

Message Passing (concluded) and Linda

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Questions?

- Anything you want to say
 - Comments, questions, stray thoughts, etc.
 - Are we too fast/slow?
- Practical problems?
 - Don't miss deadlines! (you're not Douglas Adams)

Plan for today

- Chap 8: Message passing : recap
- Chap 9: Linda

Chap 3 & 4 (skipped for now)

REMINDER: exercises in Chaps. 1, 2, 3, 6, 7, 8

Comments on message passing

- Inter-process
 - Communication
 - Coordination
 - Cooperation
 - Contention
 - Concurrency
 - Synchronisation
- We mentioned simulation and examples such as pilots, athletes, dancers, musicians, ...

Examples from the book

- Producer-consumer
 - Doesn't matter whether synch/asynch
- Matrix-multiplication
 - Here, could be synchronous action : gangstepped
- Dining philosophers
 - With synchronous channels only.
 - Each fork behaves like a semaphore
 - Both deadlock and starvation seem possible!

Rendezvous

- Like synchronous channel, except
 - Addressing asymmetric
 - Sender knows receiver's address (entry), not v-v.
 - The communication may involve computation and return of value by the receiver
 - So made for client-server

Ada

- Uses protected objects
 - Since the 1980's
 - though the concept was around earlier
 - Thus has the cleanest shared memory model
- Also has a very good communication model
 - Rendezvous
- Ada was decided carefully through the 1970s
 - Open debates and process of definition
- Has fallen away because of popularity of C, etc.
 - Use now seen as a proprietary secret!

Loosely coupled systems

- Tightly coupled systems
 - Shared memory
 - Synchronous communication
 - Whether one-to-one or broadcast
- Loosely coupled
 - Asynchronous
 - Persistent
- Linda is such a system
 - So are filing systems and databases?

Tuple space

- Large shared notice board
- Posted notes are in the form of tuples
- Can read notes matching any pattern
 - E.g., you look for a pair
 - Only singletons and triples posted
 - Block until someone posts a pair
- This blocking gives us synchronisation

Linda primitives

- `Post(v1, v2, ..., vn)`
 - Put tuple of values out
 - Release an arbitrary proc waiting on this pattern
- `Remove(X1, x2, ..., Xn)`
 - X's are variables and x's are constants
 - Remove an arbitrary matching note
 - Block if none available
- `Read(X1, x2, ..., Xn)`
 - Like remove, but leave note on board

Generalisation of read and remove

- Allow patterns such as $(X, 4, Y)$
 - Matches only triples with middle element 4
- Allow patterns such as $(X, c=, Y)$
 - Where c is a variable
 - Matches only triples with middle element = c

Linda examples

- From the book
- Given a monotonically increasing function f , with $f(0) < 0$ and $f(1) > 0$, find x where $0 < x < 1$ such that $f(x) = 0$.
 - Can be done by binary search
 - How to use more than one process
 - Can use ability to interrupt

On Engineering

- When things go wrong
 - Shinkansen fatalities
- Stability
 - Old planes
 - Why pull is stable and push is unstable
 - New planes and proof
- One world and many departments
- Specifications, tolerances, etc.
 - Elektronik är komponenter
 - We don't even know what our nuts and bolts are
 - New disciplines need patience (and modesty)
 - The limitations of formal proofs and model checking
- Build the right system, build it right.