Exploring Perl 6 Through Its Modules

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Originally from England

Since then, I've lived in...

Spain

Slovakia

...and now I'm in Sweden!

I hack on Perl 6

Snippets → Modules

Last time I was at YAPC::Asia, I gave a talk
"Solved in Perl 6"

Lots of **small snippets** of code showing how to solve a range of problems in Perl 6

Perl 6 has been growing up. Thanks to the **module ecosystem**, we can look at how Perl 6 is put to use in **larger, more practical examples**

Multiple Dispatch

Write multiple subroutines or methods that have the same name, but take a different number or different types of parameters

```
multi sub double(Int $x) { $x * 2 }
multi sub double(Str $x) { $x x 2 }

say double(21);     # 42
say double('can');  # cancan
```

JSON::Tiny: to-json

Turns simple Perl data structures into JSON – powered by multiple dispatch

```
# Real numbers simply stringify
multi to-json(Real:D $d) {
    ~$d
}
# Booleans become true or false literals
multi to-json(Bool:D $d) {
    $d ?? 'true' !! 'false';
}
```

JSON::Tiny: to-json

Turns simple Perl data structures into JSON – powered by multiple dispatch

```
# Strings need various bits of escaping
multi to-json(Str:D $d) {
    '"' ~ $d.trans(
        ['"', '\\', "\f", "\n", "\r", "\t"] =>
        ['\"', '\\\\', '\f', '\n', '\r', '\t']
    ).subst(/<-[\c32..\c126]>/,
        { ord(~$_).fmt('\u%04x') }, :g
    ) ~ '"'
}
```

JSON::Tiny: to-json

Turns simple Perl data structures into JSON – powered by multiple dispatch

```
# For anything that can be positionally
# indexed, emit a JSON array
multi to-json(Positional:D $d) {
    '[ ' ~
        $d.map(&to-json).join(', ') ~
    ' ]';
}
```

JSON::Tiny: to-json

Turns simple Perl data structures into JSON – powered by multiple dispatch

```
# Any undefined values become a null
multi to-json(Any:U $) { 'null' }

# Error on unrecognized types
multi to-json(Any:D $s) {
    die "Can't serialize an object of type " ~
        $s.^name
}
```

Grammars

Regexes have always been a key part of Perl

Perl 6 **revises regex syntax**, and takes them to the next level by adding support for **grammars**

The step up from regexes to grammars in small, but a grammar can stay **clean and maintainable** when scaled up to parse something complex

JSON::Tiny: Grammar

A grammar for parsing JSON

```
# Grammars are a kind of package, so we start
# with a package-like declaration.
grammar JSON::Tiny::Grammar;

# The TOP rule is the default entry rule when
# a grammar is used to parse something. We use
# rule to get automatic whitespace handling.
rule TOP { ^ [ <object> | <array> ] $ }
```

JSON::Tiny: Grammar

A grammar for parsing JSON

```
# Parsing of JSON objects ({ "foo": 42, … })
rule object   { '{' ~ '}' <pairlist> }
rule pairlist { <pair> * % \, }
rule pair     { <string> ':' <value> }

# Parsing of JSON arrays ([ 1, 2, 3, … ])
rule array     { '[' ~ ']' <arraylist> }
rule arraylist { <value>* % [ \, ] }
```

JSON::Tiny: Grammar

A grammar for parsing JSON

```
# A proto-regex is a bit like an alternation,
# but easily and cleanly extensible.
proto token value {*}
token value:sym<true>   { <sym> }
token value:sym<false>  { <sym> }
token value:sym<null>   { <sym> }
token value:sym<object> { <object> }
token value:sym<array>  { <array> }
token value:sym<string> { <string> }
```

JSON::Tiny: Grammar

A grammar for parsing JSON

```
# String parsing - mostly just char classes.
token string {
    \" ~ \" ( <str> | \\ <str_escape> )*
}
token str {
    <-["\\\t\n]>+
}
token str_escape {
    <["\\/bfnrt]> | u <xdigit>**4
}
```

JSON::Tiny: Actions

Action methods are invoked for each grammar rule, and build a Perl 6 data structure

```
method value:sym<number>($/) {
    make +$/.Str
}
method value:sym<string>($/) {
    make $<string>.ast
}
method value:sym<true>($/) {
    make Bool::True
}
```

Get passed the match object for the rule in $/.

This is just a few – there is about one per rule.

JSON::Tiny: from-json

A simple sub drives the overall JSON to Perl 6 data structure process

```
# Create actions object, then pass it to the
# parse method on the grammar.
sub from-json($text) is export {
    my $a = JSON::Tiny::Actions.new();
    my $o = JSON::Tiny::Grammar.parse($text,
                :actions($a));
    return $o.ast;
}
```

Traits

A way to attach extra information and/or behavior to declarations (for example, of classes, subroutines, attributes...)

```
sub some-lvalue-sub() is rw {
    …
}
```

The is rw is a trait attached to the subroutine declaration

Modules can provide extra traits too!

NativeCall

Provides an **is native** trait for routines

This indicates they are really implemented in **native code**, which should be loaded and called

The Perl 6 signature is introspected and used to work out how to pass the arguments

Write native bindings...without writing C!

NativeCall: Win32 API

Here’s an example of calling a Windows API using the NativeCall library

```
use NativeCall;

sub MessageBoxA(int32, Str, Str, int32)
    returns int32
    is native('user32')
    { * }

MessageBoxA(0, "We can haz NCI?", “Hi!", 64);
```

NativeCall: DBIish

A simple database interface for Perl 6 that feels somewhat like Perl 5's DBI, but with an API that feels more natural in Perl 6

Supports SQLite, mysql and Pg

Drivers are built using the NativeCall library, meaning that they are written in pure Perl 6

DBlish: Pg driver example

```
sub PQexecPrepared(
        OpaquePointer $conn,
        Str $statement_name,
        Int $n_params,
        CArray[Str] $param_values,
        CArray[int] $param_length,
        CArray[int] $param_formats,
        Int $resultFormat)
    returns OpaquePointer
    is native('libpq')
    { ... }
```

NativeCall supports passing and returning of arrays

NativeCall

Also supports...

Structures
Callbacks

More bindings are in progress, including an SDL one that already has enough to support implementing a Game::BubbleBreaker.

Meta-programming

The Perl 6 object system is based around a **MOP** (Meta-Object Protocol)

Can **customize the way objects work**, for example, by overriding method dispatch

Can even **add entire new features** that are not in core Perl 6, such as aspect orientation

Grammar::Tracer

Grammars are really just like classes

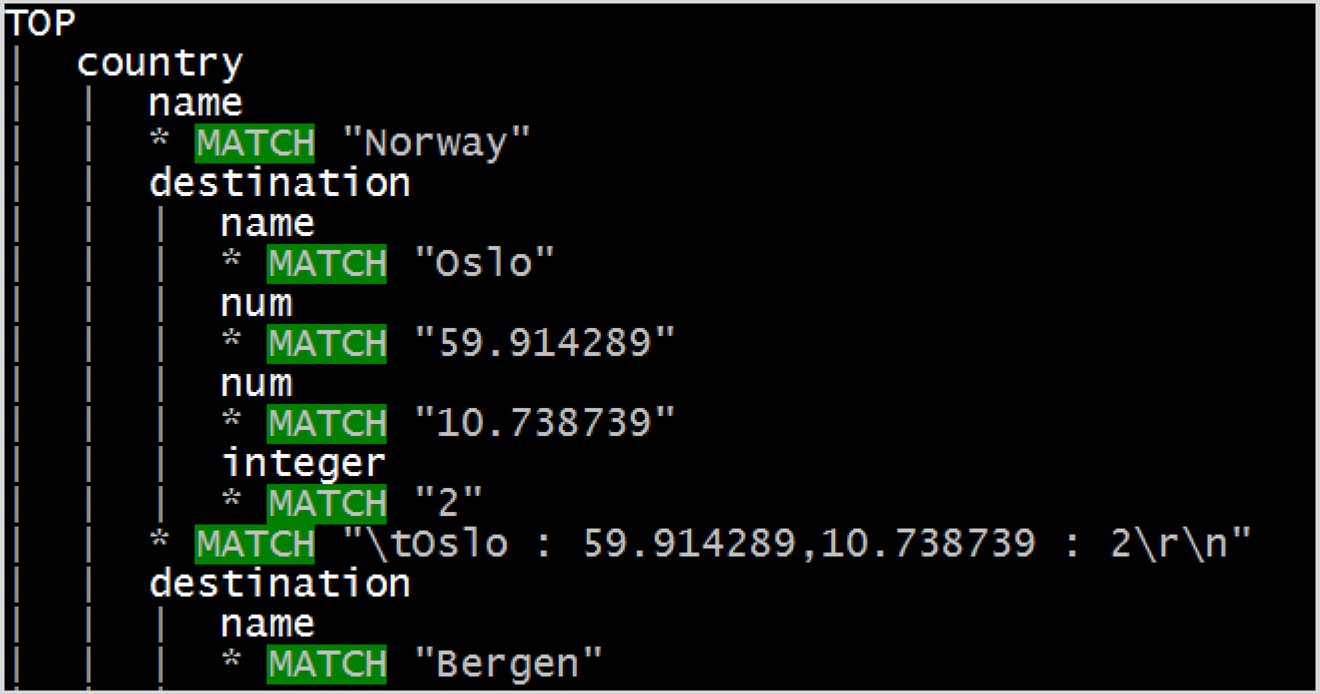
The various regexes, tokens and rules are just like methods in the class

Each call to a sub-rule is a method dispatch

Idea: use the MOP to hook method dispatch and trace which rules are being called

Grammar::Tracer

The aim is to output a tree diagram as the grammar calls down to sub-rules



```
TOP
|   country
|   |   name
|   |   * MATCH "Norway"
|   |   destination
|   |   |   name
|   |   |   * MATCH "Oslo"
|   |   |   num
|   |   |   * MATCH "59.914289"
|   |   |   num
|   |   |   * MATCH "10.738739"
|   |   |   integer
|   |   |   * MATCH "2"
|   |   * MATCH "\tOslo : 59.914289,10.738739 : 2\r\n"
|   |   destination
|   |   |   name
|   |   |   * MATCH "Bergen"
```

Grammar::Tracer

Change the meaning of `grammar`

```
# Inherit from the default grammar package.
my class TracedGrammarHOW is Metamodel::GrammarHOW
{
    …
}

# Export our subclass as the default one for the
# "grammar" package declarator.
my module EXPORTHOW { }
EXPORTHOW::<grammar> = TracedGrammarHOW;
```

Grammar::Tracer

Override method dispatch

```
method find_method($obj, $name) {
    my $meth := callsame;
    $name eq any(<parse MATCH pos from>)
        ?? $meth
        !! -> $c, |args {
            # Output rule name here...
            my $result := $meth($obj, |args);
            # Output result here...
            $result
        }
}
```

Grammar::Tracer

Display tree (uses Term::ANSIColor)

```
say ('|  ' x $indent) ~ BOLD() ~ $name ~ RESET();

$indent++;
my $result := $meth($obj, |args);
$indent--;

my $match := $result.MATCH;
say ('|  ' x $indent) ~ '* ' ~ ($result.MATCH
    ?? colored('MATCH', 'white on_green') ~
           summary($match)
    !! colored('FAIL', 'white on_red'));
```

Grammar::Tracer

[Live Demo]

Rakudo

The Rakudo Perl 6 compiler is written largely in **NQP** (Not Quite Perl 6), a small Perl 6 subset

The **CORE setting**, which provides many of the built-ins, is **written in Perl 6**

This makes it relatively easy to **hack on and extend** the compiler

Rakudo Debugger

A small core written in NQP

All the user facing stuff is built in Perl 6! ☺

Was built without having to extend the core of the compiler itself

Supports single stepping, breakpoints, evaluation, changing variables, etc.

Rakudo Debugger

[Live Demo]

Panda

Panda is a simple module installation tool for Perl 6 modules, written in Perl 6

```
panda install NativeCall
```

Where to learn more

To learn more about the modules discussed today – and many more – check out
modules.perl6.org

The Rakudo debugger and Panda are included in the Rakudo Star releases; for more see
rakudo.org

Where next?

We’re beyond the age of snippets

These days, it’s already very possible to build small tools and write modules in Perl 6

In the coming years, in addition to a growing module ecosystem, I hope to see larger applications developed in Perl 6

Thank you!

Questions?

Twitter

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http://6guts.wordpress.com