I/O and Redirection

Standard I/O (1)

Normally each Unix process has three streams opened when it starts; one for input, one for output, and one for diagnostic or error messages.

- Standard Input (stdin)
  - default place from which programs read
  - File descriptor: 0
- Standard Output (stdout)
  - default place to which programs write
  - File descriptor: 1
- Standard Error (stderr)
  - default place where errors are reported
  - File descriptor: 2

Standard I/O (2)

- For terminal,
  - The default standard input is the keyboard,
  - The default standard output is the display
  - The default standard error is the display.
- To demonstrate -- cat
  - Echoes everything you typed in with an <enter>
  - Quits when you press Ctrl-d at a new line -- (EOF)
- To redirect (change) the default
  - Use < to redirect standard input (the same as 0<)
  - Use > to redirect standard output (the same as 1>)
  - Use 2> to redirect standard error

Redirecting Standard Output

- cat file1 file2 > file3
  - concatenates file1 and file2 into file3
  - file3 is created if not there
- cat file1 file2 >| file3
  - file3 is clobbered if there
- cat file1 file2 >> file3
  - warning if file3 is not there
  - file3 is appended to if it is there
- cat > file3
  - file3 is created from whatever user provides from standard input

实际上，是将标准输出至屏幕的file1，file2输出至file3中.

file1 & file2 → screen file3.

ending by Ctrl+D.

Redirecting Standard Error

- To write standard output and standard error into different files:

  compute[1] > cat myfile > yourfile 2> yourerrorfile

- Generally direct standard output and standard error to the same place:

  compute[2] > cat myfile &> yourfile

  - If myfile exists, it is copied into yourfile
  - If myfile does not exist, an error message

    cat: myfile: No such file or directory

    is copied into yourfile

- A more general way is
  - cat myfile > yourfile 2>&1
  - stdout goes to yourfile and stderr goes to where stdout goes

Redirecting Standard Input

- compute[1] > cat < oldfile > newfile
- A more useful example:
  - compute[2] > tr string1 string2
    - read from standard input.
    - character *n* of string1 translated to character *n* of string2.
    - results written to standard output.
  - Example of use:

    compute[3] > tr aeoiu eoiua <file1 >file2

    compute[4] > tr eoiua aeoiu <file2 >file3

    compute[5] > tr a-z A-Z < file1 > file2

/dev/null

- /dev/null
  - A virtual file that is always empty.
  - Copy things to here and they disappear.
    - cp myfile /dev/null
  - Copy from here and get an empty file.
    - cp /dev/null myfile
  - Redirect error messages to this file
    - ls -l > recordfile 2> /dev/null
    - Basically, all error messages are discarded.

Filters (1)

- Filters are programs that:
  - Read from stdin.
  - Modify it (may do nothing).
  - Write the results to stdout.
- Filters typically do not need user input.
- Example:
  - tr (translate):
    - Read stdin
    - Echo to stdout, translating some specified characters
- Many filters can also take file names as operands for input, instead of using stdin.

Filters (2)

- grep patternstr:
  - Read stdin and write lines containing patternstr to stdout

compute[1] > grep "unix is easy" < myfile1 > myfile2

  - Write all lines of myfile1 containing phrase ***unix is easy*** to myfile2

- wc:
  - Count the number of chars/words/lines on stdin
  - Write the resulting statistics to stdout

- sort:
  - Sort all the input lines in alphabetical order and write to the standard output.

Pipes

- The pipe:
  - Connects stdout of one program with stdin of another
  - General form:

    command1 | command2

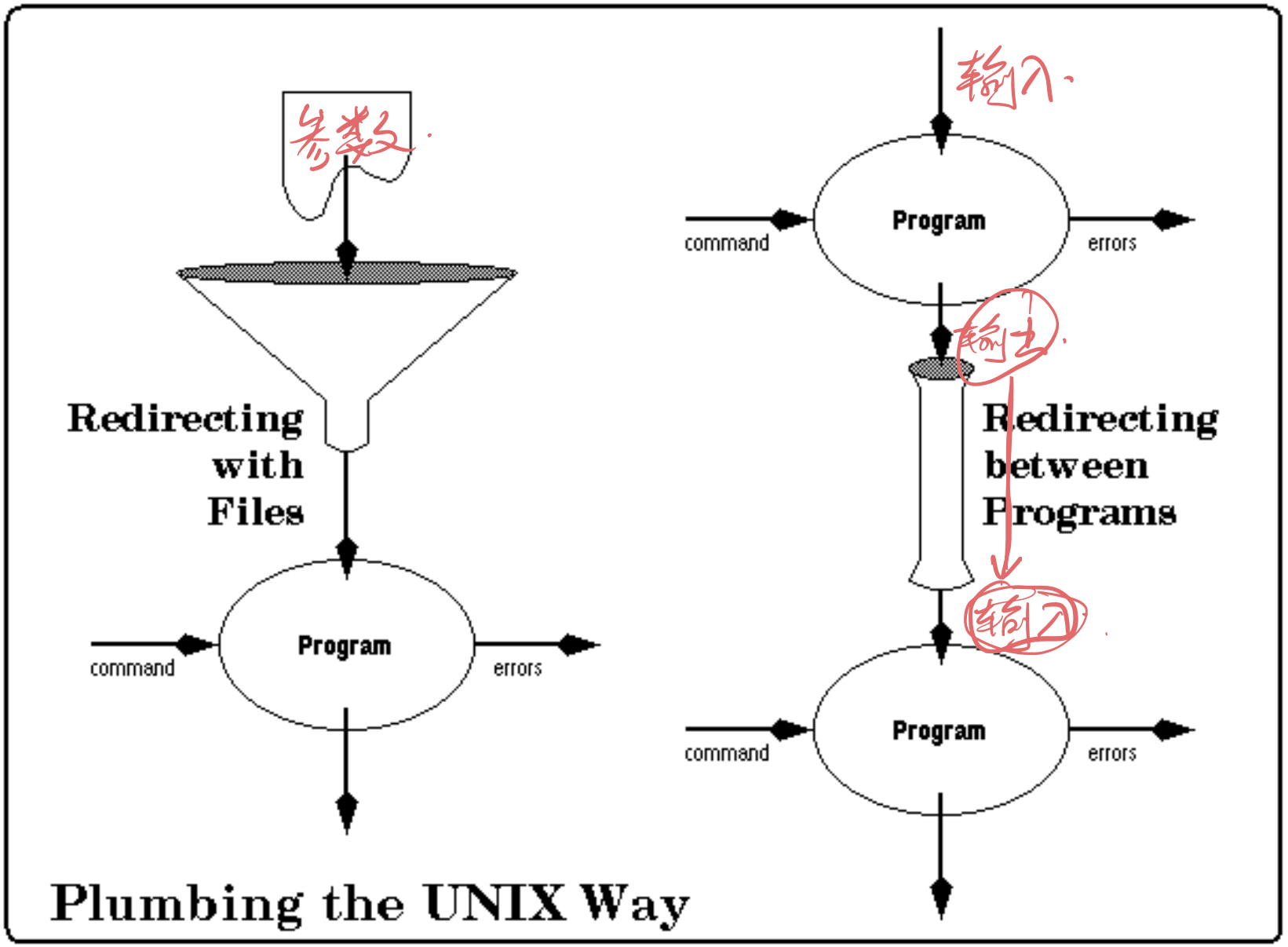
    - stdout of command1 used as stdin for command2
  - Example:

    compute[1] > cat readme.txt | grep unix | wc -l
- An alternative way (not efficient) is to:

  compute[2] > grep unix < readme.txt > tmp

  compute[3] > wc -l < tmp
- Can also pipe stderr: command1 |& command2

Redirecting and Pipes (1)



Redirecting and Pipes (2)

- Note: The name of a command always comes first on the line.
- There may be a tendency to say:

  compute[1] > readme.txt > grep unix | wc -l

  – This is WRONG!!!

  – Your shell will go looking for a program named readme.txt

- To do it correctly, many alternatives!

  compute[2] > cat readme.txt | grep unix | wc -l

  compute[3] > grep unix < readme.txt | wc -l

  compute[4] > grep unix readme.txt | wc -l

  compute[5] > grep -c unix readme.txt

The tee Command

- tee - replicate the standard output
  - cat readme.txt | tee myfile
  - tee –a (append) 二次接在文件后而非覆盖.

输出时同时保留一份文件.