MF#K - Introduction to F#

ERFA meeting @ PFA 2015-02-27

Mødegruppe for Ƒunktionelle Københavnere (MF#K)

Overview

- About me
- Matching of expectations
- Agenda
  - 09:00 |> Short introduction to F# (sales pitch)
  - 09:20 |> Demo: F# and LivNet (FK64: Settlement of remuneration)
  - 10:00 |> Summary: U want more?

About me (very shortly)

- Ramón Soto Mathiesen
- MSc. Computer Science from DIKU (Minors in Mathematics)
- Managing Specialist |> CTO of CRM Department @ Delegate A/S
  - ER-modeling, WSDL, OData (REST API)
- F# / C# / JavaScript / C++: Delegate A/S @ GitHub
- Blog: http://blog.stermon.com/

Matching of expectations

- What are you expectations for this introduction to F#?

Matching of expectations

- Functional Copenhageners Meetup Group will try to get more and more software projects to be based on functional programming languages. We mainly focus on F# and Haskell, but other functional programming languages like Scala, Lisp, Erlang, Clojure, OCaml, etc. are more than welcome.
- We expect that attendees to this introduction to F#, will get inspired to use the language in the future ☺

Short introduction to F# (sales pitch) - Buzzwords

- *less code, error-free projects, only one code base, big data, parallelism, concurrency, asynchronous processes*

Short introduction to F# (sales pitch) - F# - What is it?

- Is an ***open-source***, ***strongly typed***, ***multi-paradigm*** programming language encompassing ***functional***, ***imperative*** and ***object-oriented*** designed by Don Syme (MS Research Cambridge UK) and maintained by Microsoft, F# Software Foundation and open contributors
- It's a mature language that is part of Visual Studio and the .NET Framework
- Loved by the ***very talented*** who contribute to it for free with sometimes very usable projects:
  – Special mention to (among others):
    - Tomas Petricek (TomASP.NET)
    - Scott Wlaschin (F# for fun and profit)

Short introduction to F# (sales pitch) - F# - Why use it?

- Conciseness
- Convenience
- Correctness
- Concurrency
- Completeness

Short introduction to F# (sales pitch) - F# - Why use it?

```
let swap (x,y) = y,x
let foo = swap(42,0)
let bar = swap("42","0")
```

```
> val swap : x:'a * y:'b -> 'b * 'a
> val foo : int * int = (0, 42)
> val bar : string * string = ("0", "42")
```

- Conciseness:
  - F# is not cluttered up with coding noise such as curly brackets, semicolons and so on
  - You almost never have to specify the type of an object, thanks to a powerful ***type inference system***.
  - And, compared with C#, it generally takes ***fewer lines of code*** to solve the same problem

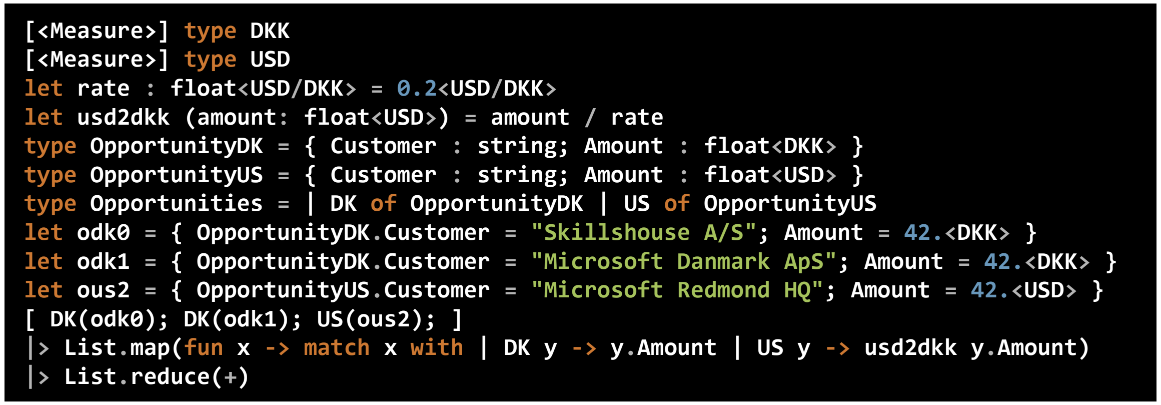
Short introduction to F# (sales pitch) - F# - Why use it?

```
let f g x = g x
f (fun x -> x * x) 42
```

```
> val f : g:('a -> 'b) -> x:'a -> 'b
> val it : int= 1764
```

- Convenience:
  - Many common programming tasks are much simpler in F#. This includes things like creating and using ***complex type definitions***, doing ***list processing***, ***comparison and equality***, ***state machines***, and much more
  - And because functions are first class objects, it is very easy to create powerful and reusable code by creating functions that have ***other functions as parameters***, or that ***combine existing functions*** to create new functionality

Short introduction to F# (sales pitch) - F# - Why use it?



```fsharp
[<Measure>] type DKK
[<Measure>] type USD
let rate : float<USD/DKK> = 0.2<USD/DKK>
let usd2dkk (amount: float<USD>) = amount / rate
type OpportunityDK = { Customer : string; Amount : float<DKK> }
type OpportunityUS = { Customer : string; Amount : float<USD> }
type Opportunities = | DK of OpportunityDK | US of OpportunityUS
let odk0 = { OpportunityDK.Customer = "Skillshouse A/S"; Amount = 42.<DKK> }
let odk1 = { OpportunityDK.Customer = "Microsoft Danmark ApS"; Amount = 42.<DKK> }
let ous2 = { OpportunityUS.Customer = "Microsoft Redmond HQ"; Amount = 42.<USD> }
[ DK(odk0); DK(odk1); US(ous2); ]
|> List.map(fun x -> match x with | DK y -> y.Amount | US y -> usd2dkk y.Amount)
|> List.reduce(+)
```

- Correctness:
  - F# has a ***powerful type system*** which prevents many common errors such as ***null reference exceptions***.
  - Values are ***immutable by default***, which prevents a large class of errors
  - In addition, you can often encode ***business logic*** using the ***type system*** itself in such a way that it is actually ***impossible to write incorrect code*** or mix up ***units of measure***, greatly ***reducing the need for unit tests***

Short introduction to F# (sales pitch) - F# - Why use it?

```
[|0 .. 10 .. (1 <<< 16)|]
|> Array.map(fun x -> x * x)
[|0 .. 10 .. (1 <<< 16)|]
|> Array.Parallel.map(fun x -> x * x)
```

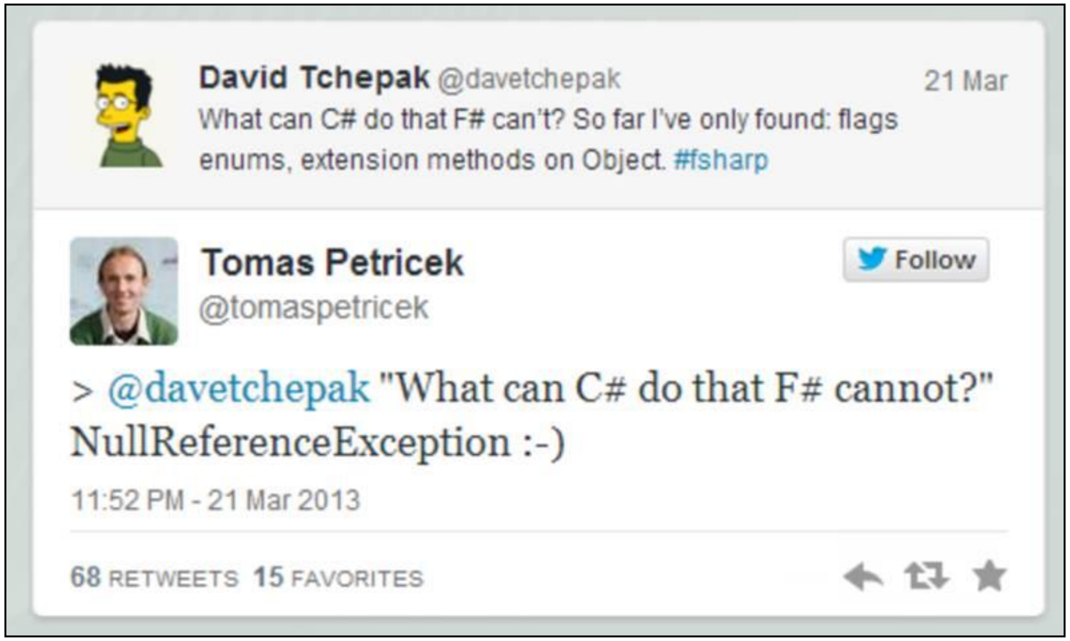
- Concurrency:
  - F# has a number of built-in libraries to help when more than one thing at a time is happening. Asynchronous programming is ***very easy***, as is parallelism. F# also has a built-in ***actor model***, and excellent support for event handling and ***functional reactive programming***
  - And of course, because ***data structures are immutable by default***, ***sharing state*** and ***avoiding locks*** is much easier

Short introduction to F# (sales pitch) - F# - Why use it?

```
open System
let ts () = DateTime.Now.ToString("o")          // ISO-8601
let ts' () = (ts ()).Replace(":", String.Empty) // Filename safe
let cw (s:string) = Console.WriteLine(s)
let cew (s:string) = Console.Error.WriteLine(s)
```

- Completeness:
  - Of course, ***F# is part of the .NET ecosystem***, which ***gives you*** seamless ***access to all the third party .NET libraries and tools***.
  - Finally, ***it is well integrated with Visual Studio***, which means you get a great IDE with ***IntelliSense support***, ***a debugger***, and many plug-ins for unit tests, source control, and other development tasks
  - Although it is a functional language at heart, F# does support other styles which are not 100% pure, which makes it much easier to interact with the non-pure world of web sites, databases, other applications, and so on. In particular, F# is designed as a hybrid functional/OO language, ***so it can do virtually everything that C# can do except …***

Short introduction to F# (sales pitch) - F# - Why use it? (*funny*)



David Tchepak @davetchepak 21 Mar
What can C# do that F# can't? So far I've only found: flags enums, extension methods on Object. #fsharp

Tomas Petricek
@tomaspetricek

> @davetchepak "What can C# do that F# cannot?" NullReferenceException :-)

11:52 PM - 21 Mar 2013

68 RETWEETS 15 FAVORITES

Remark: **string** in F# can be ***null*** as well (primitive .NET types)

Short introduction to F# (sales pitch) - F# - Why use it? (Business)

- Time to Market:
  - Easy prototyping (REPL: Read-Evaluate-Print-Loop)
  - Run as .NET code
- Efficiency:
  - JIT compilation (as C#)
  - Easy to implement parallelism
- Complexity:
  - Flexible language
  - Type inference
- Correctness:
  - Advanced types
  - Close to math

Demo: F# and LivNet (FK64: Settlement of remuneration)

- After a short demonstration of LivNet by Daniel Olsen we decided that it would make sense to showcase an example how to post-process a CSV file generated by the system
- We have chosen the following script (kørsel):
  - FK64: Afregning af vederlag
  - Task to be shown:
    1. Use the Fsharp.Data TypeProvider to ***infer types*** from .CSV file based on a sample of the script (***CsvProvider***)
    2. Load data from the script ***FK64: Afregning af vederlag***
    3. Remove entries ***without*** a Bank
    4. Normalize amount by multiplying with ***0.001***
    5. Show amount in a graph (FSharp.Charting) combined with ***Value date***.

Remark: All the above in only less than 50 lines of well-written code ☺

U want more?

- Code will be available @ dao@pfa.dk
- Slides will be available @ dao@pfa.dk
- Sign up @ MF#K for:
  - More ***fun***
  - Hands-on:
    - Phil Trelford: Hands On Fparsec (2015-03-17)
  - Talks:
    - In the pipeline talks about: ***Erlang***, ***Haskell***, ***Rust***, ...
      - Up next: Erlang in general and Haskell with CUDA (May month)
- MF#K would like to thank our sponsor(s):

delegate
Shared Success