# I/O and Redirection

# Standard I/O

- Standard Output (stdout)
  - default place to which programs write
- Standard Input (stdin)
  - default place from which programs read
- Standard Error (stderr)
  - default place where errors are reported
- To demonstrate -- cat
  - Echoes everything you typed in with an <enter>
  - Quits when you press Ctrl-d at a new line -- (EOF)

# 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
  - file3 is created if not there
  - file3 is appended to if it is there
- cat > file3
  - file3 is created from whatever user provides from standard input

# Redirecting Standard Error

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

  obelix[1] > 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 in yourfile

- In tcsh, to write standard output and standard error into different files:

  obelix[2] > (cat myfile > yourfile) >& yourerrorfile

- In sh (for shell scripts), standard error is redirected differently
  - cat myfile > yourfile 2> yourerrorfile

# Redirecting Standard Input

- obelix[1] > cat < oldfile > newfile
- A more useful example:
  - obelix[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:

    obelix[3] > tr aeoiu eoiua

    obelix[4] > 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
    - mv myfile /dev/null
  - Copy from here and get an empty file.
    - cp /dev/null myfile
  - Redirect error messages to this file
    - (ls -l > recordfile) >& /dev/null
    - Basically, all error messages are discarded.

# Filters (1)

- Filters are programs that:
  - Read stdin.
  - Modify it.
  - 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

  obelix[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

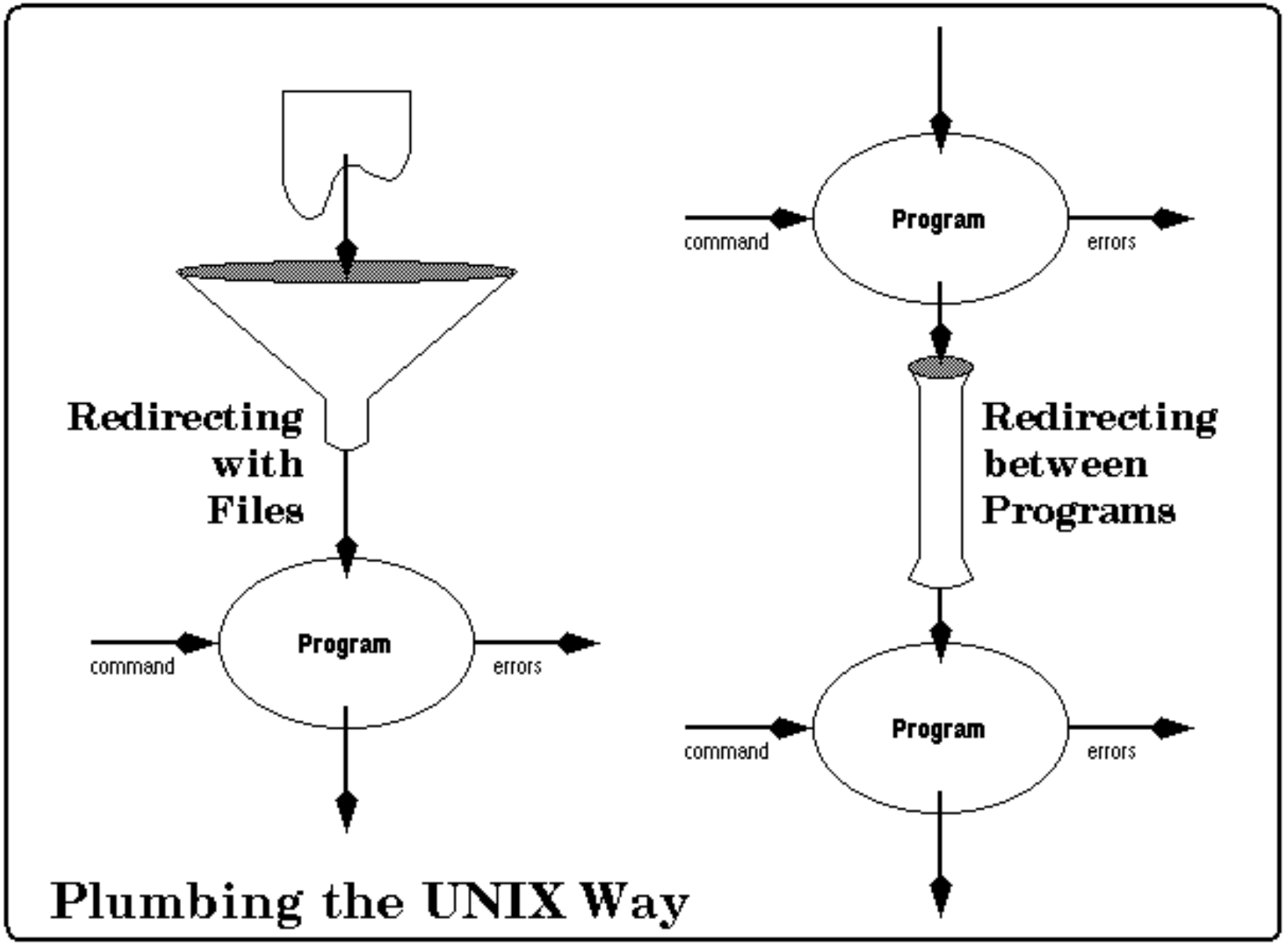
    - stdout of command1 used as stdin for command2
  - Example:

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

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

  obelix[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:

  obelix[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!

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

  obelix[2] > grep unix < readme.txt | wc -l

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

  obelix[4] > grep -c unix readme.txt

# The tee Command

- tee - replicate the standard output
  - cat readme.txt | tee myfile