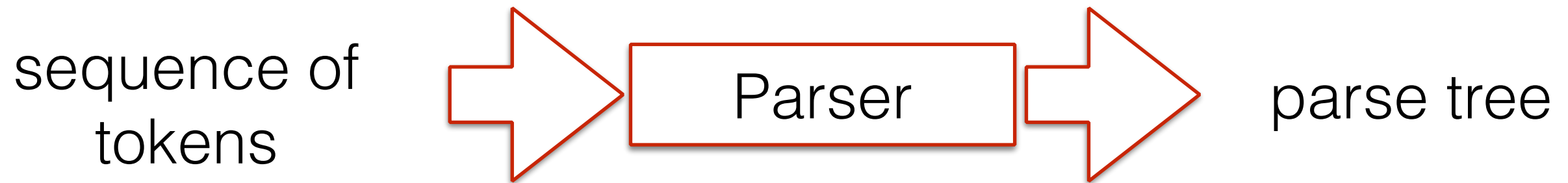


Lexer



rm	foo bar
----	---------

Parser (Syntax Analysis)



Filesystem

command

Filesystem

- Structure for shell commands:

command

Filesystem

- Structure for shell commands:

command

parameter_1

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

ls

-a

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

ls

-a

cd

hpc0

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

ls

-a

cd

hpc0

cd

..

Filesystem

command

Filesystem

- Structure for shell commands:

command

Filesystem

- Structure for shell commands:

command

parameter_1

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

Filesystem

- Structure for shell commands:

command

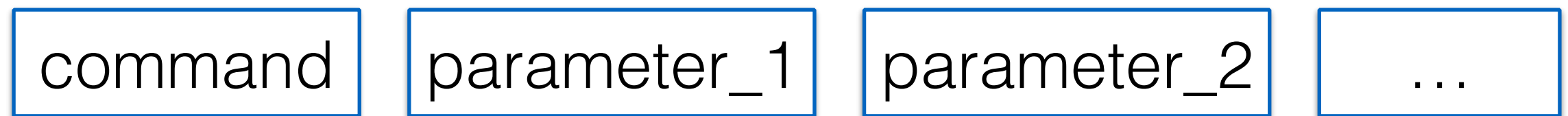
parameter_1

parameter_2

...

Filesystem

- Structure for shell commands:



- For example:

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

ls

-a

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

ls

-a

cd

hpc0

Filesystem

- Structure for shell commands:

command

parameter_1

parameter_2

...

- For example:

ls

ls

-a

cd

hpc0

cd

..

Filesystem

Command	Purpose
<code>cd</code>	change to home directory
<code>cd -</code>	change to previous directory
<code>cd ..</code>	change to (parent) directory ../
<code>cd foo</code>	change to subdirectory foo
<code>cd foo/bar</code>	change to subdirectory foo/bar/

Filesystem

Command	Purpose
<code>ls</code>	list files
<code>ls -a</code>	also list hidden files
<code>ls -l</code>	also show modification time etc.
<code>ls -l -a</code>	combines options '-l' and 'a'
<code>ls -la</code>	

Filesystem

Filesystem

Command	Purpose
<code>rm foo</code>	remove file foo

Filesystem

Command	Purpose
<code>rm foo</code>	remove file foo
<code>rm -r hpc0</code>	remove directory hpc0 (if empty)

Filesystem

Command	Purpose
<code>rm foo</code>	remove file foo
<code>rm -r hpc0</code>	remove directory hpc0 (if empty)
<code>rm -rf hpc0</code>	remove directory hpc0 (even if not empty)

Filesystem

Command	Purpose
<code>rm foo</code>	remove file foo
<code>rm -r hpc0</code>	remove directory hpc0 (if empty)
<code>rm -rf hpc0</code>	remove directory hpc0 (even if not empty)
<code>rm -rf /</code>	

Filesystem

Command	Purpose
<code>rm foo</code>	remove file foo
<code>rm -r hpc0</code>	remove directory hpc0 (if empty)
<code>rm -rf hpc0</code>	remove directory hpc0 (even if not empty)
<code>rm -rf /</code>	

- Of course we will discover more
- But the pattern is always the same ...