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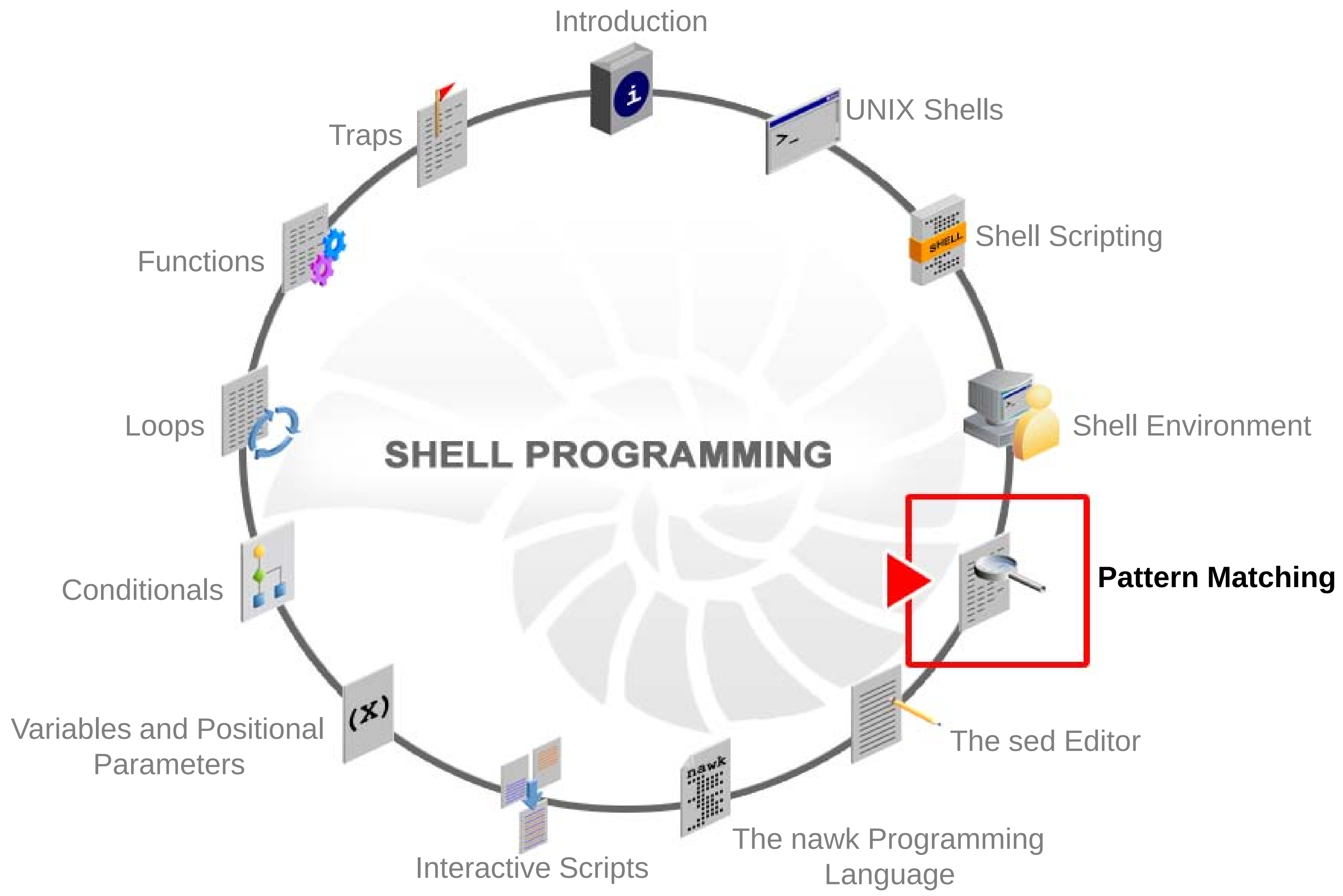
Pattern Matching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Objectives

After completing this lesson, you should be able to:

- Find patterns in a file by using the `grep` command
- Explain the role of regular expressions in pattern matching

Agenda

- Finding patterns in a file by using the `grep` command
- Explaining the role of regular expressions in pattern matching

The `grep` Command

- The `grep` command searches one or multiple text files or a pipeline for a specific pattern.
- When the pattern is found, the entire line is printed.
- The command also permits you to use regular expression characters in the search pattern.
- Syntax:

```
grep [OPTIONS] PATTERN [FILE...]
```

- Example:

```
$ ps -ef | grep msxyz
$ ps -e | grep dtterm
352 ?? 0:00 dtterm
353 ?? 0:13 dtterm
354 ?? 0:11 dtterm
1766 pts/5 0:00 dtterm
```

The grep Options

Option	Function
-b	Display the block number at the beginning of each line
-c	Display the number of matched lines
-h	Display the matched lines, but do not display the file names
-i	Ignore case sensitivity
-l	Display the file names, but do not display the matched lines
-n	Display the matched lines and their line numbers
-s	Silent mode
-v	Display all lines that do NOT match
-w	Match whole word

Agenda

- Finding patterns in a file by using the `grep` command
- Explaining the role of regular expressions in pattern matching

Regular Expression

- A regular expression (RE) is a character pattern that matches the same characters in a search.
- Regular expressions:
  - Allow you to specify patterns to search in text
  - Provide a powerful way to search files for specific pattern occurrences
  - Give additional meaning to patterns through metacharacters

Regular Expression Metacharacters

Metacharacter	Function
\	Escapes the special meaning of an RE character
^	Matches the beginning of the line
$	Matches the end of the line
\<	Matches the beginning of the word anchor
\>	Matches the end of the word anchor
[]	Matches any one character from the specified set
[-]	Matches any one character in the specified range
*	Matches zero or more of the preceding character
.	Matches any single character
\{\}	Specifies the minimum and maximum number of matches for a regular expression

Regular Expressions: Example

```
$ ps -ef | grep ’[A-Z]’
ID        PID      PPID     C STIME          TTY      TIME CMD
root      647      1        0 06:14:45       ?        0:00
/usr/lib/dmi/snmpXdmid -s sls-s10-host
noaccess 797      1        0 06:15:03       ?        1:34
/usr/java/bin/java -server -Xmx128m -
XX:+UseParallelGC -XX:ParallelGCThreads=4
root      708      704      4 06:14:50       ?        5:22
/usr/X11/bin/Xorg :0 -depth 24 -nobanner -auth/var/dt/A:0-9Aaayb
root      813      739      0 06:15:16       ?        0:00 /bin/ksh
/usr/dt/bin/Xsession
root      905      903      0 06:15:27       pts/2    0:00 -sh -c unset
DT; DISPLAY=:0; /usr/dt/bin/dtsession_res -merge
root      1045     1        1 06:15:51       ?        1:10
/usr/lib/mixer_applet2 --oaf-
activateiid=OAFIID:GNOME_MixerApplet_Factory --oa
root      1050     1        0 06:15:52       ?        0:01
/usr/lib/notification-area-applet --oafactivate-
iid=OAFIID:GNOME_NotificationA
root      1440     1284     0 08:20:35       pts/4    0:00 grep [A-Z]
<output truncated>
```

Escaping a Regular Expression

- A \ (backslash) character escapes the regular expression characters.
- The \ interprets the next character literally, not as a metacharacter.
- Thus, a `\$` matches a dollar sign and a `\.` matches a period.

Escaping a Regular Expression: Example

```
# grep ’$’ /etc/init.d/nfs.server
#!/sbin/sh
#
# Copyright 2009 Oracle, Inc. All rights reserved.
# Use is subject to license terms.
#
#ident "@(#)nfs.server 1.43 04/07/26 SMI“
# This service is managed by smf(5). Thus, this script provides
# compatibility with previously documented init.d script behaviour.
case "$1" in
'start')
        svcadm enable -t network/nfs/server
        ;;
'stop')
        svcadm disable -t network/nfs/server
        ;;
*)
        echo "Usage: $0 { start | stop }"
        exit 1
        ;;
esac
```

Line Anchors

Line anchors force a regular expression to match only at the start or end of a line.

- Use ^ for the beginning of the line.
- Use $ for the end of the line.

Line Anchors: Example

```
$ grep ’root’ /etc/group
root::0:
other::1:root
bin::2:root,daemon
sys::3:root,bin,adm
adm::4:root,daemon
uucp::5:root

<output truncated>

$ grep ’^root’ /etc/group
root::0:

$ grep ’mount$’ /etc/vfstab
#device device mount FS fsck mount mount
```

Word Anchors

Word anchors are used to refer to the beginning and end of a word in regular expressions.

- Use `\<` for the beginning of the word.
- Use `\>` for the end of the word.

Word Anchors: Example

```
$ grep ’\<uucp’ /etc/group
uucp::5:root

$ grep 'user' /etc/passwd
user:x:100:1::/home/user:/bin/sh
user2:x:101:1::/home/user2:/bin/sh
user3:x:102:1::/home/user3:/bin/sh

$ grep '\<user\>' /etc/passwd
user:x:100:1::/home/user:/bin/sh
```

Character Classes

A character class makes one small sequence of characters match a larger set of characters, such as the following:

- `[abc]` finds a single character in the class.
- `[a-c]` finds a single character in the range.
- `[^a-c]` finds a single character not in the range.

Character Classes: Example

```
$ grep ’[iu]’ /etc/group
bin::2:root,daemon
sys::3:root,bin,adm
uucp::5:root
mail::6:root
nuucp::9:root
sysadmin::14:
nogroup::65534:
$ grep ’[u-y]’ /etc/group
sys::3:root,bin,adm
uucp::5:root
tty::7:root,adm
nuucp::9:root
sysadmin::14:
webservd::80:
nobody::60001:
nogroup::65534:
$ grep ’\<[Tt]he\>’ teams
The teams are chosen randomly.
```

Single Character Match

The `.` (dot) regular expression matches any one character except the newline character.

```
$ grep ’c...h’ /usr/dict/words

$ grep ’^c...h’ /usr/dict/words

$ grep ’^c...h$’ /usr/dict/words
```

Character Match by Specifying a Range

The `\{` and `\}` expressions allow you to specify the minimum and maximum number of matches for a regular expression.

```
$ cat test
root
rooot
roooot
rooooot

$ grep ’ro\{3\}t’ test
rooot

$ grep ’ro\{2,4\}t’ test
root
rooot
roooot
```

Closure Character (*)

- The * symbol, when used in a regular expression, is termed a closure.
- * matches the preceding character zero or more times.

```
$ grep ’Team*’ teams
Team one consists of
Team two consists of
Tea for two and Dom
Tea for two and Tom
$ grep ’\<T.*m\>’ teams
Team one consists of
Tom
Team two consists of
Tea for two and Dom
Tea for two and Tom
$ grep ’*’ teams
$ grep ’abc’ *
data1:abcd
```

The egrep Command

- The `egrep` (extended `grep`) command searches a file or a pipeline for a pattern by using full regular expressions.
- Example:

```
# grep "two | team" teams

# egrep "two | team" teams
Team two consists of
The teams are chosen randomly.
Tea for two and Dom
Tea for two and Tom
```

Quiz

Which of the following forces a regular expression to match only at the end of a line?

a. ^

b. /

c. $

d. *

Summary

In this lesson, you should have learned how to:

- Find patterns in a file by using the `grep` command
- Explain the role of regular expressions in pattern matching

Practice 5 Overview: Pattern Matching

This practice covers the following topics:

- Using Regular Expressions and the `grep` Command
  - You use regular expressions to search for a pattern.
  - You use the `grep` command to search for specific string within text files.