

# F# Data: Making structured data first-class citizens

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## Abstract

Most statically typed languages assume that programs run in a closed world, but this is not the case. Modern applications interact with external services and often access data in structured formats such as XML, CSV and JSON. Static type systems do not understand such external data sources and only make data access more cumbersome. Should we just give up and leave the messy world of external data to dynamic typing and runtime checks?

Of course, we should not give up! In this paper, we show how to integrate external data sources into the F# type system. As most real-world data on the web do not come with an explicit schema, we develop a type inference algorithm that infers a type from representative samples. Next, we use the type provider mechanism for integrating the inferred structures into the F# type system.

The resulting library significantly reduces the amount of code that developers need to write when accessing data. It also provides additional safety guarantees – arguably, as much as possible if we abandon the (incorrect) closed world assumption.

**Categories and Subject Descriptors** D.3.3 [Programming Languages]: Language Constructs and Features

**Keywords** F#, Type Providers, JSON, XML, Data, Type Inference

## 1. Introduction

<sup>1</sup>

Bacon ipsum dolor amet biltong strip steak pancetta tenderloin. Picanha pork pig shank. Jowl ground round kielbasa capicola swine tenderloin tri-tip beef ribs brisket picanha boudin. Turkey ham hock jowl andouille hamburger pork chop shankle bacon, shank bresaola jerky chuck biltong sirloin meatball.

```
let data = Http.Request("http://weather.org/?q=Prague")
match JsonValue.Parse(data) with
| Record(root) →
    match Map.find "main" root with
    | Record(main) →
        match Map.find "temp" main with
        | Number(num) → printfn "Lovely %f degrees!" num

type W = JsonProvider<"http://weather.org/?q=Prague">
printfn "Lovely %f degrees!" (W.GetSample().Main.Temp)
```

The text of the paper begins here.

## **A. Appendix Title**

This is the text of the appendix, if you need one.

## **Acknowledgments**

Acknowledgments, if needed.

## **References**

[1] P. Q. Smith, and X. Y. Jones. ...reference text...