Prime Trader

and other lisp applications at Netfonds

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Netfonds

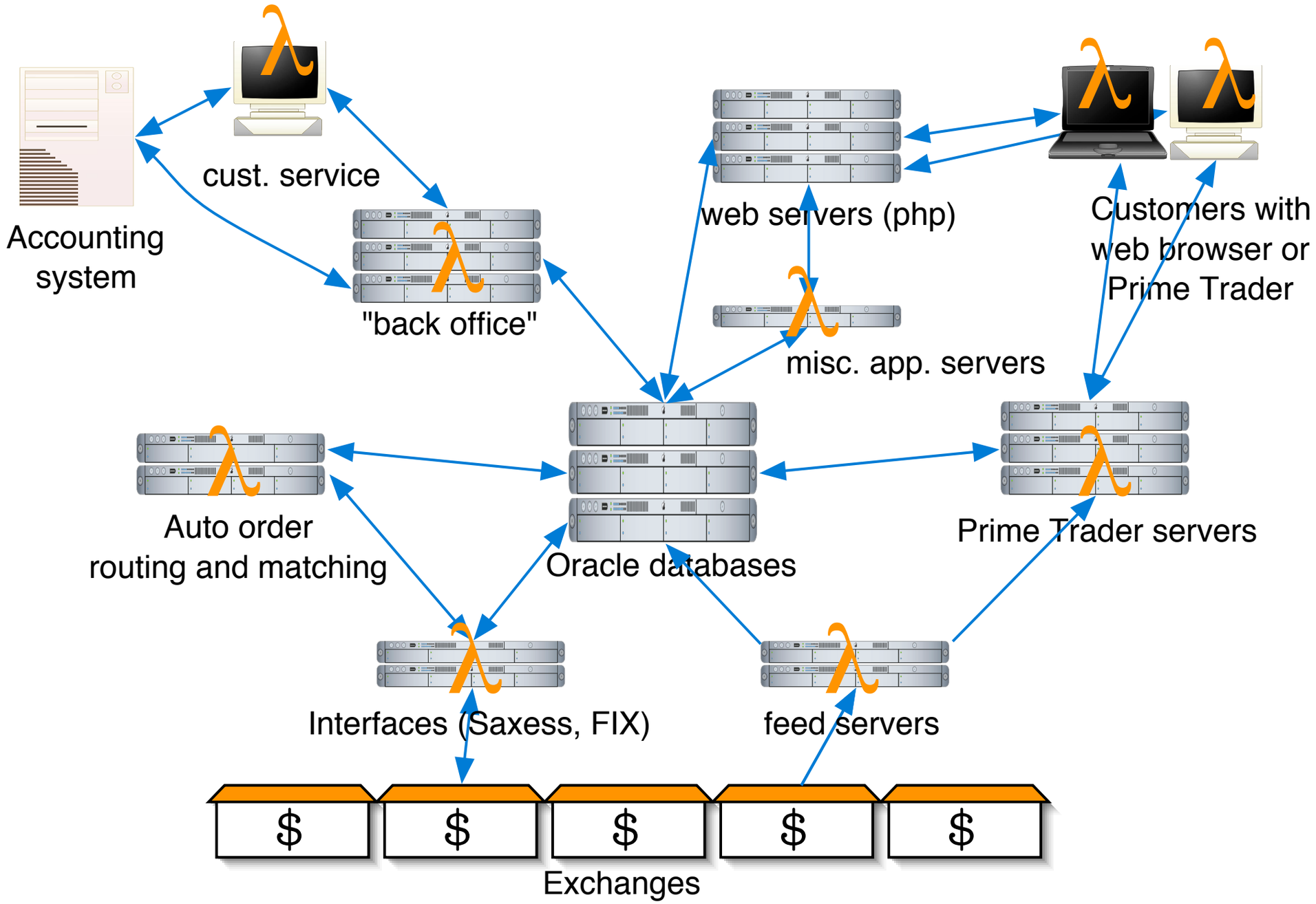
About Netfonds

- Established 1997
- Pioneered Internet-based (“self serve”) stock trading in Norway
- Offers trading and real time stock quotes on the stock exchanges of Oslo, Stockholm and New York
- 11 employees – 7000 active customers (1000 use Prime Trader)
- 3 (4) Lisp Developers / linux sysadmins

Talk Overview

- Lisp at Netfonds
- PrimeTrader
- A few problems and how we solved them
- System Demo

Simplified System Overview



Netfonds

and more...

- Interface to VPS (Norwegian central stock custody)
- Interface to banks (transfers to/from trading accounts)
- Auto-generated tax forms
- loans (of shares or money)
- risk management (portfolio VaR calculations)
- newsfeeds, real time exchange rates, etc.

PrimeTrader

- Specialized stock trading application
- Faster and more interactive than webapps
- Real time stock quotes
- Fast order entry and status
- Written in LispWorks, runs on Windows, OS X, linux
- Completely self-contained (even crypto)
- Lisp on the server side, too

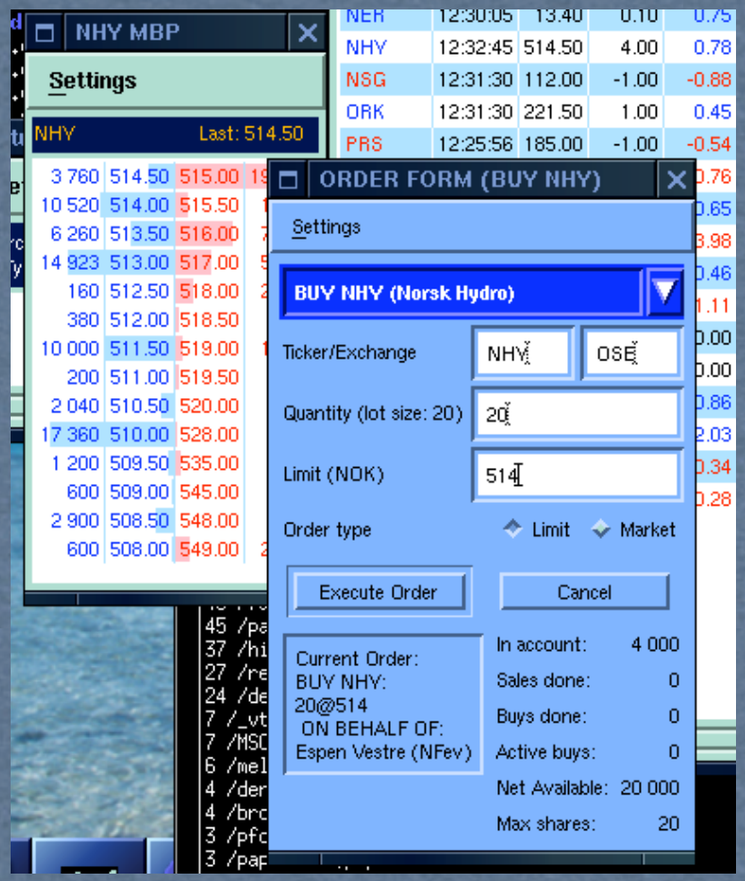
PrimeTrader

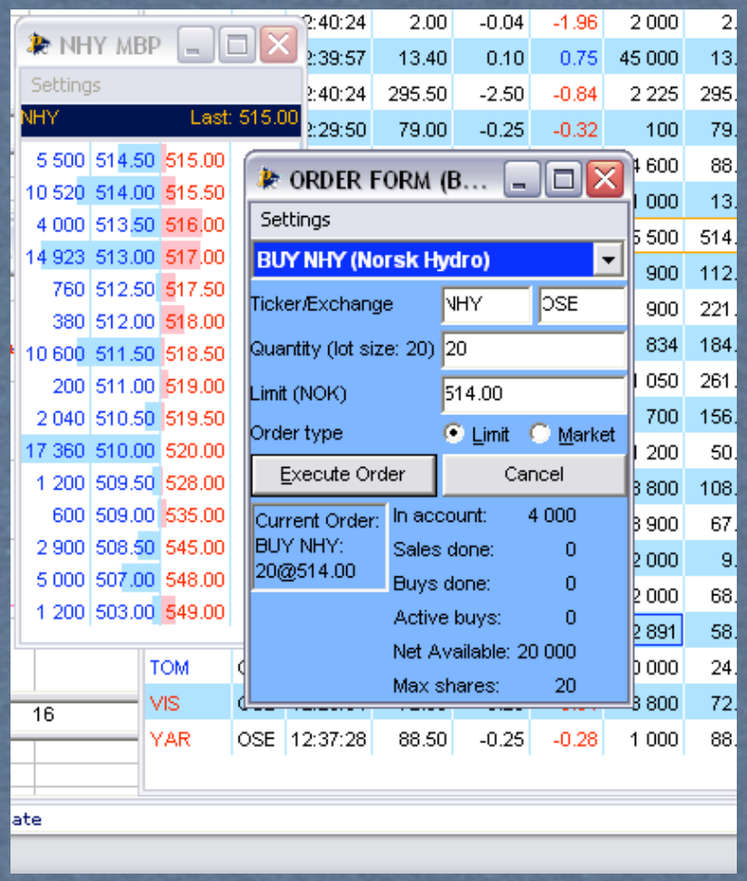
- RSA-encryption for handshake
- All personal data blowfish-encrypted
- Automatic patch downloads
- Automatic patch generation from CVS
- HTTP-based protocol
- Subscription model ensures low bandwidth
- Automatic reconnect

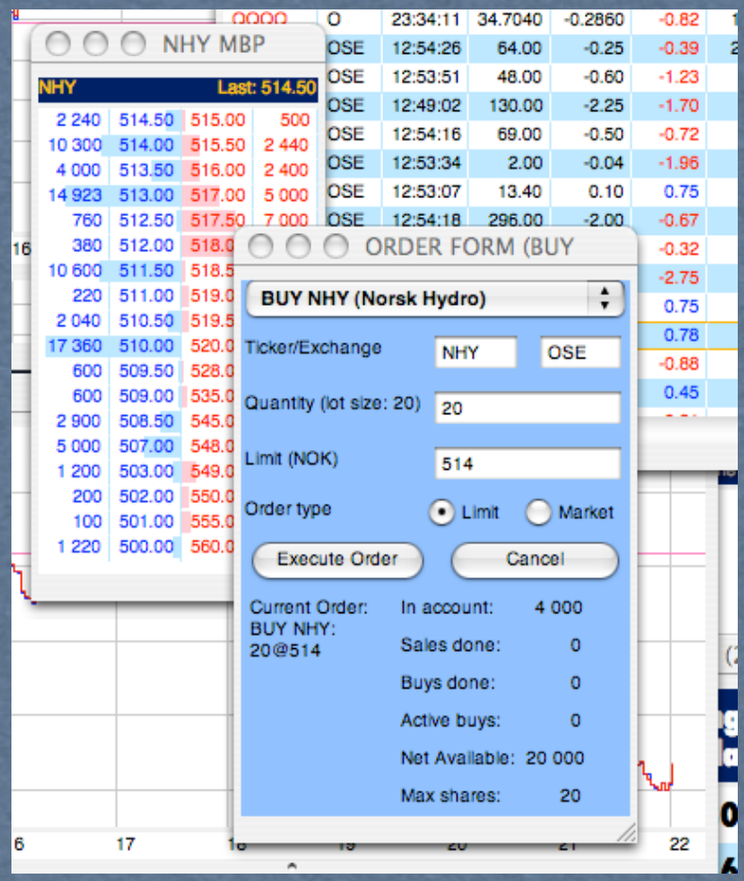
CAPI experiences

- Extremely portable (and our competitors have Windows-only offerings!)
- Fairly easy in use
- More native look&feel than many other cross-platform tools
- ...but not 100%
- wish-list: E.g. html rendering panes, drag-and-drop

3x PrimeTrader





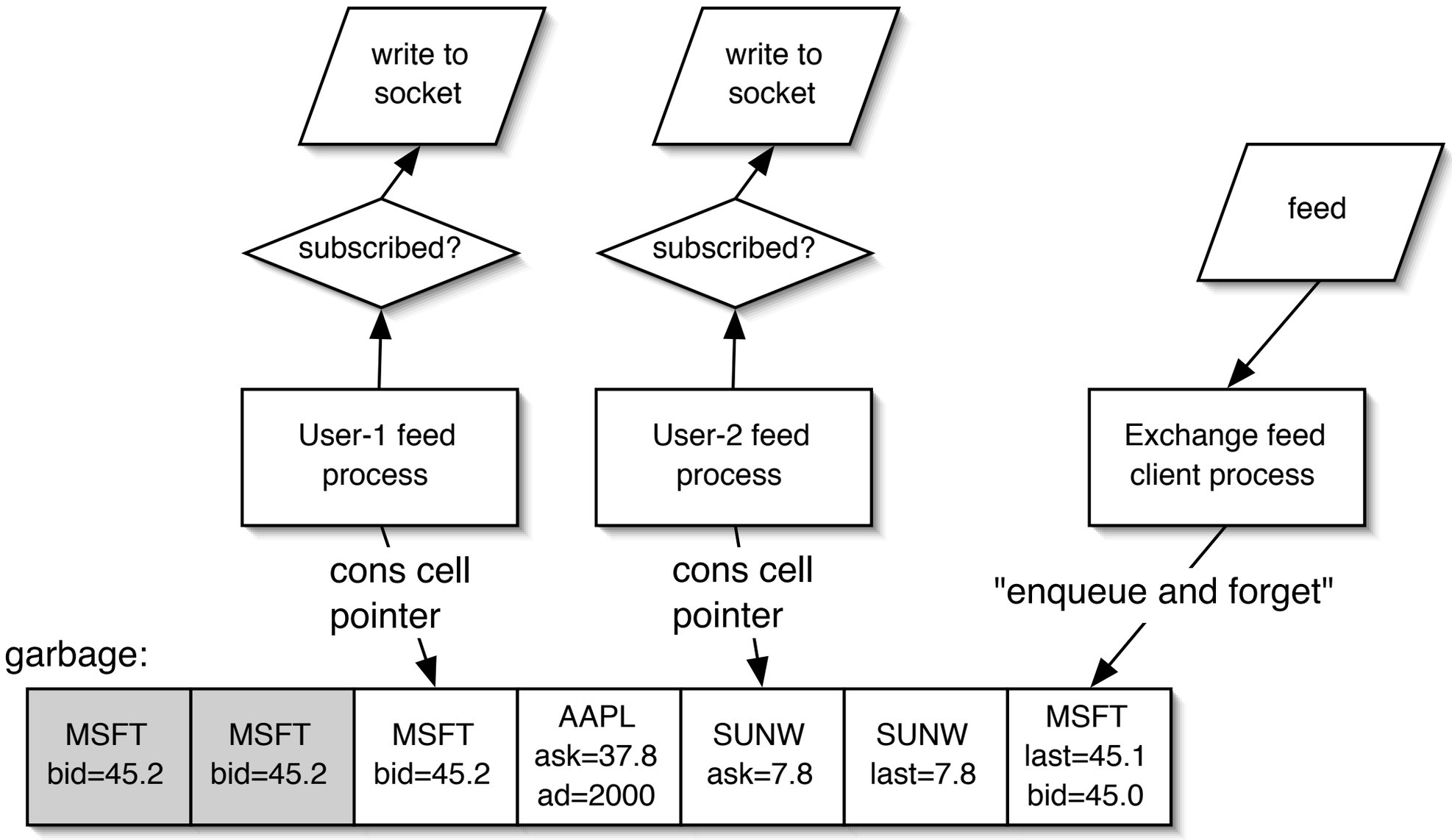


Netfonds

Some GUI comments

- Table layout is done with pinboard layouts
- Table class has been successfully reused in a wide range of internal customer service and back office applications.
- Very object-oriented: Each table cell clos- object, knows how to draw itself, subscribes to data, gets redraw messages when data changes

Server feed model



Problems

- Not kind to GC
- full GC (mark-and-sweep 2) every hour (20 minutes for US servers) cleans up
- BUT NASDAQ feed speed often exceeds 2000 trans/second!
  - slow clients can quickly lag 1 million transactions behind!
- List of 1 million CLOS objects + 50 threads + dozens of pointers to list = GC hell

Session model

- Streaming is done by “slow http calls”
- Server session ≠ Tcp session
- Session objects across tcp connections
- Need to kill idle sessions

IJK

- The Idle Job Killer looks for inactive sessions and removes them:

```
(defun kill-if-idle (cookie session)
  (with-slots (main-userid queue) session
    (when (idle-p session)
      (remhash cookie *sessions*)
      (logger:log-message
       (list
        :ijk
        (format nil "killed session ~a (userid ~a)"
                    cookie main-userid)))
(when queue ;; then really logged in!
  (setf queue nil)
  (db-log-logout session)))))
```

IJK cont.

- First version of IJK (i.e. idle-p) solved garbage problem for servers for low-volume exchanges (Oslo)
- But *not* if clients were alive, but too slow (some clients of US servers)

```
(defparameter *max-queue-length* 100000)

(defmethod flush-queue ((session nftp-session))
  (with-slots (queue queue-emptied main-userid cookie init-ip-addr) session
    (with-slots (lq:lock) queue
      (pmp:with-lock (lq:lock)
        (let ((to-delete (- (lq:queue-length queue)
                            (/ *max-queue-length* 10))))
          (loop for i below to-delete
                do (lq:pop-queue queue))
          (logger:log-message
             (list :warning :flush to-delete main-userid cookie init-ip-addr)))
        (setf queue-emptied t)))))
```

```
(defun idle-p (session)
  (with-slots (queue last-event-time streamer-process) session
    ;; sessions without queue are not yet logged in and should
    ;; be timed out after a while:
    (let ((length (if queue (lq:queue-length queue) 0)))
      (when (> length *max-queue-length*)
        (flush-queue session))
      (and (or (not queue)
               (> length 500)
               (not streamer-process))
           (> (- (get-universal-time)
                 last-event-time)
              *idle-timeout*)))))
```

Result

- NASDAQ and NYSE servers now extremely stable (about 600MB each, runs 24x7 uninterrupted since january/february)
- mark-and-sweep every 15 min. Typical timings:

```
("2005-04-21 15:40:19" "at-in-lisp" :DO-GC :STATS "freed 258109K in 766 ms cpu time")
("2005-04-21 15:55:19" "at-in-lisp" :DO-GC :STATS "freed 250749K in 778 ms cpu time”)
("2005-04-21 21:40:31" "at-in-lisp" :DO-GC :STATS "freed 187625K in 1872 ms cpu time")

("2005-04-21 21:55:31" "at-in-lisp" :DO-GC :STATS "freed 256206K in 1947 ms cpu time")
```

- Happy sysadmins
- Happy customers, too: Slow clients now get near-real-time data. Only problem: Missing details in intraday graphs

Saving bandwidth

- Unique (we think) “data subscription” system:
- Client only requests as much data as it really needs
- Streaming data for a limited number of stocks possible via GPRS (9600bps)
- Full US feed may require > 10Mbps

Data subscriptions

- Client tells server what data it wants
- Server checks subscriptions before writing object to socket

```
(defmethod subscribe ((obj nftpc))
  (with-streamer-server (obj)
    (let ((args (make-key-arglist obj)))
      (unless (already-subscribed args)
        (do-bfec-command `(subscribe ,@args)))
      (incf (gethash args *subscriptions* 0)))))
```

```
;; subscribe to specific quote:

(subscribe
  (make-instance ‘quotes
                 :paper “NHY” :exchange “OSE”))

;; subscribe to all trades on OSE

(subscribe
  (make-instance ‘trade :exchange “OSE”))
```

Subscribe, cont.

- mapping facilities for subscribing to lists of objects
- one call to server subscribes list of objects
- distributed calls to several servers (when data with mixed sources)

```
(defun sync-all-subscriptions-with-server (sublist)
  (multiple-value-bind (subscribes unsubscribes)
      (analyze-subscriptions sublist)
    (when subscribes
      (nftp:map-bfec-command 'nftp:subscribe subscribes))
    (when unsubscribes
      (nftp:map-bfec-command 'nftp:unsubscribe unsubscribes))))
```

Versions and patches

- Automatic creation of sexp-level diff of two versions (including some cheap tricks for deleted methods and changed defvars).
- compile to patch (one for each platform)
- Customers get notifications
- SHA1 fingerprint for download integrity
- fasl file loaded into running program (at startup - dynamic change of capi objects not always possible)

Server patches

- Same diff method
- Loaded into running servers through REPL server
- some scripts for mass loading (currently there are 19 PrimeTrader servers)

Bug Reporting

- catches all errors
- asks user for permission to submit bug report
- posts backtrace + LW bug form + other data to server, server sends mail to sysadmins
- gives the user a choice: continue or quit

Future Plans/wishes

- e.g.:
- better newsfeed
- more graph tools, technical analysis
- portfolio tools
- better mobile version (currently done in java, wish for common lisp :-))
- whatever the customer wants

System Demo

One moment please...