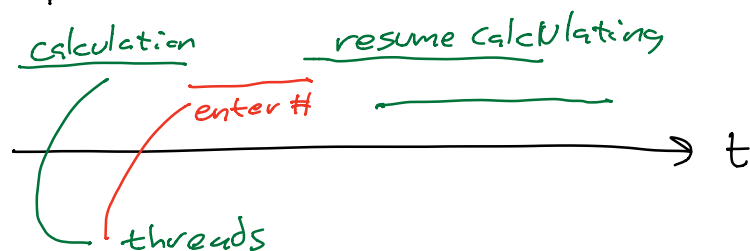


## Recitation 20: Promises

Concurrency: Multiple computations at the same time.

### Spreadsheet

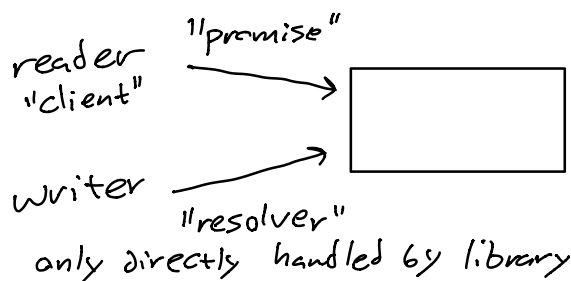


### Promises

Computation that "promises" to return a value in the future.

Callbacks

### Promises in Lwt



type 'a state =  
| Pending  
| Resolved of 'a  
| Failed of exn

Exercises: use  $\gg=$  and return to write

(i)  $\text{map} : ('a \rightarrow 'b) \rightarrow 'a \text{ promise} \rightarrow 'b \text{ promise}$

(ii)  $\text{apply} : ('a \rightarrow 'b) \text{ promise} \rightarrow 'a \text{ promise} \rightarrow 'b \text{ promise}$

let map f p = p  $\gg=$

fun x  $\rightarrow$  return (fx)

$'a \text{ promise}$        $'a \rightarrow 'b \text{ promise}$   
|                      /

$\text{let apply fp ap} = \overset{\downarrow}{\text{ap}} \gg= (\overset{\downarrow}{\text{fun a}} \rightarrow$   
 $(\text{'a} \rightarrow \text{'b}) \text{ promise fp} \gg= (\text{fun f} \rightarrow (\text{'a} \rightarrow \text{'b})$   
 $\text{return (f a)})) \rightarrow \text{'b promise}$

(iii) map2:  $(\text{'a} \rightarrow \text{'b} \rightarrow \text{'c}) \rightarrow \text{'a promise} \rightarrow \text{'b promise} \rightarrow \text{'c promise}$   
 (iv) join:  $\text{'a promise list} \rightarrow \text{'a list promise}$

implementation?

$\overset{P}{\text{filter}} (\text{Cons (h, t)}) \overset{\text{as S}}{=} \text{if } p \text{ h then } \overset{\text{fun } t}{\text{Cons (h, filter t)}} \overset{()}{}$   
 $\text{else filter t}()$