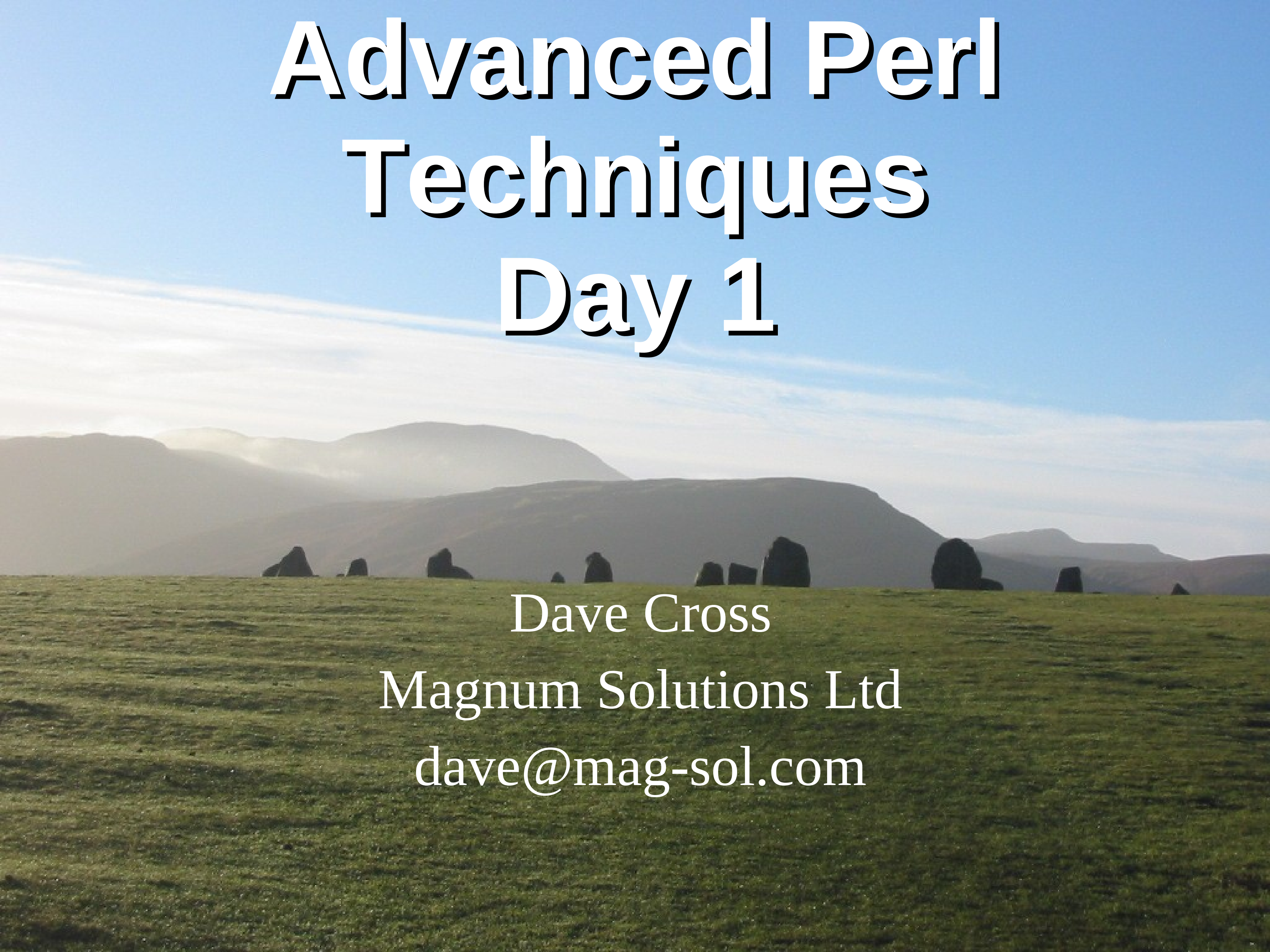
Advanced Perl Techniques Day 1



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Advanced Perl Techniques

- Advanced level training for Perl programmers
- Turn intermediate programmers into advanced programmers
- “Modern” Perl
- Perl is not dying

Advanced Perl Techniques

- One day isn't enough time
- We'll be moving fairly fast
- Lots of pointers to other information
- Feel free to ask questions

What We Will Cover

- What's new in Perl 5.10 & 5.12
- Advanced Testing
- Database access with DBIx::Class
- Handling Exceptions

Schedule

- 09:45 – Begin
- 11:15 – Coffee break
- 13:00 – Lunch
- 14:00 – Begin
- 15:30 – Coffee break
- 17:00 – End

Resources

- Slides available on-line
  - http://mag-sol.com/train/public/2010-04/adv
- Also see Slideshare
  - http://www.slideshare.net/davorg/slideshows
- Get Satisfaction
  - http://getsatisfaction.com/magnum

Perl 5.10 & 5.12

Perl Releases

- Perl 5 has moved to a regular release cycle
- Major release every year
- Minor releases when required
- Even major numbers are production releases
  - 5.10, 5.12, 5.14
- Odd major numbers are dev releases
  - 5.9, 5.11, 5.13

Perl 5.10

- Released 18th Dec 2007
  - Perl's 20th birthday
- Many new features
- Well worth upgrading

New Features

- Defined-or operator
- Switch operator
- Smart matching
- say()
- Lexical $_

New Features

- State variables
- Stacked file tests
- Regex improvements
- Many more

Defined Or

- Boolean expressions “short-circuit”
- `$val = $val || $default;`
- `$val ||= $default;`
- What if 0 is a valid value?
- Need to check “definedness”

-
  ```
  $val = defined $val
                  ? $val : $default;
  ```
- `$val = $default unless defined $val;`

Defined Or

- The defined or operator makes this easier
- `$val = $val // $default;`
- A different slant on truth
- Checks definedness
- Shortcircuit version too
- `$val //= $value;`

Switch Statement

- Switch.pm was added with Perl 5.8
- Source filter
- Parser limitations
  - Regular expressions
  - eval
- 5.10 introduces a build-in switch statement

Given ... When

- Switch is spelled “given”
- Case is spelled “when”
- Powerful matching syntax

Given Example

-
  ```
  given ($foo) {
      when (/^abc/) { $abc = 1; }
      when (/^def/) { $def = 1; }
      when (/^xyz/) { $xyz = 1; }
      default { $nothing = 1; }
  }
  ```

New Keywords

- Four new keywords
  - given
  - when
  - default
  - continue

given

- `given(EXPR)`
- Assigns the result of EXPR to `$_` within the following block
- Similar to `do { my $_ = EXPR; ... }`

when

- `when (EXPR)`
- Uses smart matching to compare $_ with EXPR
- Equivalent to `when ($_ ~~ EXPR)`
- ~~ is the new smart match operator
- Compares two values and “does the right thing”

default

- default defines a block that is executed if no when blocks match
- default block is optional

continue

- continue keyword falls through to the next when block
- Normal behaviour is to break out of given block once the first when condition is matched

continue

-
  ```
  given($foo) {
    when (/x/)
      { say '$foo contains an x';
        continue }
    when (/y/)
      { say '$foo contains a y' }
    default
      { say '$foo contains no x or y' }
  }
  ```

Smart Matching

- ~~ is the new Smart Match operator
- Different kinds of matches
- Dependent on the types of the operands
- See “perldoc perlsyn” for the full details

Smart Match Examples

- `$foo ~~ $bar; # == or cmp`
- `@foo ~~ $bar; # array contains value`
- `%foo ~~ $bar; # hash key exists`
- `$foo ~~ qr{$bar}; # regex match`
- `@foo ~~ @bar; # arrays are identical`
- `%foo ~~ %bar; # hash keys match`
- Many more alternatives

say()

- say() is a new alternative to print()
- Adds a new line at the end of each call
- `say($foo); # print $foo, “\n”;`
- Two characters shorter than print
- Less typing

Lexical $_

- $_ is a package variable
- Always exists in main package
- Can lead to subtle bugs when not localised correctly
- Can now use `my $_` to create a lexically scoped variable called $_

State Variables

- Lexical variables disappear when their scope is destroyed

-
  ```
  sub variables {
    my $x;

    say ++$x;
  }

  variables() for 1 .. 3;
  ```

State Variables

- State variables retain their value when their scope is destroyed

-
  ```
  sub variables {
    state $x;

    say ++$x;
  }

  variables() for 1 .. 3;
  ```
- Like static variables in C

Stacked File Tests

- People often think you can do this
- `-f -w -x $file`
- Previously you couldn't
- Now you can
- Equivalent to
- `-x $file && -w _ && -f _`

Regex Improvements

- Plenty of regular expression improvements
- Named capture buffers
- Possessive quantifiers
- Relative backreferences
- New escape sequences
- Many more

Named Capture Buffers

- Variables $1, $2, etc change if the regex is altered
- Named captures retain their names
- (?<name> ...) to define
- Use new %+ hash to access them

Named Capture Example

-
  ```
  while (<DATA>) {
    if (/(?<header>[\w\s]+)
          :\s+(?<value>.+)/x) {
      print "$+{header} -> ";
      print "$+{value}\n";
    }
  }
  ```

Possessive Quantifiers

- `?+, *+, ++`
- Grab as much as they can
- Never give it back
- Finer control over backtracking
- `'aaaa' =~ /a++a/`
- Never matches

Relative Backreferences

- `\g{N}`
- More powerful version of `\1`, `\2`, etc
- `\g{1}` is the same as `\1`
- `\g{-1}` is the last capture buffer
- `\g{-2}` is the one before that

New Escape Sequences

- `\h` – Horizontal white space
- `\v` – Vertical white space
- Also `\H` and `\V`

Accessing New Features

- Some new features would break backwards compatibility
- They are therefore turned off by default
- Turn them on with the `feature` pragma
- `use feature 'say';`
- `use feature 'switch';`
- `use feature 'state';`
- `use feature ':5.10';`

Implicit Loading

- Two ways to automatically turn on 5.10 features
- Require a high enough version of Perl
- `use 5.10.0; # Or higher`
- -E command line option
- `perl -e 'say “hello”'`
- `perl -E 'say “hello”'`

Perl 5.12

- Released 12 April 2010
  - 5.12.2 7 Sept 2010
- Many new enhancements
- 5.14 due spring 2011

5.12 Enhancements

- package NAME VERSION syntax
- ... operator
- Implicit strictures
- Y2038 compliance
- Smart match changes
- New modules
  - autodie
  - parent

package NAME VER

- Declare the version of a package in the package declaration
- `package My::Package 1.23;`
- Equivalent to

-
  ```
  package My::Package;
  our $VERSION = 1.23;
  ```

... Operator

- Called the “yada-yada” operator
- Used to stand in for unwritten code

-
  ```
  sub unimplemented {
    ...
  }
  ```
- Code compiles
- Throws an “unimplemented” exception when run

Implicit Strictures

- Requiring a version of Perl greater than 5.11 implicitly turns on use strict
- `use 5.12.0;`
- Is equivalent to

-
  ```
  use strict;
  use feature ':5.12';
  ```

Y2038 Compliance

- Core time functions are now Y2038 compliant

Smart Match Changes

- Some changes to Smart Match operator
- No longer commutative
- See new table in perlsyn

New Modules

- Some new modules in the standard distribution
- autodie
- parent
  - Better version of base.

More Information

- perldoc perl5100delta
- perldoc perl5120delta

5.10 & 5.12 Examples

- Write a program that uses at least three or four of the new features

Advanced Testing

Writing Test Modules

- Standard test modules all work together
- Built using Test::Builder
- Ensures that test modules all use the same framework
- Use it as the basis of your own Test::* modules
- Test your Test::Builder test modules with Test::Builder::Tester

Test::Between

-
  ```
  package Test::Between;

  use strict;
  use warnings;

  use base 'Exporter';
  our @EXPORT = qw(is_between);

  use Test::Builder;

  my $test = Test::Builder->new;
  ```

Test::Between

-
  ```
  sub is_between {
    my ($item, $lower, $upper, $desc)
        = @_;

    return (
  $test->ok($lower le $item &&
          $item le $upper, $desc)
   || $test->diag("$item is not between
  $lower and $upper")
  );
  }

  1;
  ```

Using Test::Between

-
  ```
  #!/usr/bin/perl
  use strict;
  use warnings;
  use Test::More tests => 3;
  use Test::Between;

  is_between('b', 'a', 'c', 'alpha');
  is_between( 2,   1,   3,  'numeric');
  is_between('two',1,   3,  'wrong');
  ```

Test::Between Output

-
  ```
  $ prove -v test.pl
  test.pl ..
  1..3
  ok 1 – alpha
  ok 2 – numeric
  not ok 3 – wrong

  #   Failed test 'wrong'
  #   at test.pl line 11.
  # two is not between 1 and 3
  # Looks like you failed 1 test of 3.
  Dubious, test returned 1 (wstat 256,
  0x100)
  Failed 1/3 subtests
  ```

Test::Between Output

-
  ```
  Test Summary Report
  -------------------
  test.pl (Wstat: 256 Tests: 3 Failed: 1)
    Failed test:  3
    Non-zero exit status: 1
  Files=1, Tests=3,  1 wallclock secs
  ( 0.07 usr  0.01 sys +  0.05 cusr  0.01
  csys =  0.14 CPU)
  Result: FAIL
  ```

Mocking Objects

- Sometimes it's hard to test external interfaces
- Fake them
- Test::MockObject pretends to be other objects
- Gives you complete control over what they return

Testing Reactors

- You're writing code that monitors a nuclear reactor
- It's important that your code reacts correctly when the reactor overheats
- You don't have a reactor in the test environment

Testing Reactors

- Even if you did, you wouldn't want to make it overheat every time you run the tests
- Especially if you're not 100% sure of your code
- Of if you're running unattended smoke tests
- Fake it with a mock object

My::Monitor Spec

- If the temperature of a reactor is over 100 then try to cool it down
- If you have tried cooling a reactor down 5 times and the temperature is still over 100 then return an error

My::Monitor Code

-
  ```
  package My::Monitor;

  sub new {
    my $class = shift;
    my $self = { tries => 0 };

    return bless $self, $class;
  }
  ```

My::Monitor Code

-
  ```
  sub check {
    my $self = shift;
    my $reactor = shift;

    my $temp = $reactor->temperature;

    if ($temp > 100) {
      $reactor->cooldown;
      ++$self->{tries};
      if ($self->{tries} > 5) {
        return;
      }
      return 1;
  ```

My::Monitor Code

-
```
  } else {
    $self->{tries} = 0;
    return 1;
  }
}

1;
```

Mock Reactor

- Create a mock reactor object that acts exactly how we want it to
- Reactor object has two interesting methods
- temperature - returns the current temperature
- cooldown - cools reactor and returns success or failure

monitor.t

-
  ```
  use Test::More tests => 10;

  use Test::MockObject;

  # Standard tests

  BEGIN { use_ok('My::Monitor'); }

  ok(my $mon = My::Monitor->new);
  isa_ok($mon, 'My::Monitor');
  ```

monitor.t

-
  ```
  # Create Mock Reactor Object

  my $t = 10;
  my $reactor = Test::MockObject;

  $reactor->set_bound('temperature',
                      \$t);

  $reactor->set_true('cooldown');
  ```

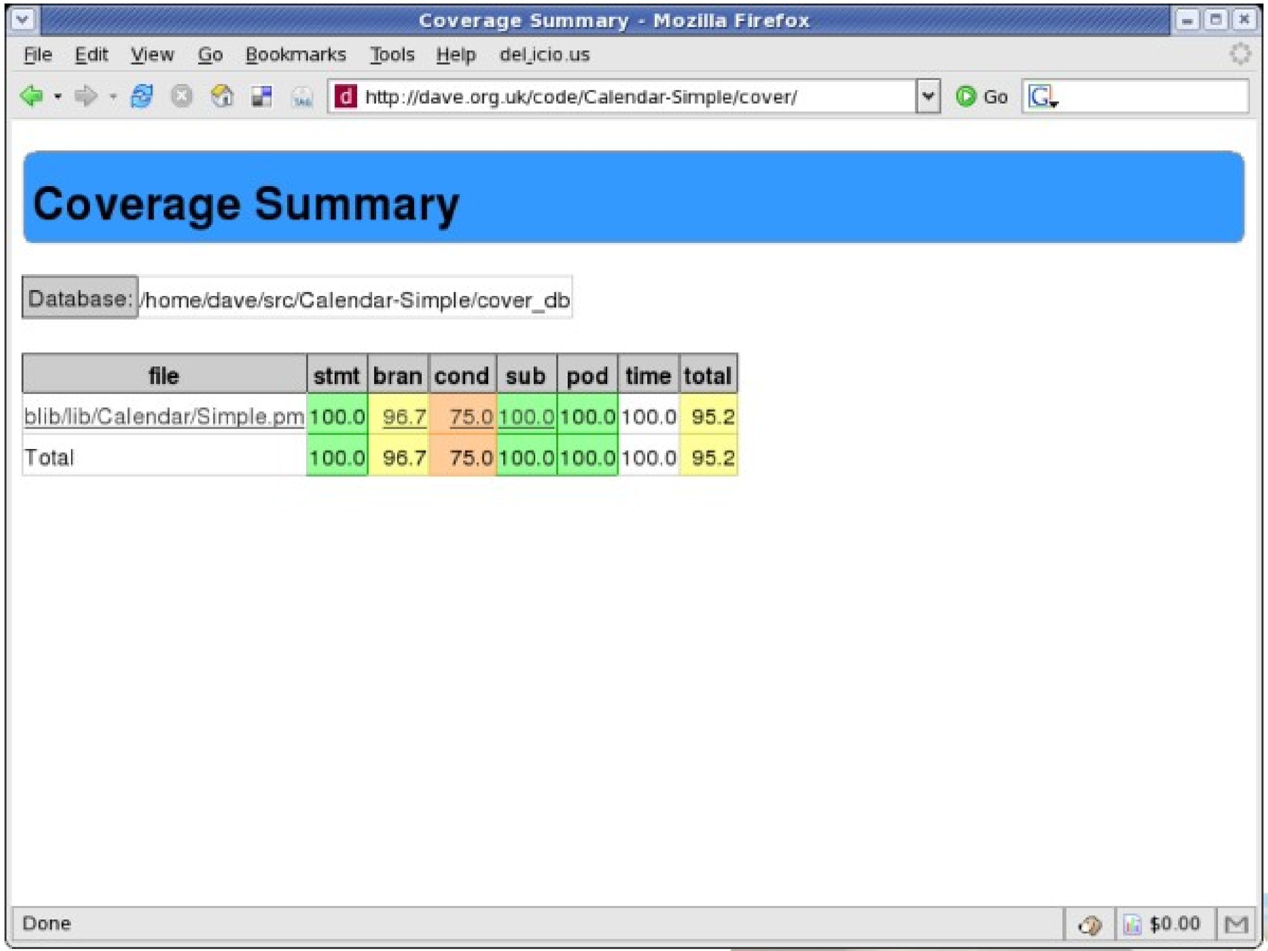
monitor.t

-
  ```
  # Test reactor
  ok($mon->check($reactor));
  $t = 120;
  ok($mon->check($reactor)) for 1 .. 5;
  ok(!$mon->check($reactor));
  ```

How Good Are Your Tests?

- How much of your code is exercised by your tests?
- Devel::Cover can help you to find out
- Deep internal magic
- Draws pretty charts
  - `HARNESS_PERL_SWITCHES= -MDevel::Cover make test`
  - `cover`

Devel::Cover Output

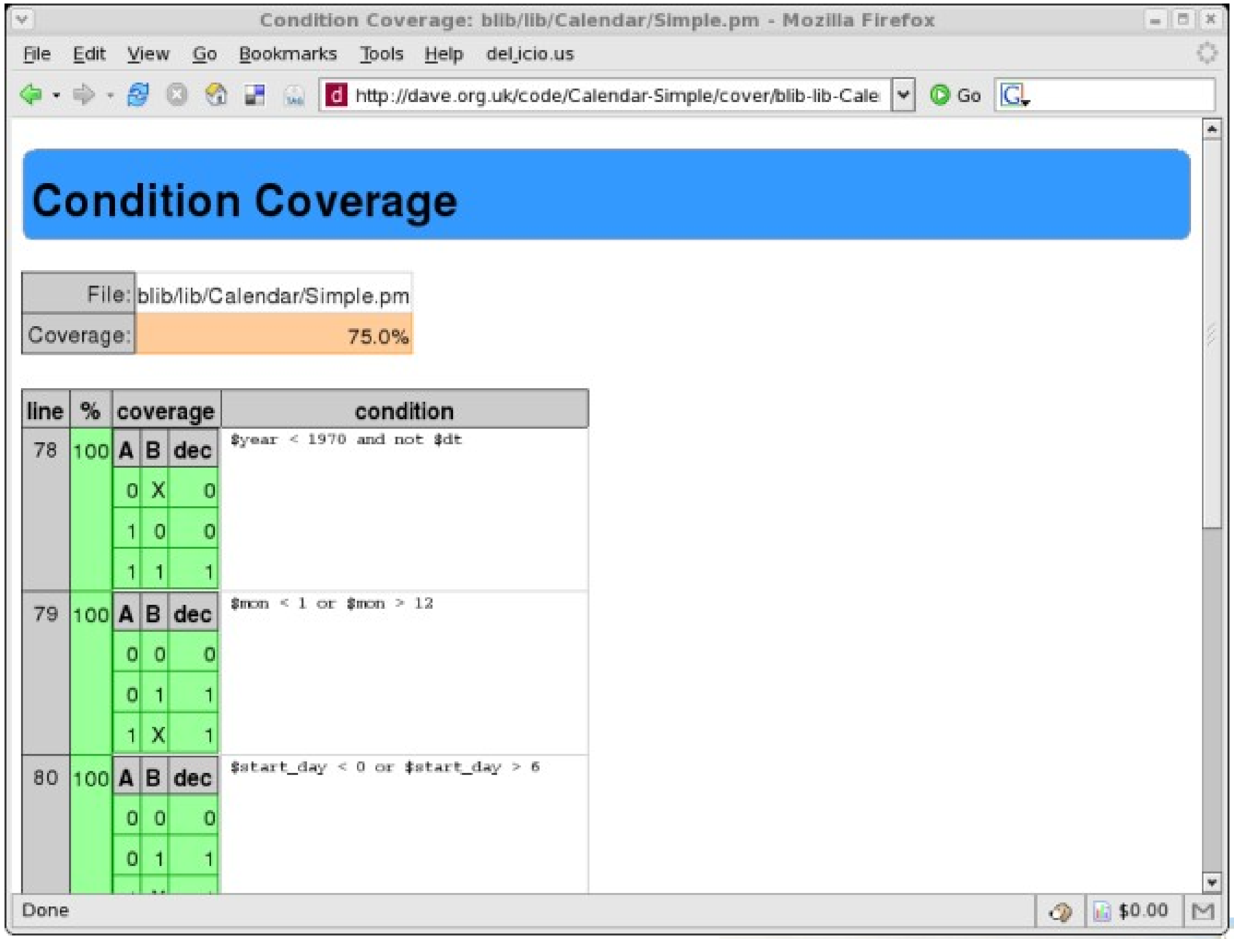

Coverage Summary - Mozilla Firefox
File Edit View Go Bookmarks Tools Help del.icio.us
http://dave.org.uk/code/Calendar-Simple/cover/
Go
Done
$0.00

Coverage Summary

Database: /home/dave/src/Calendar-Simple/cover_db

file	stmt	bran	cond	sub	pod	time	total
blib/lib/Calendar/Simple.pm	100.0	96.7	75.0	100.0	100.0	100.0	95.2
Total	100.0	96.7	75.0	100.0	100.0	100.0	95.2

Devel::Cover Output


Condition Coverage: blib/lib/Calendar/Simple.pm - Mozilla Firefox
File Edit View Go Bookmarks Tools Help del.icio.us
http://dave.org.uk/code/Calendar-Simple/cover/blib-lib-Cale
Go
Done
$0.00

Condition Coverage

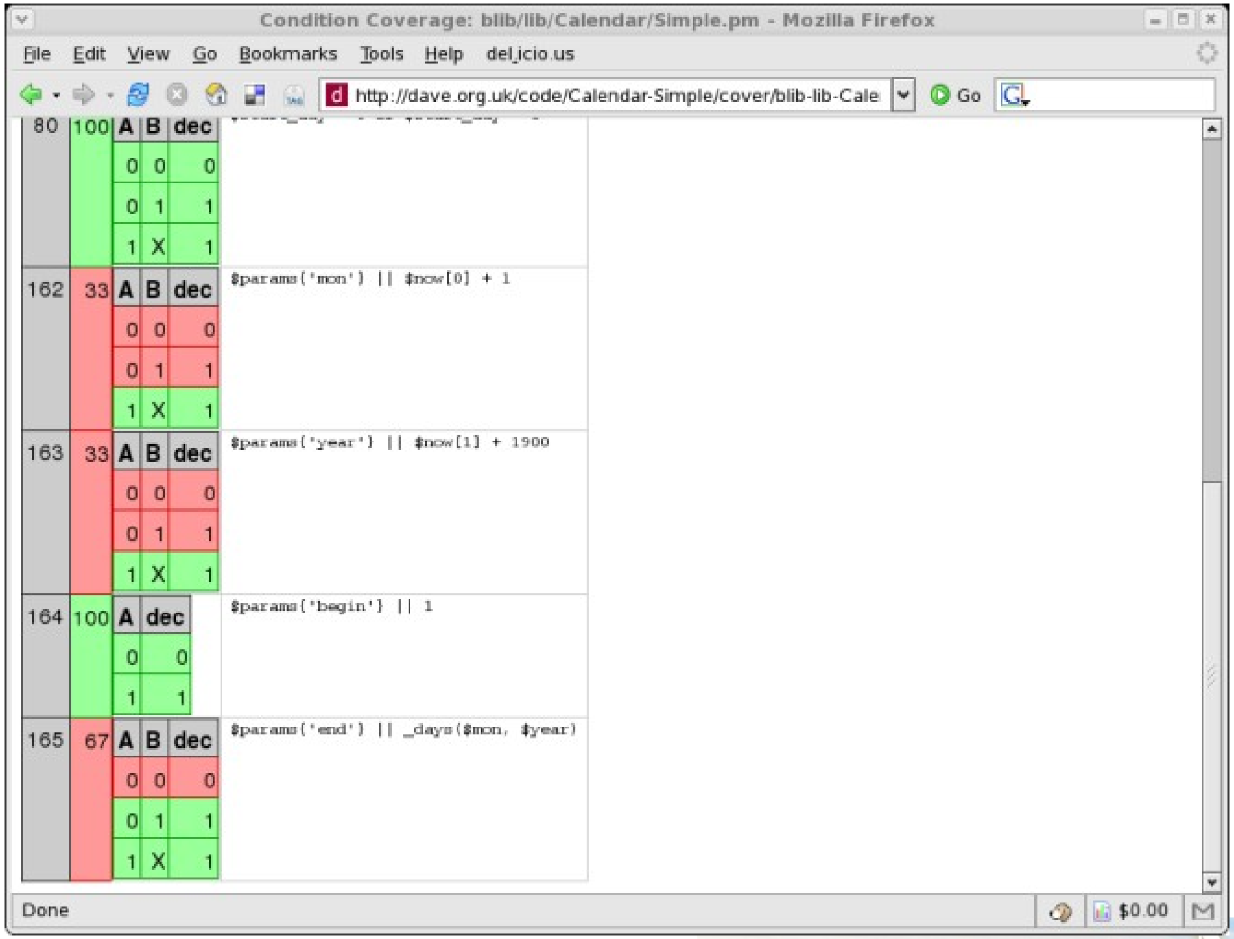
File:	blib/lib/Calendar/Simple.pm
Coverage:	75.0%

line	%	coverage			condition
78	100	A	B	dec	`$year < 1970 and not $dt`
		0	X	0	
		1	0	0	
		1	1	1	
79	100	A	B	dec	`$mon < 1 or $mon > 12`
		0	0	0	
		0	1	1	
		1	X	1	
80	100	A	B	dec	`$start_day < 0 or $start_day > 6`
		0	0	0	
		0	1	1	

UKUUG
17th February 2011

Magnum Solutions Limited
Open Source Consultancy, Development & Training

Devel::Cover Output


Condition Coverage: blib/lib/Calendar/Simple.pm - Mozilla Firefox
File Edit View Go Bookmarks Tools Help del.icio.us
http://dave.org.uk/code/Calendar-Simple/cover/blib-lib-Cale
Go
Done
$0.00

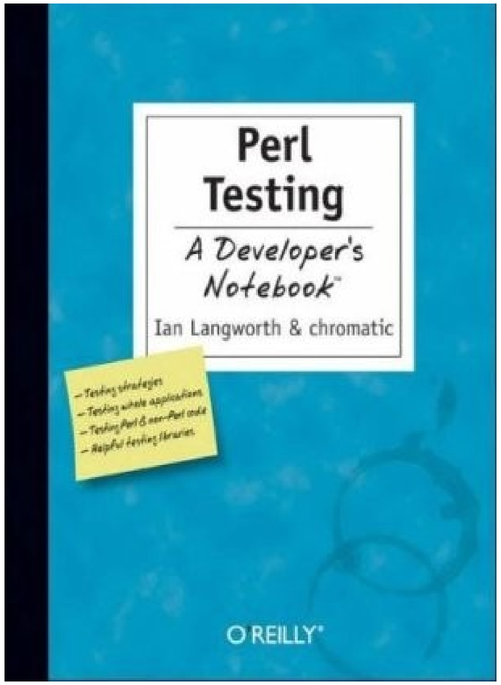
line	%	A	B	dec	condition
80	100	0	0	0	[illegible]
		0	1	1	
		1	X	1	
162	33	0	0	0	$params{'mon'} || $now[0] + 1
		0	1	1	
		1	X	1	
163	33	0	0	0	$params{'year'} || $now[1] + 1900
		0	1	1	
		1	X	1	
164	100	0		0	$params{'begin'} || 1
		1		1	
165	67	0	0	0	$params{'end'} \|\| _days($mon, $year)
		0	1	1	
		1	X	1	

Alternative Test Paradigms

- Not everyone likes the Perl testing framework
- Other frameworks are available
- Test::Class
  - xUnit style framework
- Test::FIT
  - Framework for Interactive Testing
  - http://fit.c2.com

More Information

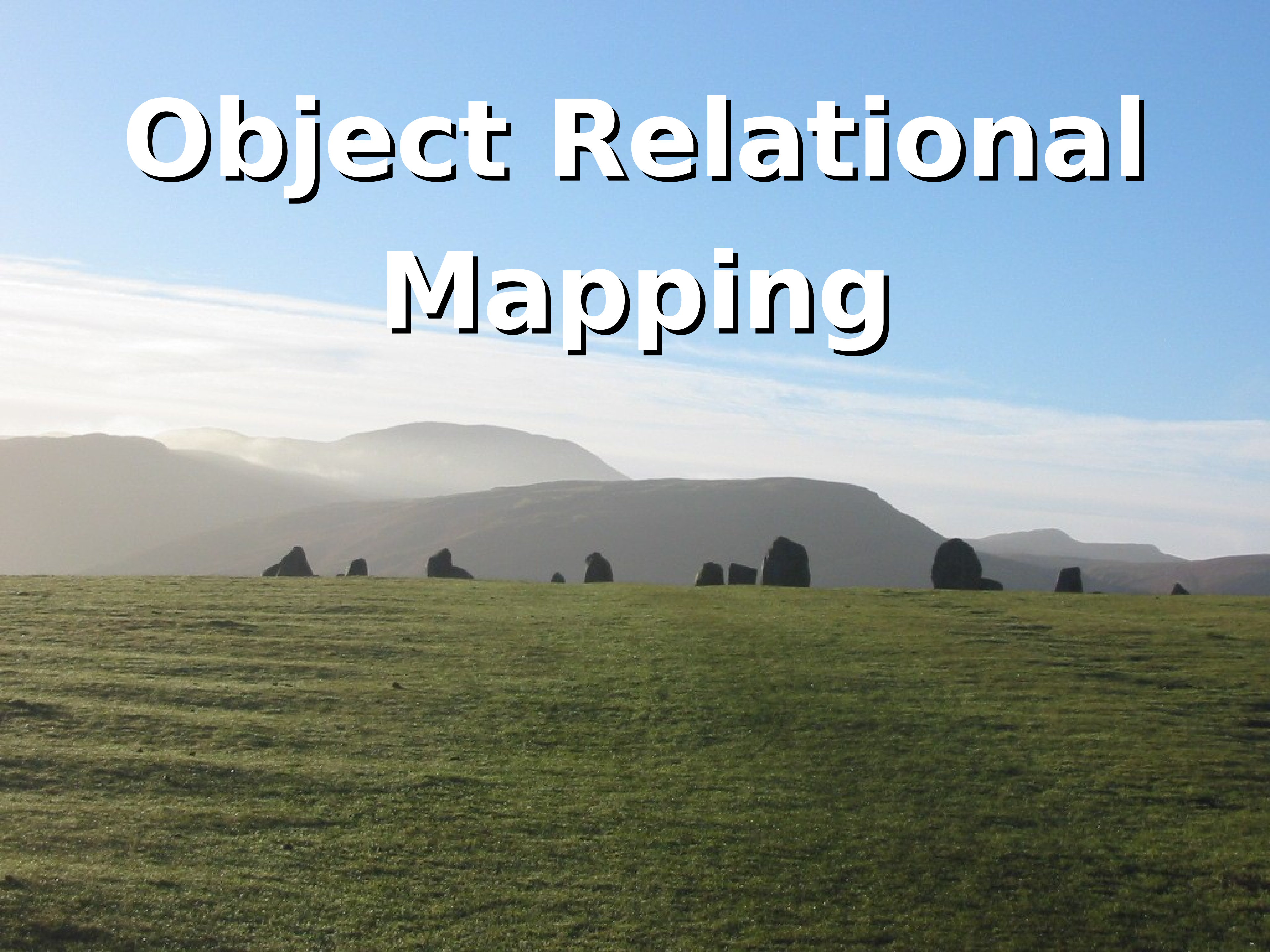
- Perl Testing: A Developer's Notebook (Ian Langworth & chromatic)
- perldoc Test::MockObject
- perldoc Test::Builder
- Devel::Cover
- etc...



Testing Examples

- Write a test plan for the supplied Perl module
- Do you need to mock any of the interfaces?
- How good is the coverage of your tests?

Object Relational Mapping



ORM

- Mapping database relations into objects
- Tables (relations) map onto classes
- Rows (tuples) map onto objects
- Columns (attributes) map onto attributes
- Don't write SQL

SQL Is Tedious

- Select the id and name from this table
- Select all the details of this row
- Select something about related tables
- Update this row with these values
- Insert a new record with these values
- Delete this record

Replacing SQL

- Instead of

-
  ```
  SELECT *
  FROM   my_table
  WHERE  my_id = 10
  ```
- and then dealing with the prepare/execute/fetch code

Replacing SQL

- We can write

-
  ```
  use My::Object;

  # warning! not a real orm
  my $obj = My::Object->retrieve(10)
  ```
- Or something similar

Writing An ORM Layer

- Not actually that hard to do yourself
- Each class needs an associated table
- Each class needs a list of columns
- Create simple SQL for basic CRUD operations
- Don't do that

Perl ORM Options

- Plenty of choices on CPAN
- Fey::ORM
- Rose::DB
- Class::DBI
- DBIx::Class
  - The current favourite

DBIx::Class

- Standing on the shoulders of giants
- Learning from problems in Class::DBI
- More flexible
- More powerful

DBIx::Class Example

- Modeling a CD collection
- Three tables
- artist (artistid, name)
- cd (cdid, artist, title)
- track (trackid, cd, title)

Main Schema

- Define main schema class
- DB/Main.pm
-
```
package DB::Main;
use base qw/DBIx::Class::Schema/;

__PACKAGE__->load_classes();

1;
```

Object Classes

- DB/Main/Artist.pm

-
  ```
  package DB::Main::Artist;
  use base qw/DBIx::Class/;
  __PACKAGE__->load_components(qw/PK::Auto
  Core/);
  __PACKAGE__->table('artist');
  __PACKAGE__->add_columns(qw/ artistid name
  /);
  __PACKAGE__->set_primary_key('artistid');
  __PACKAGE__->has_many(cds =>
                        'DB::Main::Cd');
  1;
  ```

Object Classes

- DB/Main/CD.pm

-
  ```
  package DB::Main::CD;
  use base qw/DBIx::Class/;
  __PACKAGE__->load_components(qw/PK::Auto
  Core/);
  __PACKAGE__->table('cd');
  __PACKAGE__->add_columns(qw/ cdid artist
  title year /);
  __PACKAGE__->set_primary_key('cdid');
  __PACKAGE__->belongs_to(artist =>
                                'DB::Main::Artist');
  1;
  ```

Inserting Artists

-
  ```
  my $schema =
    DB::Main->connect($dbi_str);

  my @artists = ('The Beta Band',
                 'Beth Orton');

  my $art_rs = $schema->resultset('Artist');

  foreach (@artists) {
    $art_rs->create({ name => $_ });
  }
  ```

Inserting CDs

- Hash of Artists and CDs
-
```
my %cds = ( 'The Three EPs' =>
                      'The Beta Band',
            'Trailer Park'  =>
                      'Beth Orton');
```

Inserting CDs

- Find each artist and insert CD
-
```
foreach (keys $cds) {
  my ($artist) = $art_rs->search(
                   { name => $cds{$_} }
                 );

  $artist->add_to_cds({
    title => $_,
  });
}
```

Retrieving Data

- Get CDs by artist
-
```
my ($artist) = $art_rs->search({
                 name => 'Beth Orton',
               });

foreach ($artist->cds) {
  say $_->title;
}
```

Searching for Data

- Search conditions can be more complex
- Alternatives

  -
    ```
    $rs->search({year => 2006},
                {year => 2007});
    ```
- Like

  -
    ```
    $rs->search({name =>
                   { 'like', 'Dav%' }});
    ```

Searching for Data

- Combinations

  -
    ```
    $rs->search({forename =>
                           { 'like', 'Dav%' },
                         surname => 'Cross' });
    ```

Don't Repeat Yourself

- There's a problem with this approach
- Information is repeated
- Columns and relationships defined in the database schema
- Columns and relationships defined in class definitions

Repeated Information

-
  ```
  CREATE TABLE artist (
    artistid INTEGER PRIMARY KEY,
    name     TEXT NOT NULL
  );
  ```

Repeated Information

-
  ```
  package DB::Main::Artist;
  use base qw/DBIx::Class/;
  __PACKAGE__->
   load_components(qw/PK::Auto Core/);
  __PACKAGE__->table('artist');
  __PACKAGE__->
   add_columns(qw/ artistid name /);
  __PACKAGE__>
   set_primary_key('artistid');
  __PACKAGE__->has_many('cds' =>
  'DB::Main::Cd');
  ```

Database Metadata

- Some people don't put enough metadata in their databases
- Just tables and columns
- No relationships. No constraints
- You may as well make each column VARCHAR(255)

Database Metadata

- Describe your data in your database
- It's what your database is for
- It's what your database does best

No Metadata (Excuse 1)

- "This is the only application that will ever access this database"
- Nonsense
- All data will be shared eventually
- People will update your database using other applications
- Can you guarantee that someone won't use mysql to update your database?

No Metadata (Excuse 2)

- "Database doesn't support those features"
- Nonsense
- MySQL 3.x is not a database
  - It's a set of data files with a vaguely SQL-like query syntax
- MySQL 4.x is a lot better
- MySQL 5.x is most of the way there
- Don't be constrained by using inferior tools

DBIC::Schema::Loader

- Creates classes by querying your database metadata
- No more repeated data
- We are now DRY
- Schema definitions in one place
- But...
- Performance problems

Performance Problems

- You don't really want to generate all your class definitions each time your program is run
- Need to generate the classes in advance
- `dump_to_dir` method
- Regenerate classes each time schema changes

Alternative Approach

- Need one canonical definition of the data tables
- Doesn't need to be SQL DDL
- Could be in Perl code
- Write DBIx::Class definitions
- Generate DDL from those
- Harder approach
  - Might need to generate ALTER TABLE

Conclusions

- ORM is a bridge between relational objects and program objects
- Avoid writing SQL in common cases
- DBIx::Class is the currently fashionable module
- Lots of plugins
- Caveat: ORM may be overkill for simple programs

More Information

- Manual pages (on CPAN)
- DBIx::Class
- DBIx::Class::Manual::*
- DBIx::Class::Schema::Loader
- Mailing list (Google for it)

DBIx::Class Examples

- Create the CD database on your computer
- Use DBIx::Class::Schema::Loader to generate classes for your database
- Write code to insert data into the tables
- Write code to report on the data in the tables

Exception Handling

Error Handling

- How do you handle errors in your code?
- Return error values from subroutines

-
  ```
  sub get_object {
    my ($class, $id) = @_;
    if (my $obj = find_obj_in_db($id)) {
      return $obj;
    } else {
      return;
    }
  }
  ```

Problems

- What if someone doesn't check return code?

-
  ```
  my $obj = MyClass->get_object(100);
  print $obj->name; # error
  ```
- Caller assumes that $obj is a valid object
- Bad things follow

Basic Exceptions

- Throw an exception instead
-
```
sub get_object {
  my ($class, $id) = @_;
  if (my $obj = find_obj_in_db($id)) {
    return $obj;
  } else {
    die “No object found with id: $id”;
  }
}
```
- Now caller has to deal with exceptions

Dealing with Exceptions

- Use eval to catch exceptions
-
```
my $obj = eval {
  MyClass->get_object(100)
};

if ($@) {
  # handle exception...
} else {
  print $obj->name; # error
}
```

Exceptions as Objects

- $@ can be set to an object
-
```
sub get_object {
  my ($class, $id) = @_;
  if (my $obj = find_obj_in_db($id)) {
    return $obj;
  } else {
    die MyException->new(
      type => 'obj_not_found',
      id   => $id,
    );
  }
}
```

Exception::Class

- Easy way to define your own exception objects
- Define exception hierarchies
- As recommended in *Perl Best Practices*

Define Exceptions

-
  ```
  use Exception::Class (
    'MyException',
    'AnotherException' => { isa => 'MyException' },
    'YetAnotherException' => {
      isa         => 'AnotherException',
      description =>
        'These exceptions are related to IPC'
    },
    'ExceptionWithFields' => {
      isa    => 'YetAnotherException',
      fields => [ 'grandiosity', 'quixotic' ],
      alias  => 'throw_fields',
    },
  );
  ```

Using Exceptions

-
  ```
  eval { MyException->throw( error => 'I feel funny.' ) };

  my $e;

  if ( $e = Exception::Class->caught('MyException') ) {
    warn $e->error, "\n", $e->trace->as_string, "\n";
    warn join ' ', $e->euid, $e->egid, $e->uid,
                   $e->gid, $e->pid, $e->time;
    exit;
  }
  elsif ( $e = Exception::Class->caught('ExceptionWithFields')
  ) {
    $e->quixotic ? do_something_wacky() : do_something_sane();
  }
  else {
    $e = Exception::Class->caught();
    ref $e ? $e->rethrow : die $e;
  }
  ```

Try Catch

- TryCatch adds “syntactic sugar”

-
  ```
  try {
    ...
  }
  catch ($e) {
    ...
  }
  ```
- Looks a lot like many other languages

TryCatch with Scalar

-
  ```
  try {
    some_function_that_might_die();
  }
  catch ($e) {
    if ($e =~ /some error/) {
      # handle error
    } else {
      die $e;
    }
  }
  ```

TryCatch with Object

-
  ```
  try {
    some_function_that_might_die();
  }
  catch ($e) {
    if ($e->type eq 'file') {
      # handle error
    } else {
      die $e;
    }
  }
  ```

Better Checks

-
  ```
  try {
    some_function_that_might_die();
  }
  catch (My::Error $e) {
    # handle error
  }
  ```

Even Better Checks

-
  ```
  try {
    some_function_that_might_die();
  }
  catch (HTTP::Error $e
    where { $e->code == 404 }) {
    # handle 404 error
  }
  ```

Multiple Checks

-
  ```
  try {
    some_function_that_might_die();
  }
  catch (HTTP::Error $e where { $e->code == 404 }) {
    # handle 404 error
  }
  catch (HTTP::Error $e where { $e->code == 500 }) {
    # handle 500 error
  }
  catch (HTTP::Error $e) {
    # handle other HTTP error
  }
  catch ($e) {
    # handle other error
  }
  ```

More on Exceptions

- Exceptions force callers to deal with error conditions
- But you have to explicitly code to throw exceptions

-
  ```
  open my $fh, '<', 'somefile.txt'
    or die $!;
  ```
- What if you forget to check the return value?

Not Checking Errors

-
  ```
  open my $fh, '<', 'somefile.txt';
  while (<$fh>) {
    # do something useful
  }
  ```
- If the 'open' fails, you can't read any data
- You might not even get any warnings

Automatic Exceptions

- `use Fatal qw(open);`
- Comes with Perl since 5.003
- Errors in built-in functions become fatal errors
- This solves our previous problem
- `open my $fh, '<', 'somefile.txt';`

However

- Fatal.pm has its own problems
- Unintelligent check for success or failure
- Checks return value for true/false
- Assumes false is failure
- Can't be used if function can legitimately return a false value
  - e.g. fork

Also

- Nasty error messages
-
```
$ perl -MFatal=open -E'open my $fh,
"notthere"'
Can't open(GLOB(0x86357a4), notthere):
No such file or directory at (eval 1)
line 4
main::__ANON__('GLOB(0x86357a4)',
'notthere') called at -e line 1
```

Enter autodie

- autodie is a cleverer Fatal
- In Perl core since 5.10.1
- Fatal needed a list of built-ins
- autodie assumes all built-ins
  - `use autodie;`

Turning autodie on/off

- Lexically scoped
  - `use autodie;`
  - `no autodie;`
- Turn off for specific built-ins
  - `no autodie 'open';`

Failing Calls

- autodie has more intelligence about failing calls
- Not just a boolean check
- Understands fork, system, etc

Errors are Objects

- Errors thrown by autodie are objects
- Can be inspected for details of the error

-
  ```
  try {
    open my $fh, '<', 'not-there';
  }

  catch ($e) {
    warn 'Error opening ', $e->args->[-1], "\n";
    warn 'File: ', $e->file, "\n";
    warn 'Function: ', $e->function, "\n";
    warn 'Package: ', $e->package, "\n";
    warn 'Caller: ', $e->caller, "\n";
    warn 'Line: ', $e->line, "\n";
  }
  ```

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Nicer Errors Too

-
  ```
  $ perl -Mautodie -E'open my $fh,
  "not-there"'
  Can't open($fh, 'not-there'): No such
  file or directory at -e line 1
  ```

More Information

- perldoc TryCatch
  - See also Try::Tiny
- perldoc Fatal
- perldoc autodie
- autodie - The art of Klingon Programming
  - http://perltraining.com.au/tips/2008-08-20.html

Exceptions Examples

- Write a program that relies on autodie to throw exceptions
- Write a class which uses Exception::Class to throw exceptions
- Write code which uses your class

That's all folks

- Any questions?