A typed foreign function interface for ML
(concluded)

Jeremy Yallop

28 November 2013

Embedding domain-specific languages

Identify **terms** in the DSL

```
typ ::= int | float | ...
        typ *
fn ::= typ
       typ → fn
```

Embedding domain-specific languages

Identify **terms** in the DSL . . . and create a function for each term

```
typ ::= int | float | ...
        typ *
fn ::= typ
       typ → fn
```

```
val int : typ
val float : typ
...
val ptr : typ → typ
val returning : typ → fn
val (@->) : typ → fn → fn
```

Embedding domain-specific languages

Identify the **types** of terms

```
typ ::= int | float | ...
        typ *
fn  ::= typ
        typ → fn
```

```
val int : typ
val float : typ
...
val ptr : typ → typ
val returning : typ → fn
val (@->) : typ → fn → fn
```

Embedding domain-specific languages

Identify the **types** of terms . . . and align the functions with thpse types

```
typ ::= int | float | ...
        typ *
fn  ::= typ
        typ → fn
```

```
val int : int typ
val float : float typ
...
val ptr : α typ → α ptr typ
val returning : α typ → α fn
val (@→) : α typ → β fn → (α → β) fn
```

Embedding domain-specific languages

Identify the **semantics** of terms

$$
\begin{aligned}
[\![\mathsf{int}]\!] &= \quad \ldots \\
[\![\mathsf{float}]\!] &= \quad \ldots \\
[\![typ]\!] &= \quad \ldots \\
[\![typ \to fn]\!] &= \quad \ldots
\end{aligned}
$$

Embedding domain-specific languages

Identify the **semantics** of terms . . . and create evaluation functions

$$
\begin{aligned}
[\![\mathsf{int}]\!] &= \quad \ldots \\
[\![\mathsf{float}]\!] &= \quad \ldots \\
[\![typ]\!] &= \quad \ldots \\
[\![typ \to fn]\!] &= \quad \ldots
\end{aligned}
$$

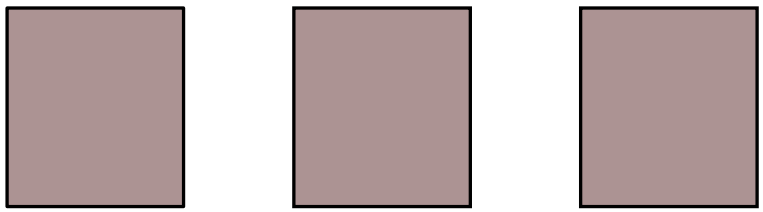
```
val foreign :
  string → (α → β) fn → α → β

val compile_fn :
  string → (α → β) fn → code
...
```

Implementation techniques

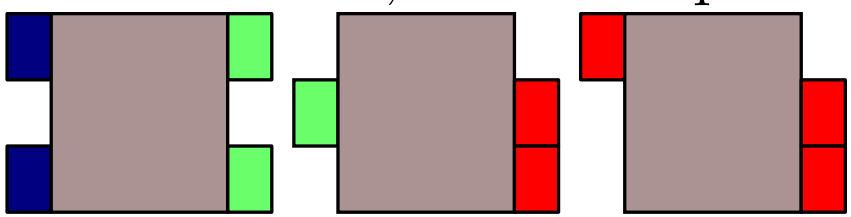
Standard data types

Unsafe interface, unsafe implementation



Phantom types

Safe interface, unsafe implementation



Generalized algebraic data types

Safe interface, safe (and efficient!) implementation