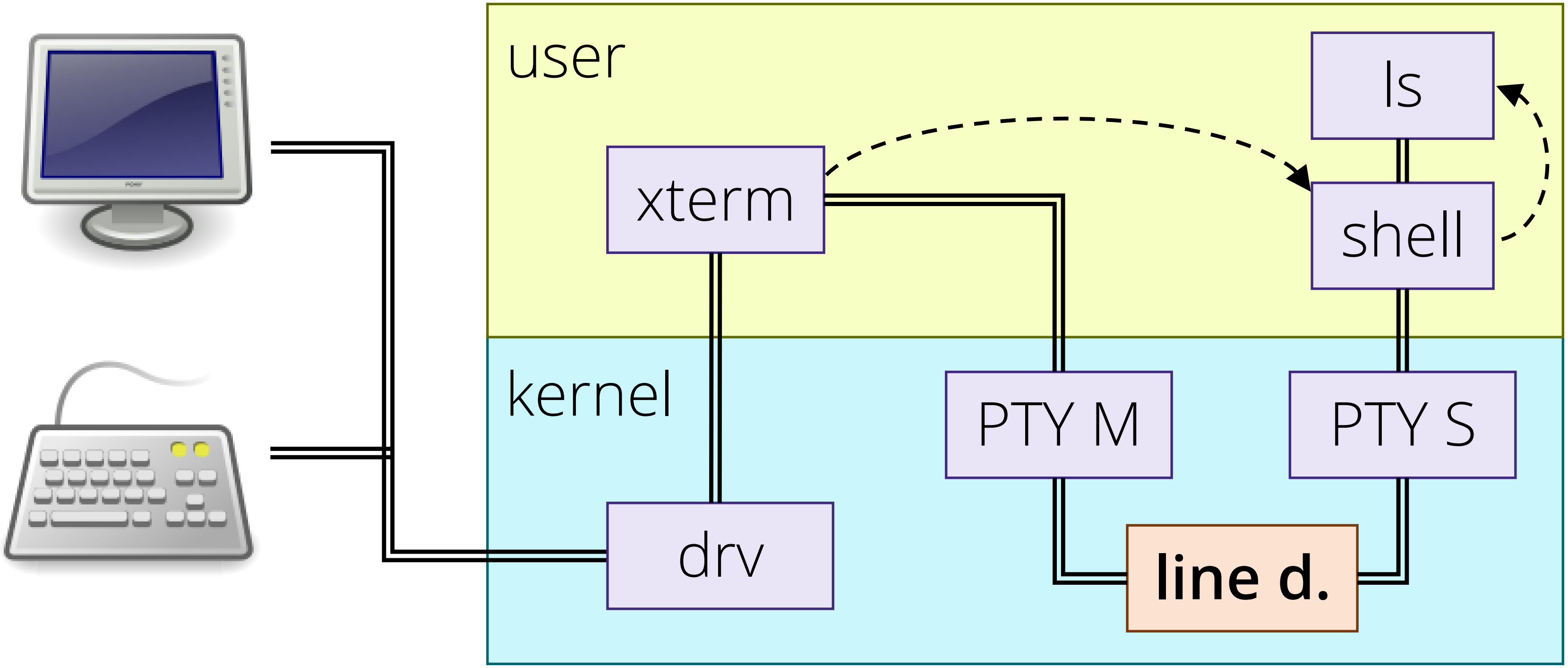
The TTY, part 2

COMS10012 Software Tools

PTYs

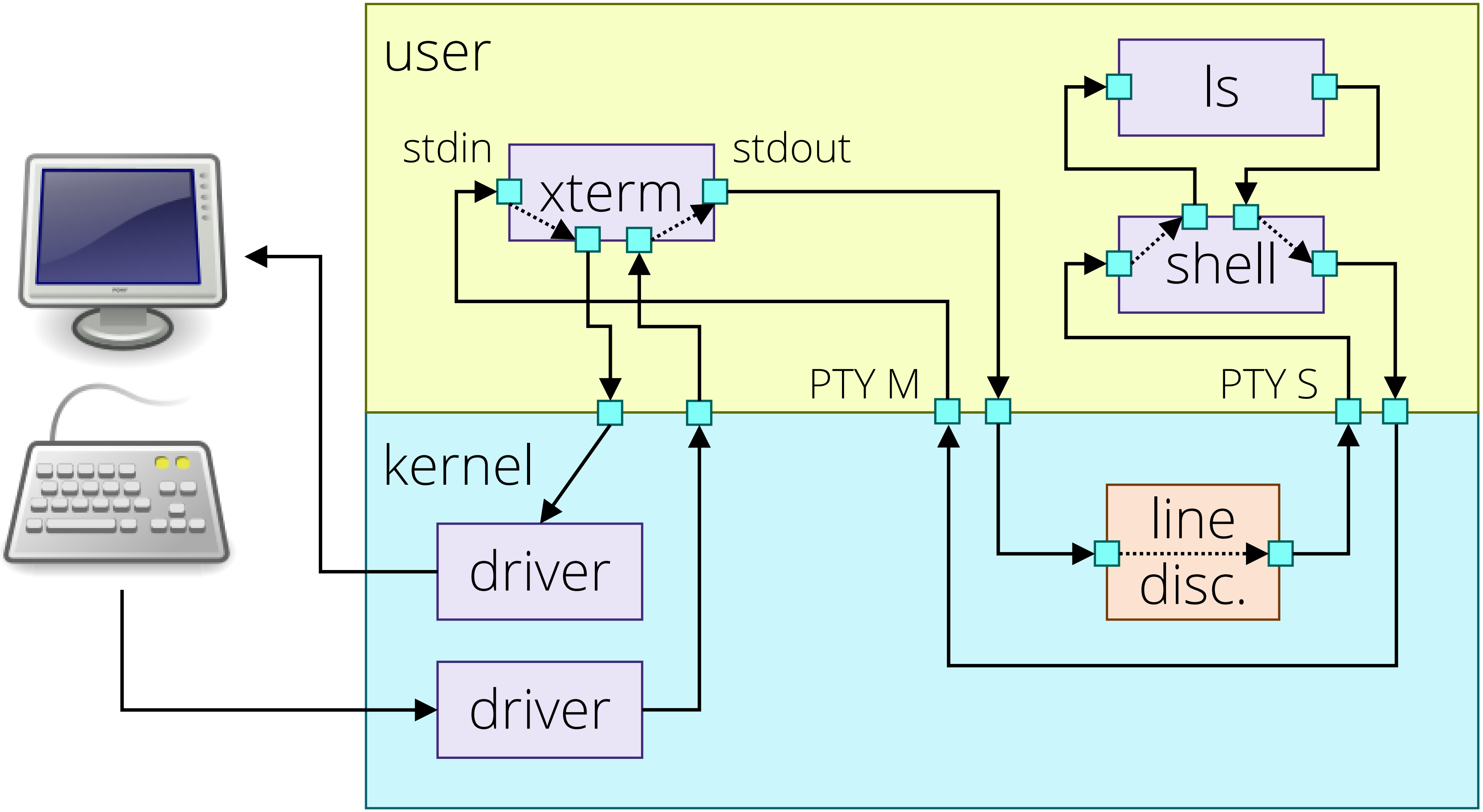
PTYs – user-mode terminals



subprocesses

POSIX way to start a process:

1. `fork` (make a copy of the current process)
2. adjust file descriptors, if necessary
3. `exec` (replaces current copy)


user
stdin
xterm
stdout
ls
shell
PTY M
PTY S
kernel
driver
line disc.
driver

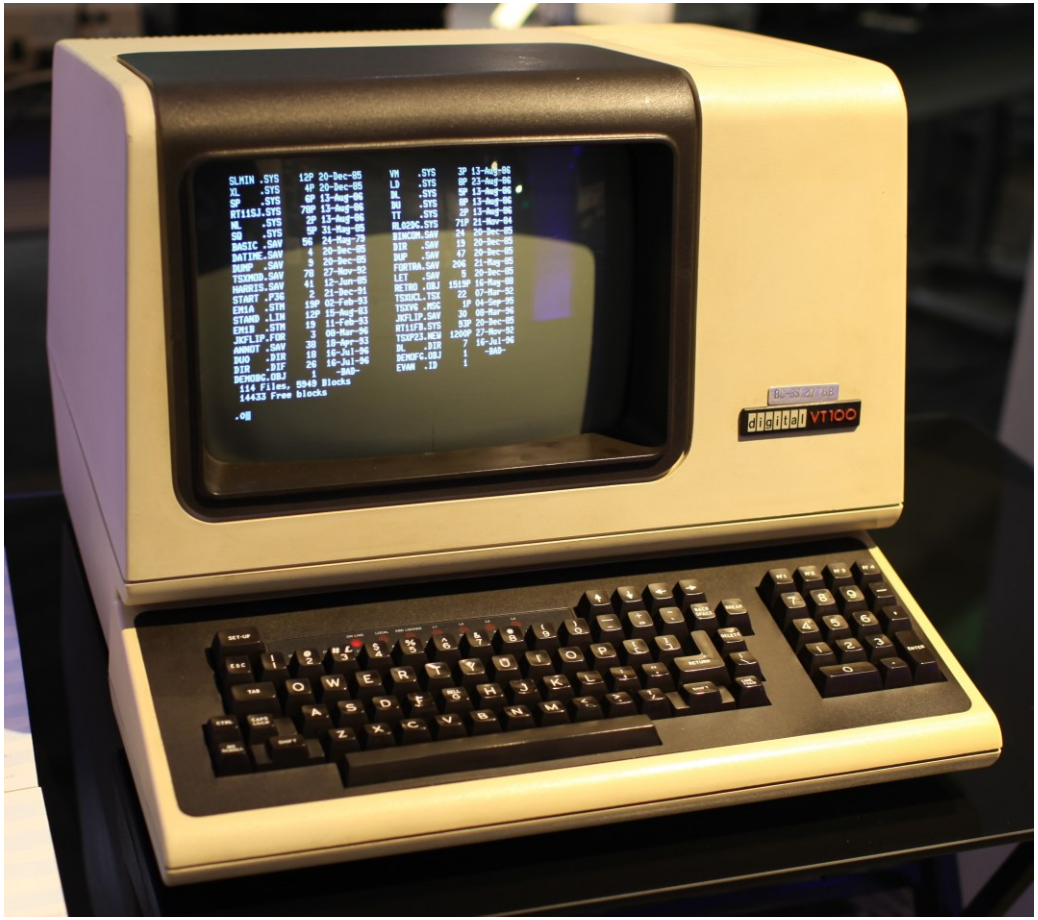
Smart Terminals

line editing

```
$ ed hello.c
73
1
#include <stdlib.h>
1c
#include <stdio.h>
.
1
wq
72
$
```

```
#include <stdlib.h>
int main() {
  printf("%s\n", "Hi");
  return 0;
}
```

graphical terminals: DEC VT100



```
SLMIN .SYS     12P 20-Dec-85    VM    .SYS     3P 13-Aug-86
XL    .SYS      4P 20-Dec-85    LD    .SYS     8P 23-Aug-86
SP    .SYS      6P 13-Aug-86    DL    .SYS     5P 13-Aug-86
RT11SJ.SYS     78P 13-Aug-86    DU    .SYS     8P 13-Aug-86
NL    .SYS      2P 13-Aug-86    TT    .SYS     2P 13-Aug-86
SB    .SYS      5P 31-May-85    RL02DG.SYS    71P 21-Nov-84
BASIC .SAV     56  24-May-79    BINCOM.SAV    24  20-Dec-85
DATIME.SAV      4  20-Dec-85    DIR   .SAV    19  20-Dec-85
DUMP  .SAV      9  20-Dec-85    DUP   .SAV    47  20-Dec-85
TSXMOD.SAV     78  27-Nov-92    FORTRA.SAV   206  21-May-85
HARRIS.SAV     41  12-Jun-85    LET   .SAV     5  20-Dec-85
START .P36      2  21-Dec-91    RETRO .OBJ  1519P 16-May-88
EM1A  .STM     19P 02-Feb-93    TSXUCL.TSX    22  07-Mar-92
STAND .LIN     12P 15-Aug-83    TSXVG .MSC     1P 04-Sep-95
EM1B  .STM     19  11-Feb-93    JKFLIP.SAV    30  08-Mar-96
JKFLIP.FOR      3  08-Mar-96    RT11FB.SYS    93P 20-Dec-85
ANNOT .SAV     38  18-Apr-93    TSXP23.NEW  1200P 27-Nov-92
DUO   .DIR     18  16-Jul-96    DL    .DIR     7  16-Jul-96
DIR   .DIF     26  16-Jul-96    DEMOFG.OBJ     1   -BAD-
DEMOBG.OBJ      1   -BAD-       EVAN  .ID      1
 114 Files, 5949 Blocks
 14433 Free blocks

.o
```

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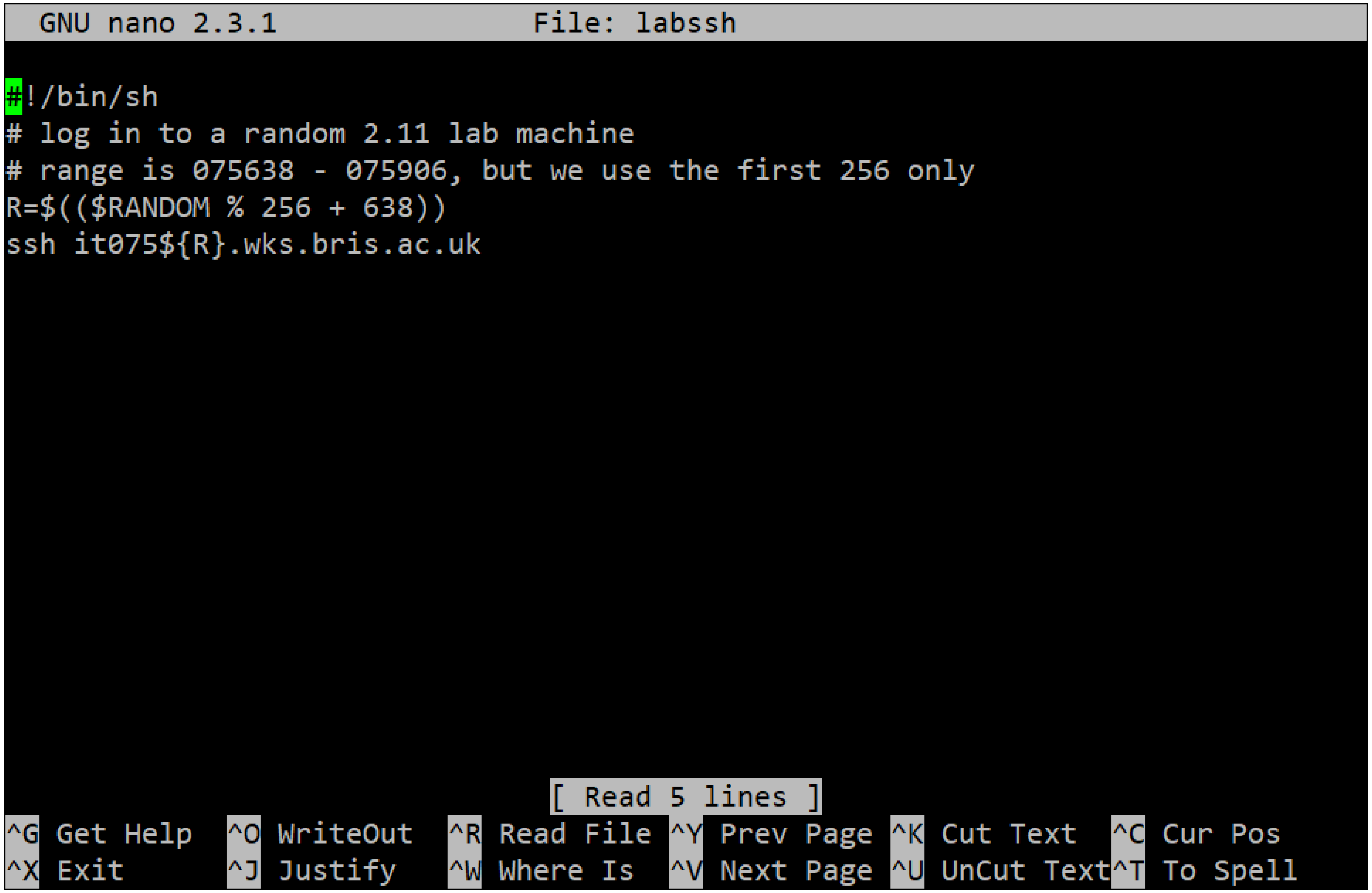
raw and cooked

Traditionally, UNIX supported

- cooked mode: line discipline is active
- raw mode: line discipline not active
  (lets you build e.g. full screen editors)

Nowadays, many more options exist:
`stty -a` shows options, details in manual.

nano



```
  GNU nano 2.3.1                File: labssh

#!/bin/sh
# log in to a random 2.11 lab machine
# range is 075638 - 075906, but we use the first 256 only
R=$(($RANDOM % 256 + 638))
ssh it075${R}.wks.bris.ac.uk
```

```
                              [ Read 5 lines ]
^G Get Help    ^O WriteOut    ^R Read File   ^Y Prev Page   ^K Cut Text    ^C Cur Pos
^X Exit        ^J Justify     ^W Where Is    ^V Next Page   ^U UnCut Text^T To Spell
```

terminal editors

vi	VIsual version of ed
pico/nano	basic terminal screen editor
emacs	Stallman's macro editor
micro	my favourite (micro-editor.github.io)

Readline

bash lets you edit the command line with arrow keys, use up/down to scroll through previous commands etc.

This is done using a library called *readline*.
It puts the terminal into (almost) raw mode to take complete control of the input and output.

Readline

```
#include <readline/readline.h>

char* line = readline("> ");
if (line != NULL) {
     ...
     free(line);
}
```

Outside C programs, **`rlwrap COMMAND`** runs a command wrapped in readline – useful to know!

To be continued in part 3 …