F# OpenCL C Type Provider

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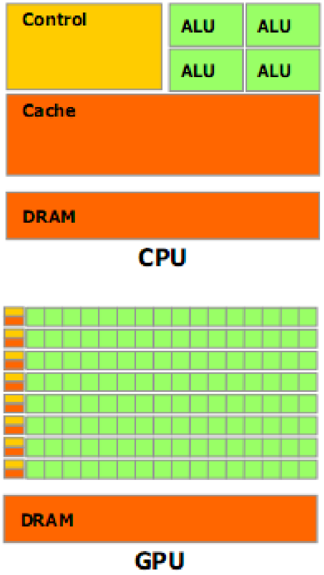
September 27, 2018

GPGPU



General purpose computations on grphical processor units

- (Almost) SIMD architecture
- Huge amount of “simple” ALUs on single chip
- May be a good choice for huge data processing

General purpose applications of GPGPU

- Initially is sientific computations
  - Phis
  - Math
  - Chem
- But more amd more general application
  - Finance/Banking
  - Bioinformatics
  - Data Analytics and Data Science (Hadoop, Spark ...)
  - Security analytics (log processing)

Problem: GPGPU <-> High level programming

Low-level platforms and languages for GPGPU programming

- NVIDIA CUDA: Cuda C, Cuda Fortran
- **OpenCL: OpenCL C**

High-level platform and languages for applications

- C++
- Pyhon, Haskell, OCaml, . . .
- JVM: Java, Scala, . . .
- **.NET: C#, F#, . . .**

Existing solutions and problems

- Generative approach (haskell, Alea, etc): good byt what about code reusing
- Simple drivers (textual, for example)

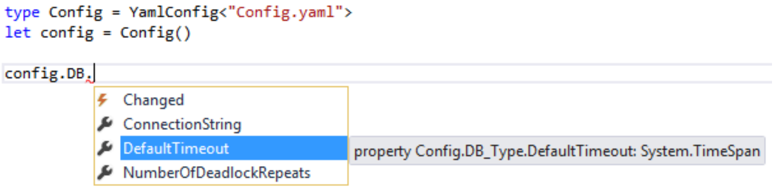
Type providers

our focus is .NET, so it is the way to solve our problem Compile-tyme metaprogramming -> design-time features in IDE completion, type informtion, etc

Type providers

more inside, exaples of R, COM, INI providers

- Config



```
type Config = YamlConfig<"Config.yaml">
let config = Config()

config.DB.
```

```
property Config.DB_Type.DefaultTimeout: System.TimeSpan
```

Brahma.FSharp

- F# quotations to OpenCL C translator
- Runtime
  - Comand queue
  - Context management
  - Memory management
  - F# aliases for OpenCL-specifc functions

OpenCL C type provider

- Imorove OpenCL C lexer, parser and translator
- Unify kernels on client side
- Improve user exp

Architecture

Diagram

Limitations

- Only (small) subset of OpenCL C
  - h files
  - preprocessor
  - subset of sintax
  - !!!
- Very simple type mapping
- !!!
- !!!

Examples

Screens

Future work

- Imorove OpenCL C lexer, parser and translator
- Unify kernels on client side
- Improve user exp

Summary

- F# OpenCL C type provider
- Prototype
- Type-safe using of existing OpenCL C code in F# applications

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  https://github.com/YaccConstructor/Brahma.FSharp

Thakns!