Buy a Feature: an Adventure in Immutability and Actors

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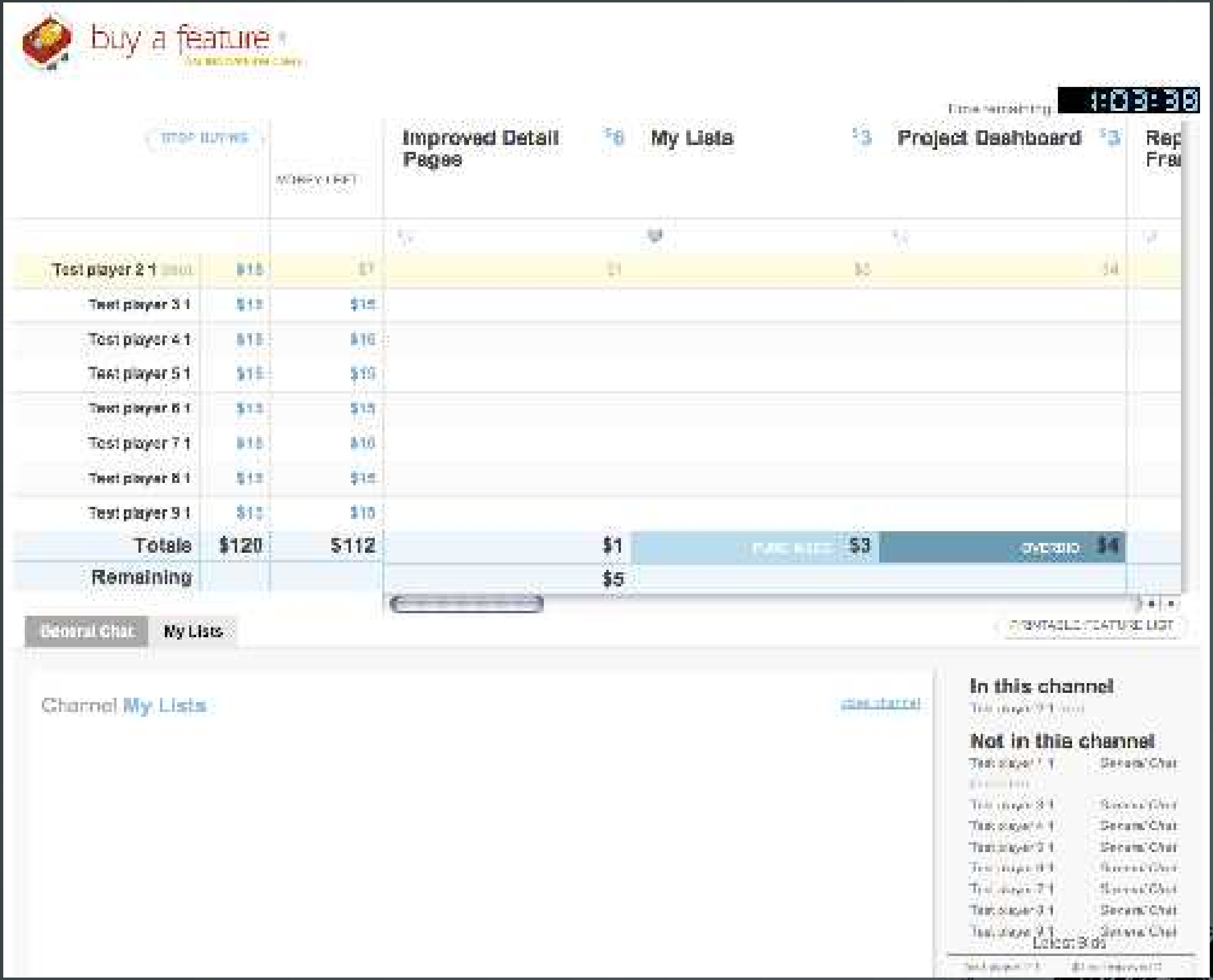
David Pollak

- Not strict, but pretty lazy
- Lead developer for *Lift* web framework
- Scala since November 2006, Ruby/Rails, Java/J2EE
- Spreadsheet junky (writing more than using)
- Paying work (all *Lift* based):
  - Enthiosys' Buy a Feature
  - SAP's ESME project
  - Gump-it: stuff worth missing

About Buy a Feature (online)

- The first of Enthiosys' online Innovation Games
- Serious Gaming for Agile Product Management
- Game Play:
  - Create a list of product features with estimated costs
  - 4-8 player buy features that they want
  - Motivate negotiations between players
  - Learn how players sell each other on features

Buy a Feature



buy a feature

Time remaining 1:03:38

STOP BUYING		MONEY LEFT	Improved Detail Pages $6	My Lists $3	Project Dashboard $3	Rep Fra
Test player 2 1	$15	$7	$1	$3	$4	
Test player 3 1	$15	$15				
Test player 4 1	$15	$15				
Test player 5 1	$15	$15				
Test player 6 1	$15	$15				
Test player 7 1	$15	$15				
Test player 8 1	$15	$15				
Test player 9 1	$15	$15				
Totals	$120	$112	$1	[illegible] $3	[illegible] $4	
Remaining			$5			

PRINTABLE FEATURE LIST

General Chat | My Lists

Channel My Lists

clear channel

In this channel

Test player 2 1

Not in this channel

Test player 1 1	General Chat
Test player 3 1	General Chat
Test player 4 1	General Chat
Test player 5 1	General Chat
Test player 6 1	General Chat
Test player 7 1	General Chat
Test player 8 1	General Chat
Test player 9 1	General Chat

About Scala & *Lift*

- Scala
  - Hybrid OO & Functional Language
  - Compiles to Java Byte-Code and runs fast on JVM
  - Compatible with Java libraries
  - FP concepts including Actors and Immutablity
- *Lift*
  - Concise, powerful web framework
  - Leverages Scala's functional features
  - Awesome Comet and AJAX support

Buy a Feature Architecture

- *Lift* based Comet front-end
- UI state managed in *Lift* CometActors
- All user interaction via JSON messages/events
- Events sent to GameActor
- GameActor updates GameBoard and writes events
- GameActor sends GameBoard, etc. to CometActors

Actors – Why?

- Excellent concurrency management
- Event oriented
- Asynchronous

-
  ```
  case EndGame =>
  recordGameEnding()
  this ! ChatMessage(Empty, timeNow,
                     "Game Ended", Empty, Empty)
  eachListener(_ ! EndGame)
  ```

Actors – Where?

- UI
  - Pushes UI state changes out to browser
  - Listen for incoming events/messages
- Cross-session Game managers
  - Incoming events serialized
  - Incoming events → New State
  - New State → Listners (other Actors)

Events – Why?

- Anything that can change state is an Event
- Events are timestamped and written to RDBMS
- Events can be replayed through the system for TiVo style game replay and pausing
- Complementary to Actors

Events – Where?

- Broswer → Server (CometActor)
- CometActor → GameActor
- GameActor → RDBMS
- GameActor → Listners (mostly UI CometActor)
- CometActor → Browser

Post-Processing

- Game Events are recalled, in order from RDBMS
- Game Events are send through the GameBoard
- GameBoard is queried for results
- GameBoard is immutable, so a separate copy can be associated with each Event
- Thus, there's a freeze-frame at each event

Defects

- *Lift* session bugs
  - Lots of stupid problems working around J2EE sessions
  - Why? I'm a moron
- Parsing
  - Users entering free text → lots of unexpected input
  - Most of our tests are here
- Post-processing
  - Didn't use GameBoard, but rolled my own – bad results
  - Too many GameBoards in memory

Team Integration

- Disbelief over code size
- Attempts to dive below the abstractions
- Java-like coding on the road to functional
- Eventual adoption of map, fold, and filter
- NPE: Thing of the past
- Lack of tool support and examples in the wild are speed bumps, especially with existing code
- Need a team mentor to help with transition

Conclusion

- Amazing productivity for people once up the FP curve
- Very low defect rate
- None of the defects were concurrency related!!
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- Very flexible system (added Flash front end in a day)

End

- Questions?

Scala: Functions are Objects

- Objects can be passed as parameters
- Functions are syntactically easy to create
```
var name = “”
SHtml.text(name, name = _)
```
- They bind to variables/values (e.g. name)

Partial Functions

- PartialFunction[A,B] extends Function1[A,B]
- isDefinedAt(x: A)
- Better known as pattern matching:

```
{
  case Foo(bar) => bar
  case Baz(dog) => dog
}
```

Composing Partial Function

```
{ case Foo(bar) => bar
  case Baz(dog) => dog
} orElse { // compose
  case Moo(cow) => cow
  case Meow(cat) => cat
}
```

Extractors and Guards

- Extract data while matching other parts in a pattern:
```
{ case “Foo” :: id :: Nil => doIt(id) }
```
- Guards:
```
{ case “Foo” :: id :: Nil
  if isValid(id) && loggedIn_? =>
  doIt(id) }
```

Remembering Functions

- Functions are Objects
- Map[String, String => XML]
- Map[String, PartialFunction[String, XML]]
- GET /ajax?OPAQUE_ID=someValue
- Map[OPAQUE_ID](someValue)

XML literals and manipulation

- In Scala, XML is like String: supported at the language level and immutable

```
<foo>{(1 to 10).
     map(i => <val>{i}</val>)}</foo>
```

-
  ```
  (xml \ “val”).map(_.text.toInt).
    .foldLeft(0)(_ + _) == 55
  ```

Actors and Partial Functions

- Threadless, stackless units of execution
- React to events and otherwise consume nothing but memory
- react(PartialFunction[Any, Any]) →
  ```
  react {case Foo(bar) => doSomething(bar)
          case Baz(dog) =>
  doElse(dog) }
  ```
- react(primaryHndlr orElse secondaryHndler)

Lift REST APIs

- LiftRules.addDispatchBefore {
  case RequestMatcher(
     RequestState(
        "showstates":: xs, _),_) =>

  XmlServer.showStates(xs) }
- def showStates(...) = XmlResponse(
  <states renderedAt={timeNow.toString}>
  ... </states>)

Lift and HTML forms

- var name = “”
- text(name, name = _)
- def setLocale(loc: String) ...
- select(Locale.getAvailableLocales.toList.
map(lo => (lo.toString, lo.getDisplayName)),
setLocale)

Lift & AJAX

- AJAX elements are bound to functions:
- a(() => {cnt = cnt + 1; SetHtml("cnt_id", Text(cnt.toString))}, “click me”)
- ajaxSelect(opts,
     v => DisplayMessage("You selected "+v))

Lift CometActors

- *Lift* deals with all the plumbing:

```
def render = bind("time" -> timeSpan)
override def lowPriority = {
    case Tick => reRender(false)
}
```