# Moo in practice - System::Image::Update

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Niederrhein Perl Mongers

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# Overview

## Part I

## Introduction

# Motivation

## Moo and System::Image::Update

- real world examples over far-fetched conceptuals
- MooX::ConfigFromFile and MooX::Options provide way more features and flexibility than MooseX competitors
- $2^{nd}$ generation of modern OO in Perl5

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## System::Image::Update

- Provides an out-of-the-box solution for managing updates on embedded devices
- Easy to re-use in several layers of the firmware
  - self-sustaining (automatic) update management including forced updates (mind heartbleed)
  - embedable into middleware
  - ability for shortcuts
- self-healing capabilities

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- slightly above basic Perl experience
- ever heard of Smalltalk and its OO-concept is a strong bonus

# Part II

# Moo basics

## Classes in Moo

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```
{
package System::Image::Update;

use Moo;
use MooX::Options with_config_from_file => 1;
use IO::Async ();
...
use File::ConfigDir::System::Image::Update qw(system_image_update_dir);
around BUILDARGS => sub {...};
sub run {..}
sub collect_savable_config {}
sub reset_config {}
sub save_config {}
}
System::Image::Update->new_with_options->run;
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```
{   package System::Image::Update::Role::HTTP;

    use Moo::Role; # now it's a role - no 'is a' relationship anymore

    sub do_http_request { ... }
    around collect_savable_config => sub {...};
}
{   package System::Image::Update::Role::Scan;

    use Moo::Role;
    with "System::Image::Update::Role::HTTP"; # consumes a role

    sub scan { my $self = shift; $self->do_http_request(...) };
}
```

# Attributes in Moo

```
package System::Image::Update::Role::Scan;

use Moo::Role;

has scan_interval => ( is => "ro", default => 6*60*60 );
has update_manifest_uri => ( is => "lazy" );

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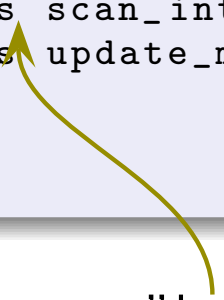

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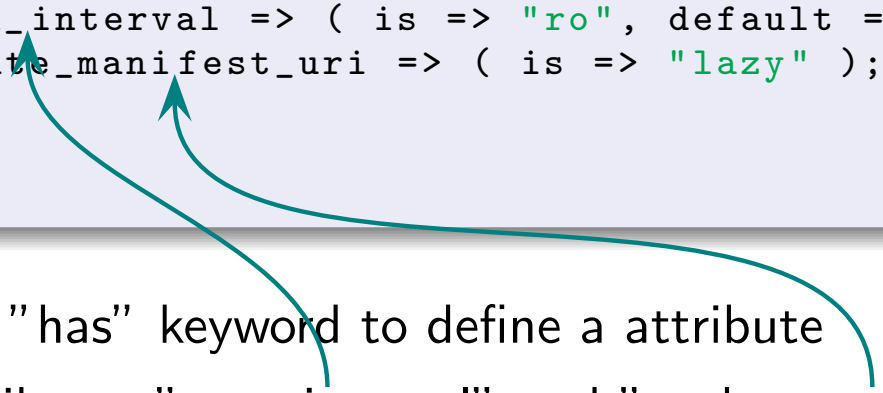

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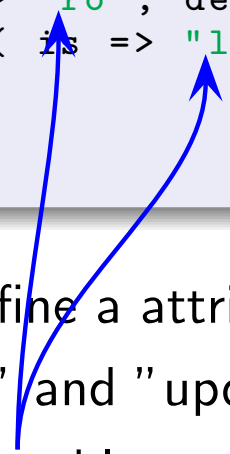

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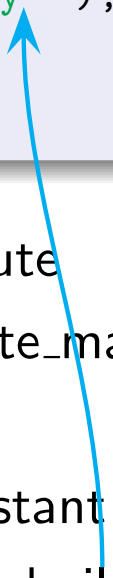

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- attributes "scan_interval" and "update_manifest_uri"
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- update_manifest_uri is initialized by a builder

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clearer takes a method name (`string`) which will clear the attribute (supports *attribute shortcut*)

predicate takes a method name (`string`) which will return true if an attribute has a value (supports *attribute shortcut*)

# Methods in Moo

```
package System::Image::Update::Role::Async;

use IO::Async; use IO::Async::Loop;
use IO::Async::Timer::Absolute; use IO::Async::Timer::Countdown;

use Moo::Role;

has loop => ( is => "lazy", predicate => 1 );
sub _build_loop { return IO::Async::Loop->new() }

sub wakeup_at { my ( $self, $when, $cb_method ) = @_;
    my $timer;
    $self->loop->add($timer = IO::Async::Timer::Absolute->new(
        time      => $when,
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    $timer;
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- nothing like `MooseX::Declare` - pure Perl5 keywords are enough for plain methods

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- No support for `super`, `override`, `inner` or `augment`

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- ensures that inherited methods invocation happens right (mostly - remember around)

## Methods Modifiers - around avoid calling $orig

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extends "System::Image::Update";
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- receives responsibility
- runtime of modified method completely eliminated

# Methods Modifiers - around modifying $orig return value

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package System::Image::Update::Role::Scan;

use strict; use warnings; use Moo::Role;

around collect_savable_config => sub {
    my $next                    = shift;
    my $self                    = shift;
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- runtime of modified method added to this method's runtime

# Part III

# System::Image::Update

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- Closer Adoption to Rademacher Way: Control from Hardware development until Customer Service

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- created Yocto CPAN Layer for cross compiling lot's of CPAN modules

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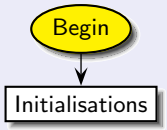

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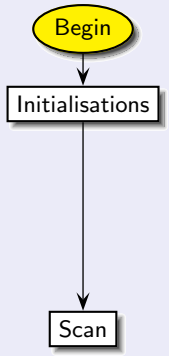

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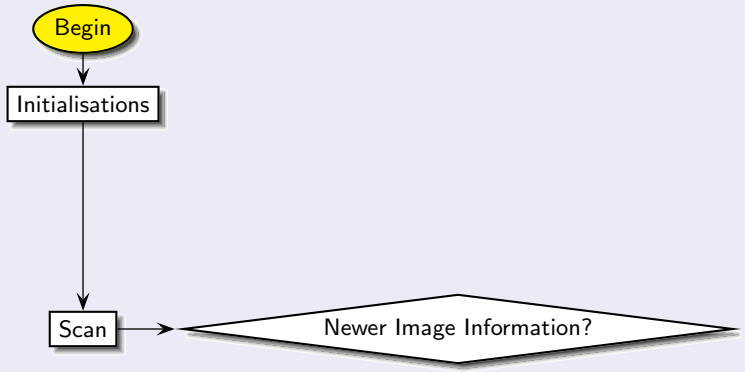

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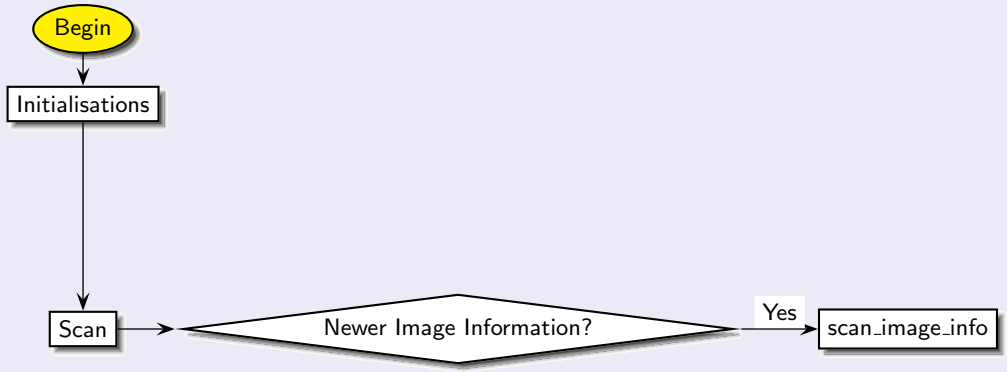

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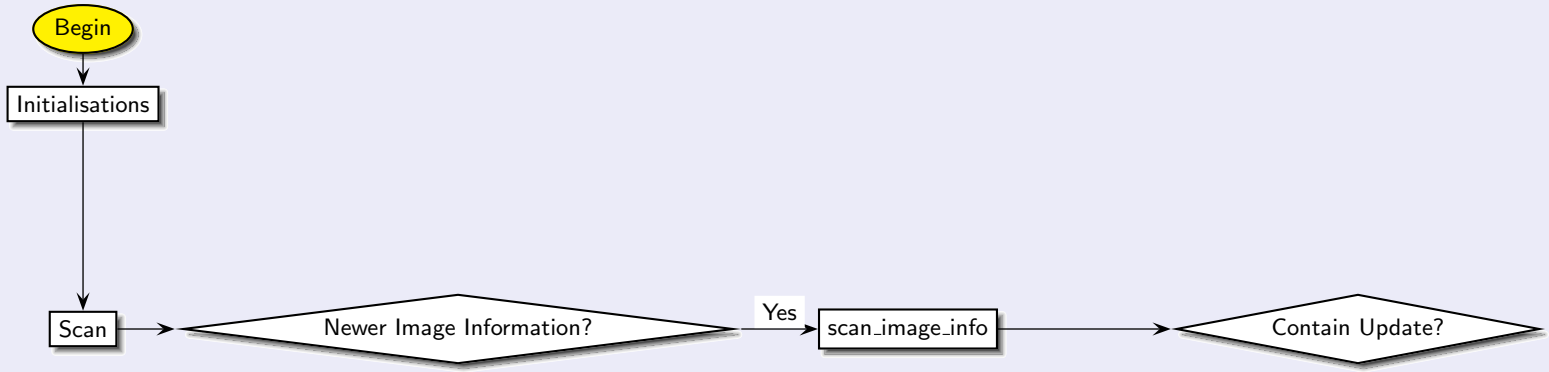

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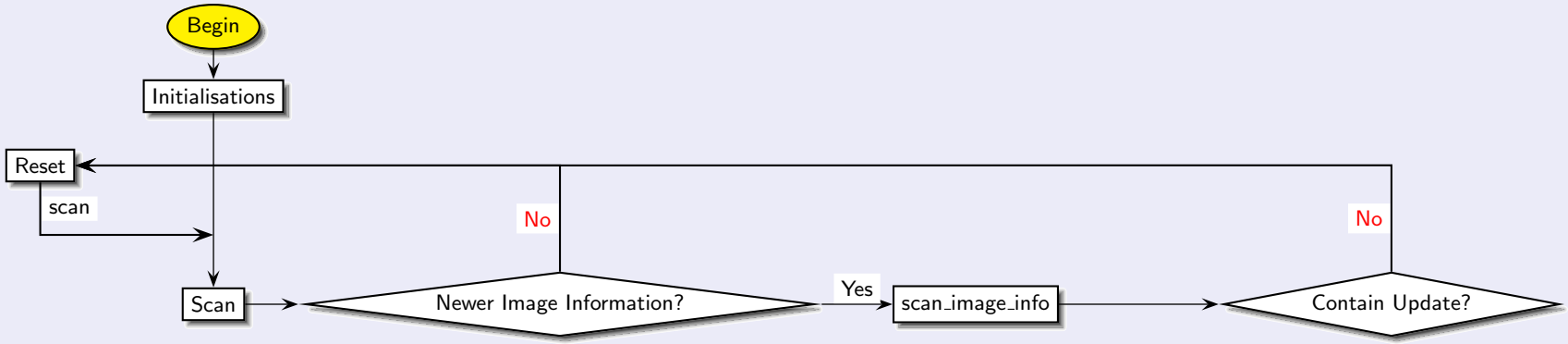

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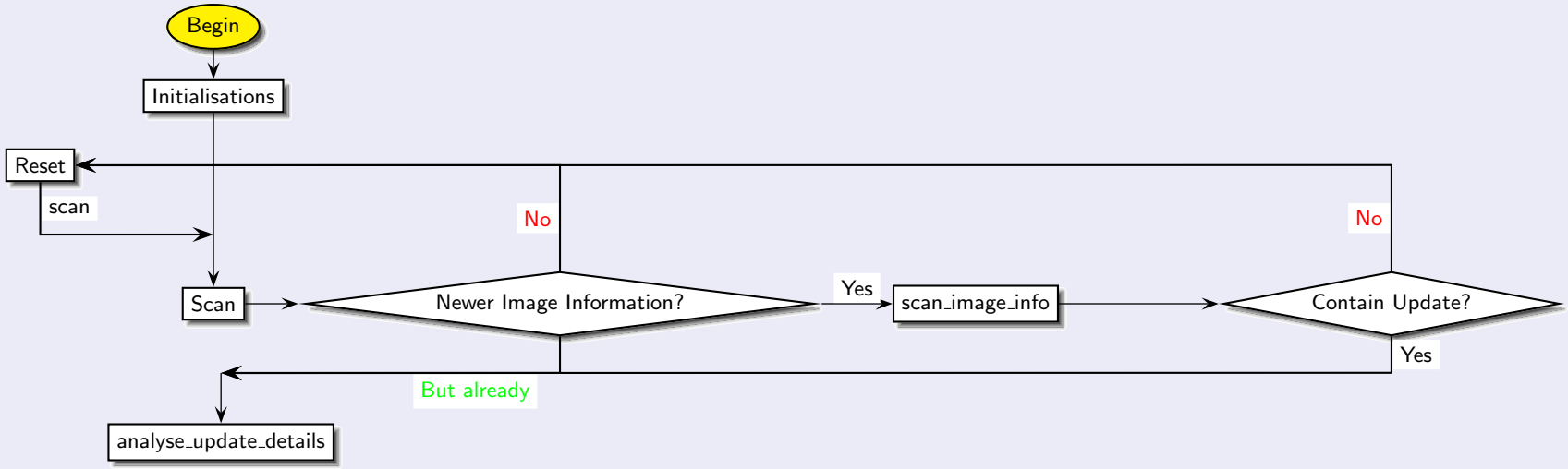

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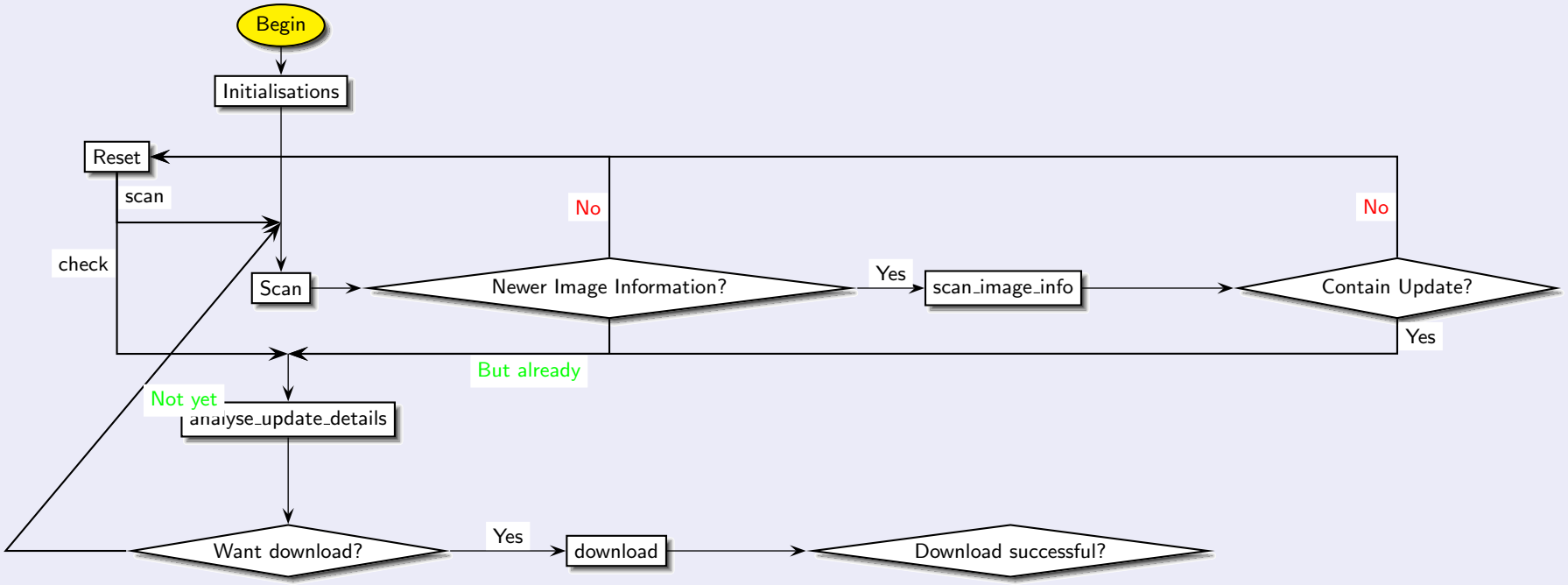

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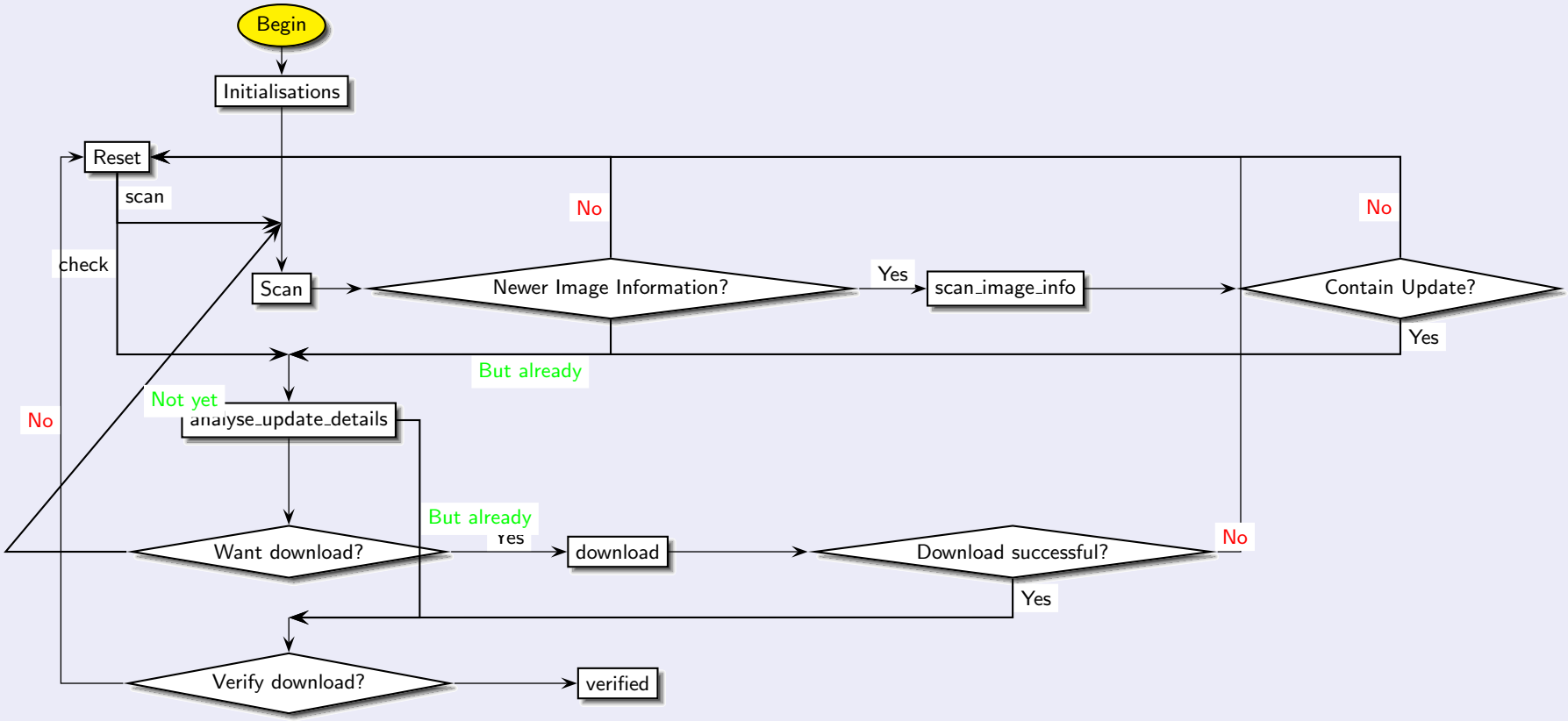

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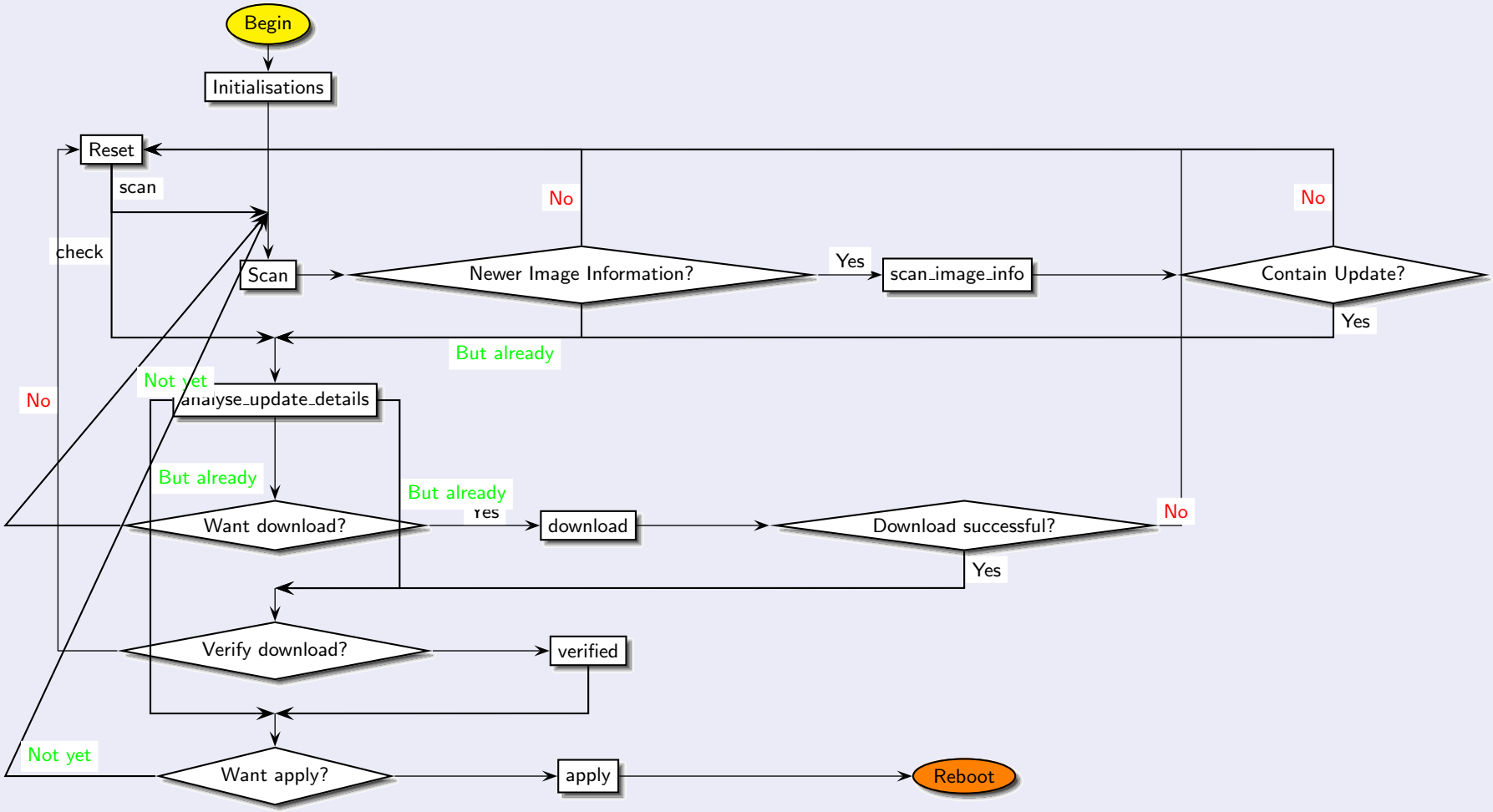

## State Control

```
package System::Image::Update;

use strict; use warnings; use Moo;
with "System::Image::Update::Role::Scan", "System::Image::Update::Role::Check",

has status => ( is => "rw", lazy => 1, builder => 1, predicate => 1,
    isa => sub { __PACKAGE__->can( $_[0] ) or die "Invalid status: $_[0]" }
);

sub _build_status { -f $_[0]->update_manifest ? "check" :
    $_[0]->has_recent_update and -e $_[0]->download_image ? "prove" : "scan";
}
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    $_[0]->has_recent_update and -e $_[0]->download_image ? "prove" : "scan";
}
```

- automatic recovering after down-state (power outage, Vodka party, . . . )

## State Control

```
package System::Image::Update;

use strict; use warnings; use Moo;
with "System::Image::Update::Role::Scan", "System::Image::Update::Role::Check",

has status => ( is => "rw", lazy => 1, builder => 1, predicate => 1,
    isa => sub { __PACKAGE__->can( $_[0] ) or die "Invalid status: $_[0]" }
);

sub _build_status { -f $_[0]->update_manifest ? "check" :
    $_[0]->has_recent_update and -e $_[0]->download_image ? "prove" : "scan";
}
```

- automatic recovering after down-state (power outage, Vodka party, . . . )
- room for improvements like continue aborted download

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}
```

- automatic recovering after down-state (power outage, Vodka party, . . . )
- room for improvements like continue aborted download
- no direct path to "download" or "apply" to avoid mistakes

# State Control II

```
package System::Image::Update;

use strict; use warnings; use Moo;
with "System::Image::Update::Role::Scan", "System::Image::Update::Role::Check",

has status => ( ... );

around BUILDARGS => sub {
    my $next = shift; my $class = shift; my $params = $class->$next(@_);

    $params->{status} and $params->{status} eq "apply"
      and $params->{status} = "prove";
    $params->{status} and $params->{status} eq "prove"
      and $params->{recent_update}
      and $params->{recent_update}->{apply} = DateTime->now->epoch;

    $params;
};
```

## State Control II

```
package System::Image::Update;

use strict; use warnings; use Moo;
with "System::Image::Update::Role::Scan", "System::Image::Update::Role::Check",

has status => ( ... );

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};
```

- toggleable are "download" and "prove"

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```

- toggleable are "download" and "prove"
- "apply" is protected by "prove" to ensure no corrupted image is applied

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      and $params->{recent_update}
      and $params->{recent_update}->{apply} = DateTime->now->epoch;

    $params;
};
```

- toggleable are "download" and "prove"
- "apply" is protected by "prove" to ensure no corrupted image is applied
- protection needs to be improved before releasing to wildlife

# Middleware Information Center

```
package Update::Status;

use strict; use warnings; use Moo;
extends "System::Image::Update";

around _trigger_recent_update => sub {};

around BUILDARGS => sub {
    my $next = shift; my $class = shift; my $params = $class->$next(@_);
    exists $params->{status} and delete $params->{status};
    $params;
};
```

## Middleware Information Center

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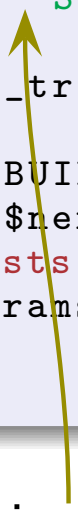
```



- derive from "System::Image::Update" to get the real world picture

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package Update::Status;

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extends "System::Image::Update";

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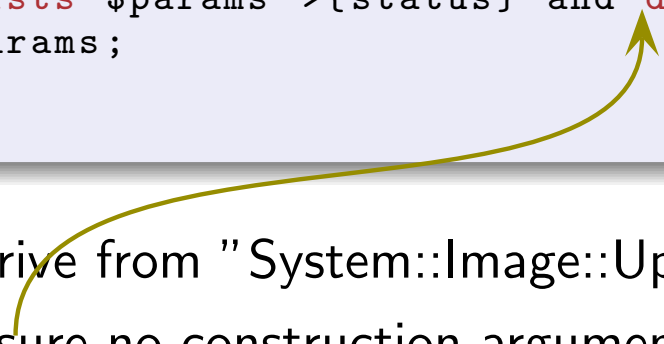

- derive from "System::Image::Update" to get the real world picture
- ensure no construction argument wastes the self-diagnostics

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```
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- derive from "System::Image::Update" to get the real world picture
- ensure no construction argument wastes the self-diagnostics
- prevent automatism starts when recent update is found

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```

- derive from "System::Image::Update" to get the real world picture
- ensure no construction argument wastes the self-diagnostics
- prevent automatism starts when recent update is found

What information?

# Middleware Information Center

```
package Update::Status;

use strict; use warnings; use Moo;
extends "System::Image::Update";

around _build_config_prefix => sub { "sysimg_update" };

around _trigger_recent_update => sub {};

around BUILDARGS => sub {
    my $next = shift; my $class = shift; my $params = $class->$next(@_);
    exists $params->{status} and delete $params->{status};
    $params;
};
```

# Middleware Information Center

```
package Update::Status;

use strict; use warnings; use Moo;
extends "System::Image::Update";

around _build_config_prefix => sub { "sysimg_update" };

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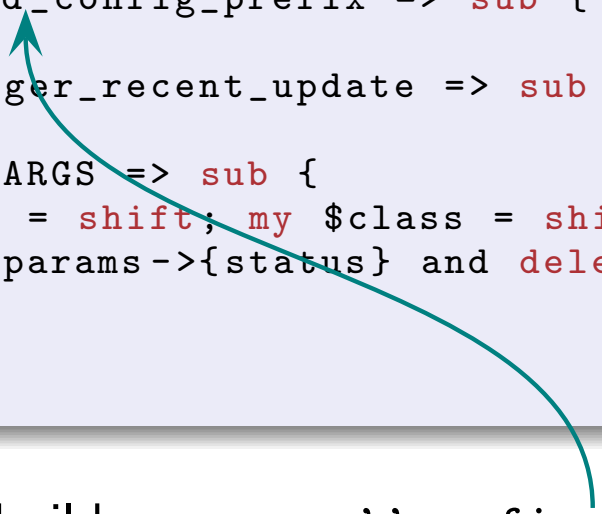

- default builder guesses ''config_prefix'' from $0

## Middleware Information Center

```
package Update::Status;

use strict; use warnings; use Moo;
extends "System::Image::Update";

around _build_config_prefix => sub { "sysimg_update" };

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    exists $params->{status} and delete $params->{status};
    $params;
};
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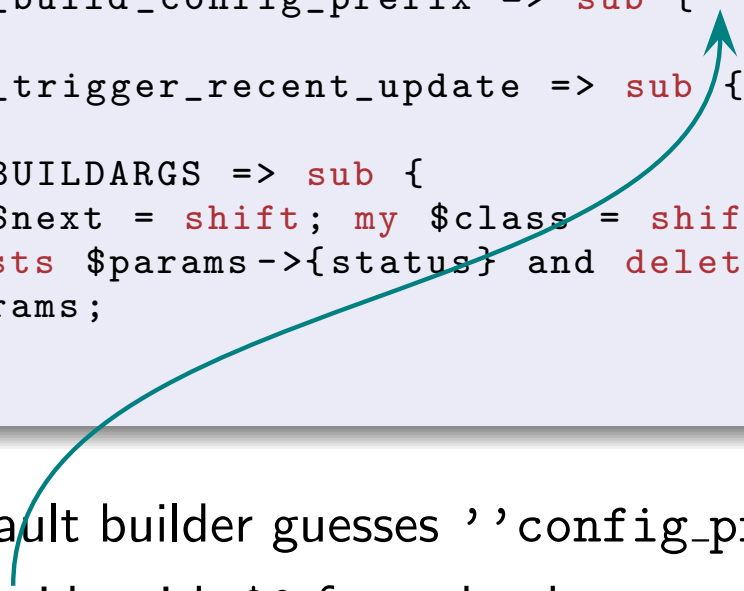

- default builder guesses ''config_prefix'' from $0
- override with $0 from the daemon

# Middleware Delivery Center

```
package hp2sm;
use strict; use warnings; use Dancer2 ':syntax'; ...; use Update::Status;

get '/status' => sub {
    my $us = Update::Status->new;
    my $status = "idle";
    $us->has_recent_update and $status = "available";
    $us->status eq "prove" and $status = "downloading";
    $us->has_recent_update and -f $us->download_image
      and $us->download_sums->{size} == stat( $us->download_image )->size
      and $status = "proved";
    my $pl = get_process_stats();
    firstval { $pl->process_name($_) =~ /flash-device/ } ( 0 .. $pl->entries()
      and $status = "applying";
};
```

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- Load and guess current status of "System::Image::Update" instance

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- Load and guess current status of "System::Image::Update" instance
- start with "idle" and prove from earliest to latest

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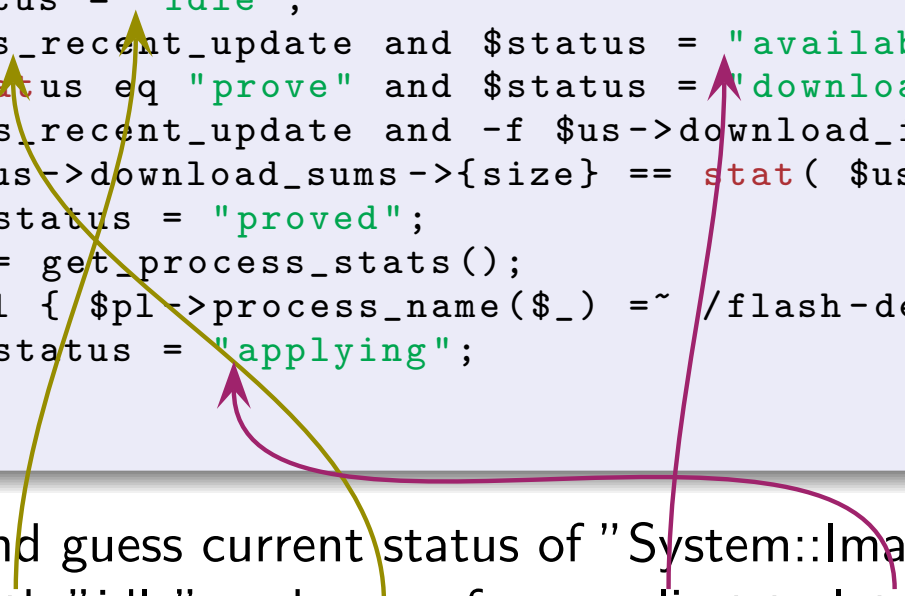

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- Load and guess current status of "System::Image::Update" instance
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- better status overrides earlier measures - ''prove'' implies has_recent_update

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};
```

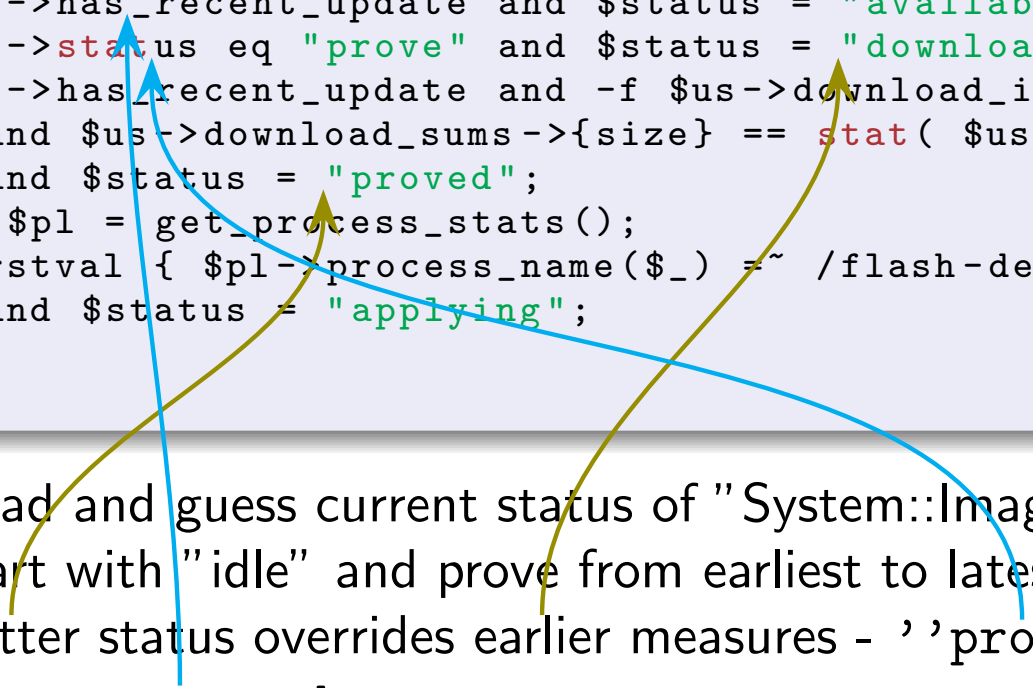

- Load and guess current status of "System::Image::Update" instance
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```

- Load and guess current status of "System::Image::Update" instance
- start with "idle" and prove from earliest to latest
- better status overrides earlier measures - ''prove'' implies has_recent_update
- ''apply'' is currently done by an external process

# Middleware Delivery Center

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use strict; use warnings; use Dancer2 ':syntax'; ...; use Update::Status;

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- Load and guess current status of "System::Image::Update" instance
- start with "idle" and prove from earliest to latest
- better status overrides earlier measures - ''prove'' implies has_recent_update
- ''apply'' is currently done by an external process
- use Unix::Statgrab to grep for processes

# Middleware Strikes Back

```
package hp2sm;
use strict; use warnings; use Dancer2 ':syntax'; ...; use Update::Status;

put '/status/downloading' => sub {
    my $us = Update::Status->new();
    $us->has_recent_update or return $json->encode( { result => "n/a" } );
    $us->status("download"); $us->save_config;
    system("svc -t /etc/daemontools/service/sysimg_update/");
    return $json->encode( { result => "ok" } );
};
```

## Middleware Strikes Back

```
package hp2sm;
use strict; use warnings; use Dancer2 ':syntax'; ...; use Update::Status;

put '/status/downloading' => sub {
    my $us = Update::Status->new();
    $us->has_recent_update or return $json->encode( { result => "n/a" } );
    $us->status("download"); $us->save_config;
    system("svc -t /etc/daemontools/service/sysimg_update/");
    return $json->encode( { result => "ok" } );
};
```

## Middleware Information Boosted Persistency

```
package Update::Status;
use strict; use warnings; use Moo;
extends "System::Image::Update";

around collect_savable_config => sub {
    my $next = shift; my $self = shift; my $save_cfg = $self->$next(@_);
    $self->has_status and $save_cfg->{status} = $self->status;
    $self->has_download_file
      and $save_cfg->{download_file} = $self->download_file;
    $save_cfg; };
```

## system-image-update_git.bb top

```
DESCRIPTION = "System::Image::Update helps managing updates of OS images ..."
SRC_URI = "git://github.com/rehsack/System-Image-Update.git;rev=646fa928... \
           file://run file://sysimg_update.json"
RDEPENDS_${PN} += "archive-peek-libarchive-perl crypt-ripemd160-perl"
RDEPENDS_${PN} += "datetime-format-strptime-perl"
RDEPENDS_${PN} += "log-any-adapter-dispatch-perl"
RDEPENDS_${PN} += "file-configdir-system-image-update-perl"
RDEPENDS_${PN} += "moo-perl moox-configfromfile-perl moox-log-any-perl"
RDEPENDS_${PN} += "moox-options-perl net-async-http-perl"
RDEPENDS_${PN} += "digest-md5-perl digest-md6-perl"
RDEPENDS_${PN} += "digest-sha-perl digest-sha3-perl"
RDEPENDS_${PN} += "daemontools system-image"
S = "${WORKDIR}/git"
BBCLASSEXTEND = "native"

inherit cpan
do_configure_append() {
    oe_runmake manifest
}
```

## system-image-update_git.bb top

```
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SRC_URI = "git://github.com/rehsack/System-Image-Update.git;rev=646fa928... \
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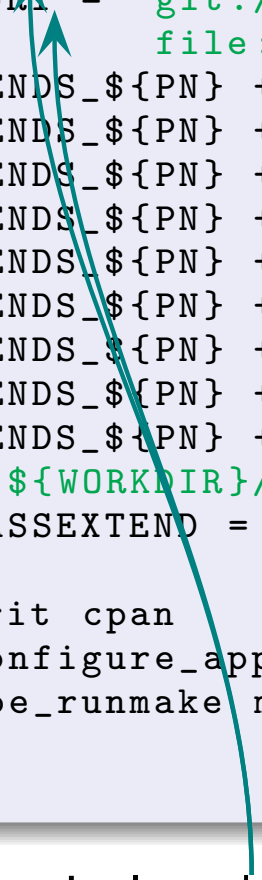

- typical package stuff . . . ,

## system-image-update_git.bb top

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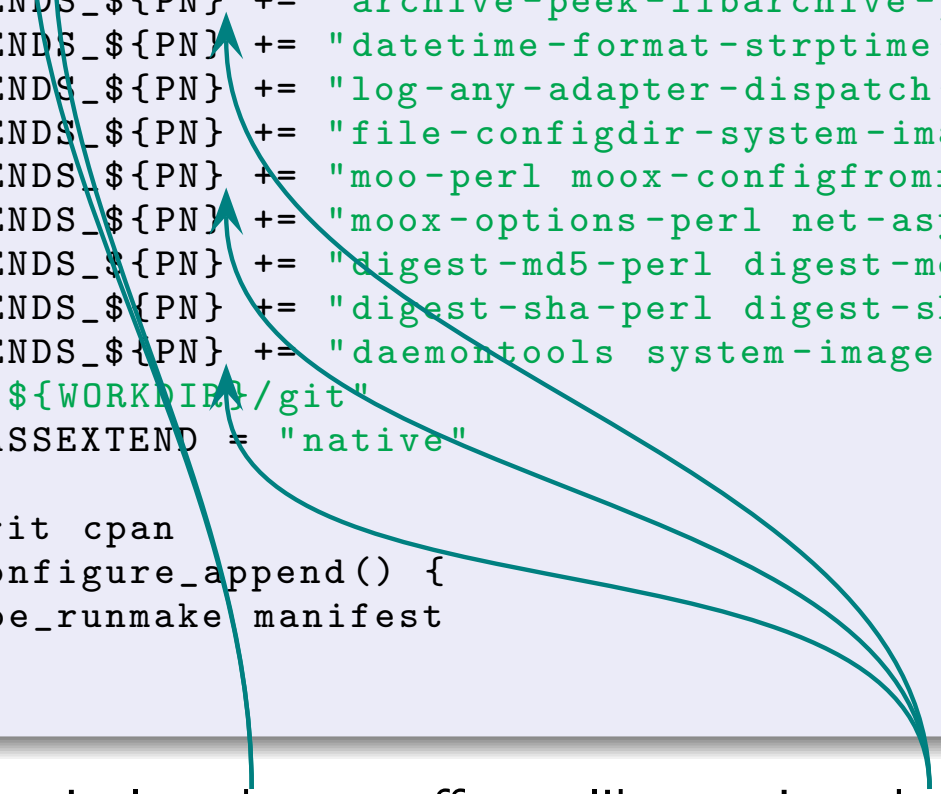

- typical package stuff . . . , like runtime dependencies

## system-image-update_git.bb top

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SRC_URI = "git://github.com/rehsack/System-Image-Update.git;rev=646fa928... \
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S = "${WORKDIR}/git"
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do_configure_append() {
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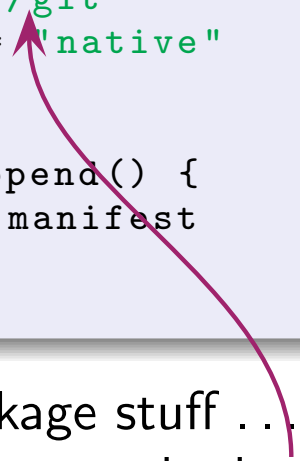

- typical package stuff . . . , like runtime dependencies
- git checkouts need adoption of source path

## system-image-update_git.bb top

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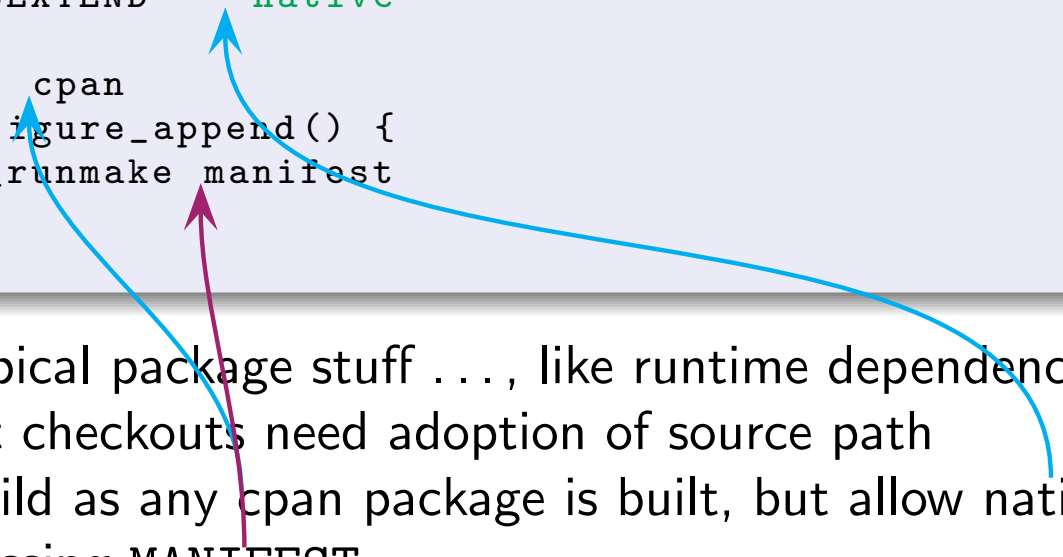

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## system-image-update_git.bb bottom

```
SERVICE_ROOT = "${sysconfdir}/daemontools/service"
SYSUPDT_SERVICE_DIR = "${SERVICE_ROOT}/sysimg_update"

do_install_append() {
    install -d -m 755 ${D}${sysconfdir}
    install -m 0644 ${WORKDIR}/sysimg_update.json ${D}${sysconfdir}

    install -d ${D}${SYSUPDT_SERVICE_DIR}
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FILES_${PN} += "${sysconfdir}"
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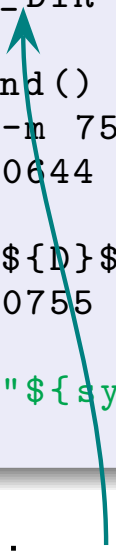

- define location of startup scripts

## system-image-update_git.bb bottom

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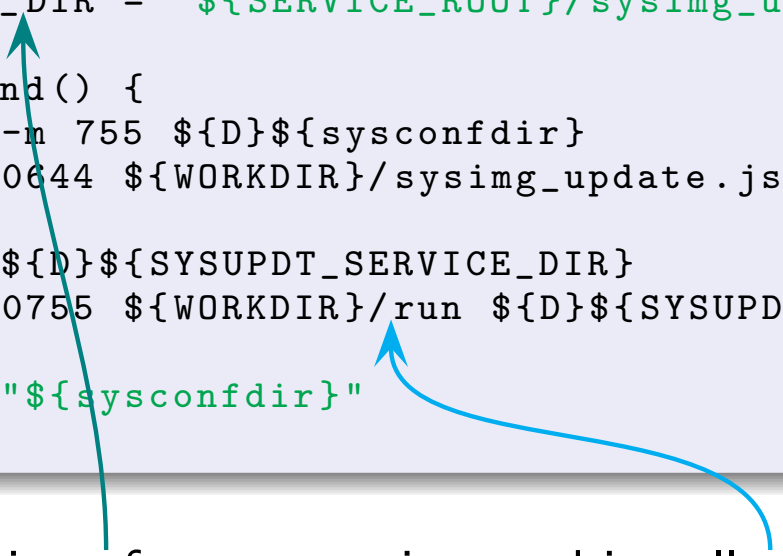

- define location of startup scripts and install to there

## system-image-update_git.bb bottom

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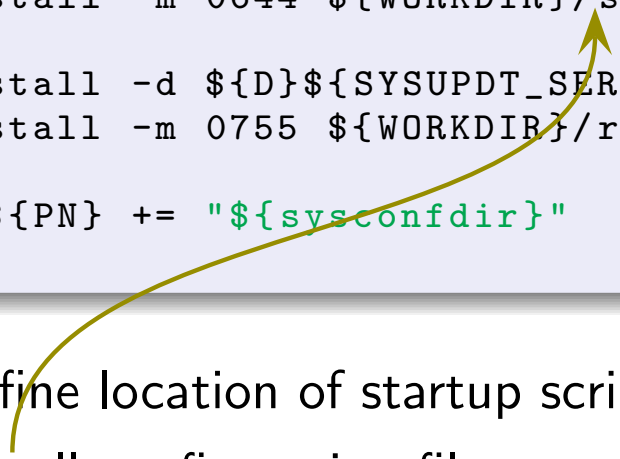

- define location of startup scripts and install to there
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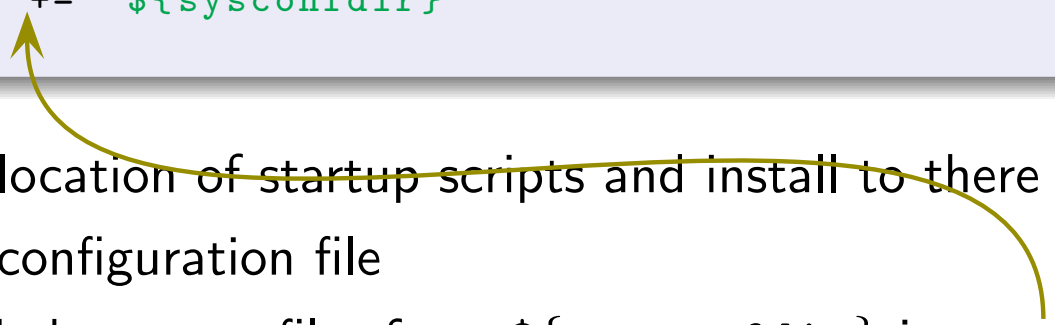

- define location of startup scripts and install to there
- install configuration file
- tell bitbake to put files from ${sysconfdir} into package

## sysimg_update.json

```
{
    "log_adapter" : [
        "Dispatch",
        "outputs", [
            [ "File",   "min_level", "debug", "filename",
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            [ "File",   "min_level", "error", "filename",
              "/var/log/sysimg_update.error", "newline", 1, "mode", ">>" ],
            [ "Screen", "min_level", "notice", "newline", 1, "stderr", 1 ]
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- Provides settings for `Log::Any` (mind `_trigger_log_adapter` in `System::Image::Update::Role::Logging` consuming `MooX::Log::Any`)
- redirect place to store update manifest (files)
- Provide authentication to update server for development boxes (avoid `builder` is called)

# Overview

## Part IV

## Finish

## Conclusion

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- benefit of common runtime (faster load) when using
- improve design by
  - using roles for behavioral design (avoid duck typing)
  - using explicit patterns for clear separation of concerns
  - express intensions clearer for method overloading by using *method modifiers*

# Resources

## Software on MetaCPAN

https://metacpan.org/pod/Moo
https://metacpan.org/search?q=MooX
https://metacpan.org/pod/MooX::Options
https://metacpan.org/pod/MooX::ConfigFromFile
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## Software on GitHub

https://github.com/moose/Moo
https://github.com/rehsack/System-Image-Update
https://github.com/perl5-utils/File-ConfigDir-System-Image-Update

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https://github.com/rehsack/System-Image-Update
https://github.com/perl5-utils/File-ConfigDir-System-Image-Update

## Software for Cross-Building Perl-Modules

https://www.yoctoproject.org/
https://github.com/rehsack/meta-cpan

# Resources

## IRC

irc://irc.perl.org/#moose
irc://irc.perl.org/#web-simple
irc://irc.perl.org/#dancer
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## Hints

http://sck.pm/WVO # proper usage of the roles in perl
https://metacpan.org/pod/Moo#CLEANING-UP-IMPORTS

# Thank You For Listening

## Questions?

Jens Rehsack <rehsack@cpan.org>