

# STATUS CHANGE: NOW USING EVENT SOURCING

by Emily Stamey

<https://joind.in/talk/eac30>





I'm a PHP developer

Co-Organizer of Triangle PHP and

Director of WWCode

Raleigh/Durham

I work at a company that builds  
tools for network security threat  
assessment

I workED at a University

INQUEST

# WHAT WE'LL COVER:

- Processes from paper to web forms
- What is Event Sourcing?
- Introducing what this code looks like (LIGHT)
- Advantages and Disadvantages

# BRACE YOURSELF!



© PHOTO BY CIARAN LEE



# RELAX, ENJOY THE RIDE!



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# SIGN THE WAIVER

I, \_\_\_\_(state your name)\_\_\_\_, will not blame Emily if Event Sourcing makes my head explode. I promise I will not leave a bad review. And I promise to be kind to myself as I learn new things.



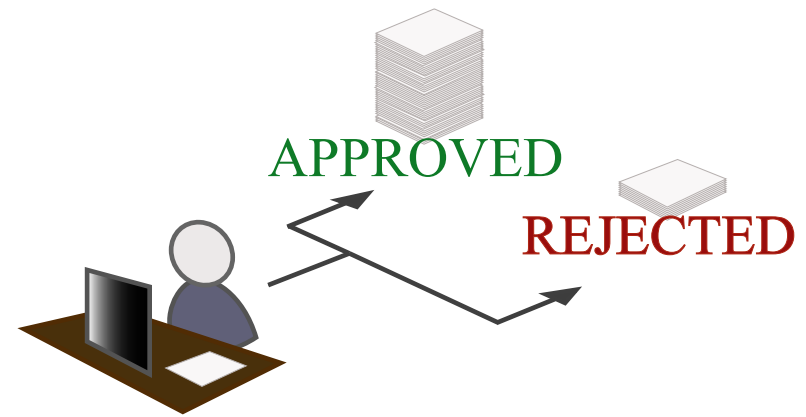
# FORMS

A lot of our systems were built to  
replace paper processes

They often closely map to this  
physical form.

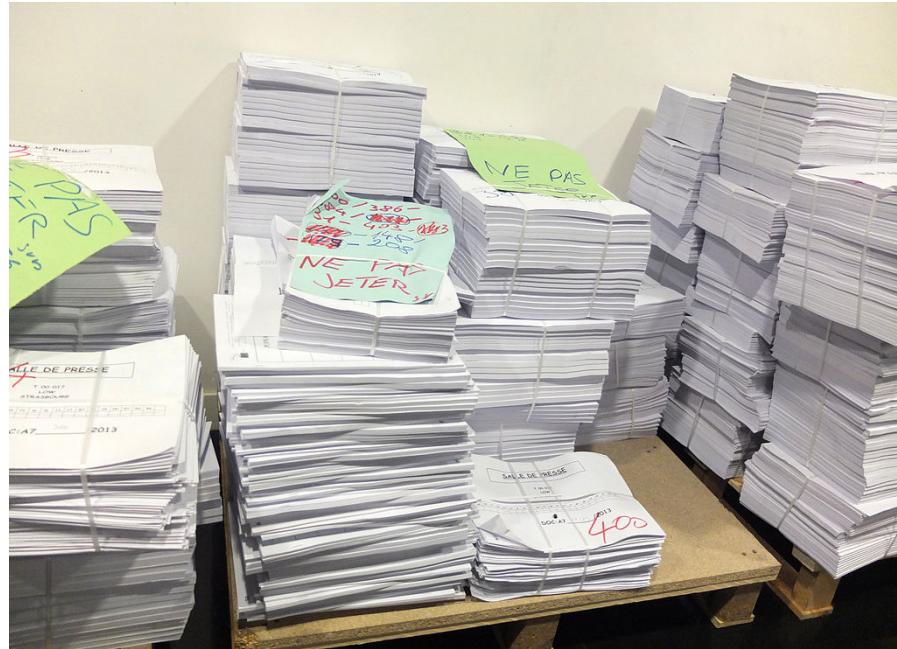
A close-up photograph of a U.S. Individual Income Tax Form 1040. The form is white with black text. The top right corner reads "Department of the Treasury—Internal Revenue Service". Below this, the title "U.S. Individual Income Tax Return" is printed. The form number "1040" is prominently displayed in the top left. The text "For the year Jan. 1—Dec. 31, 2005, or other year" is visible. The form includes sections for "Your first name and initial" (with "Roy" handwritten), "If a joint return, spouse's first name" (with "Heather" handwritten), and "Address (number and street, city, state, and ZIP code)". The word "Label" is printed vertically on the left side of the form.

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# PAPER FORMS HANDLING STATE



Piles indicate status of the form

# PAPER FORMS HANDLING STATE

**COLLEGE APPLICATION**

**Personal Information**

Name (Last) DOE (First) JOHN (Middle Initial) M Home Telephone 123-456  
Address (Mailing Address) 123456 Main St (City) ANYTOWN (State) CA Other Telephone 987-6543  
E-Mail Address \_\_\_\_\_

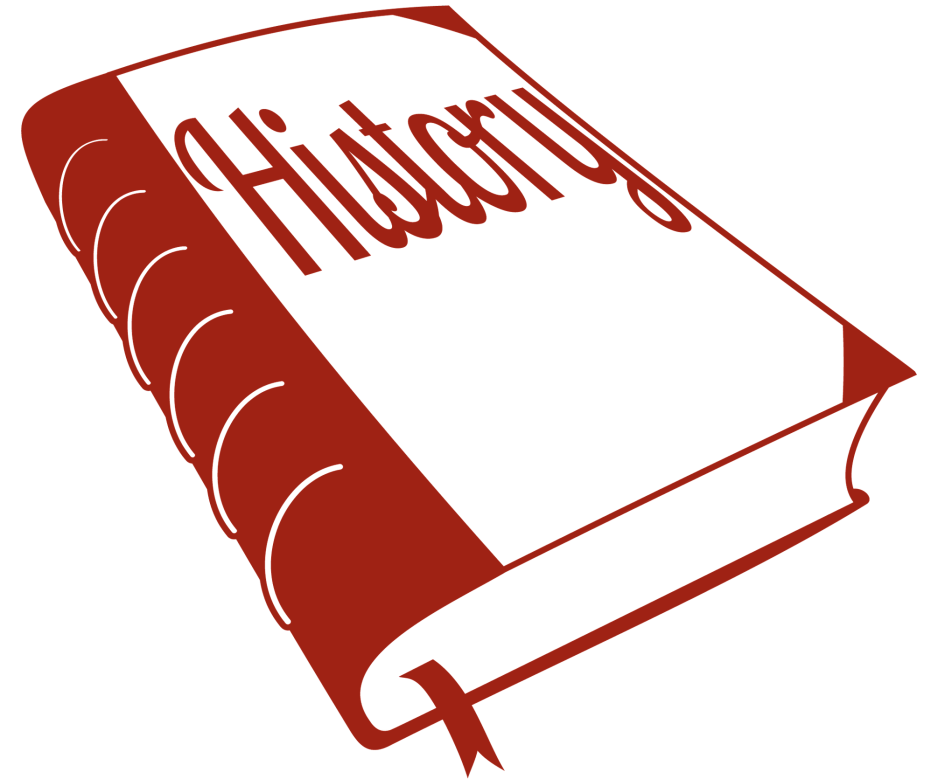
**Current Income**

High School Graduate Or General Education (GED) Test Passed? Yes No  
If no, list the highest grade completed \_\_\_\_\_

| Business School, Military (Most recent first) |                             | Credits Earned              |                 | Graduate | Degree & Year | Major or Subject |
|---|-----------------------------|-----------------------------|-----------------|----------|---------------|------------------|
| Dates Attended                                | Quarterly or Semester Hours | Quarterly or Semester Hours | Other (Specify) |          |               |                  |
|   |                             |                             |                 | Yes      |               |                  |

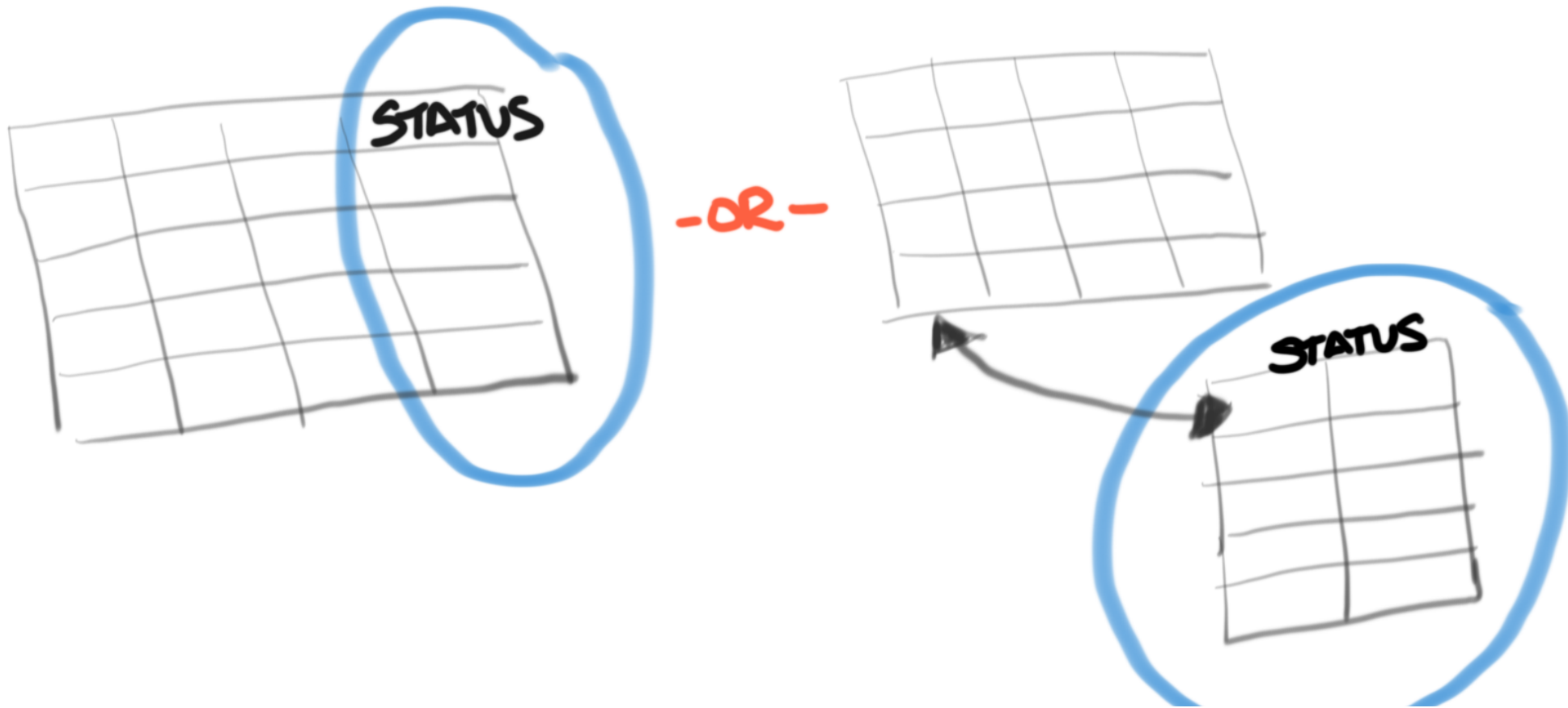
Status doesn't really communicate why or what happened

# WHY ARE THEY IN THE CURRENT STATE?





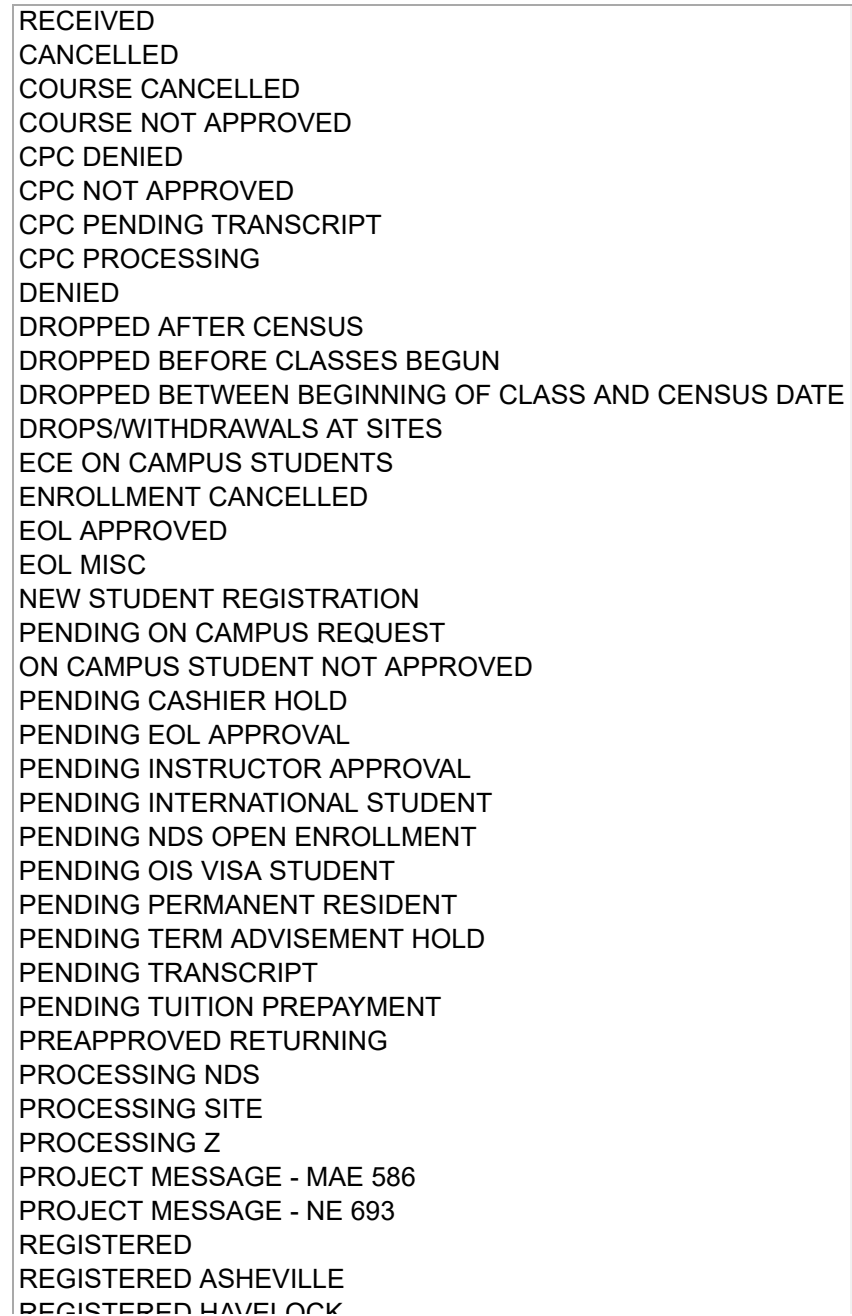
# COMPENSATING MEASURES



# HOW WORKFLOWS BECOME COMPLEX

# A SIMPLE STATUS DROP-DOWN

# A "SIMPLE" STATUS DROP-DOWN



RECEIVED  
CANCELLED  
COURSE CANCELLED  
COURSE NOT APPROVED  
CPC DENIED  
CPC NOT APPROVED  
CPC PENDING TRANSCRIPT  
CPC PROCESSING  
DENIED  
DROPPED AFTER CENSUS  
DROPPED BEFORE CLASSES BEGUN  
DROPPED BETWEEN BEGINNING OF CLASS AND CENSUS DATE  
DROPS/WITHDRAWALS AT SITES  
ECE ON CAMPUS STUDENTS  
ENROLLMENT CANCELLED  
EOL APPROVED  
EOL MISC  
NEW STUDENT REGISTRATION  
PENDING ON CAMPUS REQUEST  
ON CAMPUS STUDENT NOT APPROVED  
PENDING CASHIER HOLD  
PENDING EOL APPROVAL  
PENDING INSTRUCTOR APPROVAL  
PENDING INTERNATIONAL STUDENT  
PENDING NDS OPEN ENROLLMENT  
PENDING OIS VISA STUDENT  
PENDING PERMANENT RESIDENT  
PENDING TERM ADVISEMENT HOLD  
PENDING TRANSCRIPT  
PENDING TUITION PREPAYMENT  
PREAPPROVED RETURNING  
PROCESSING NDS  
PROCESSING SITE  
PROCESSING Z  
PROJECT MESSAGE - MAE 586  
PROJECT MESSAGE - NE 693  
REGISTERED  
REGISTERED ASHEVILLE  
REGISTERED HAVELOCK

# SOMETHING HAPPENED

# SOMETHING HAPPENED

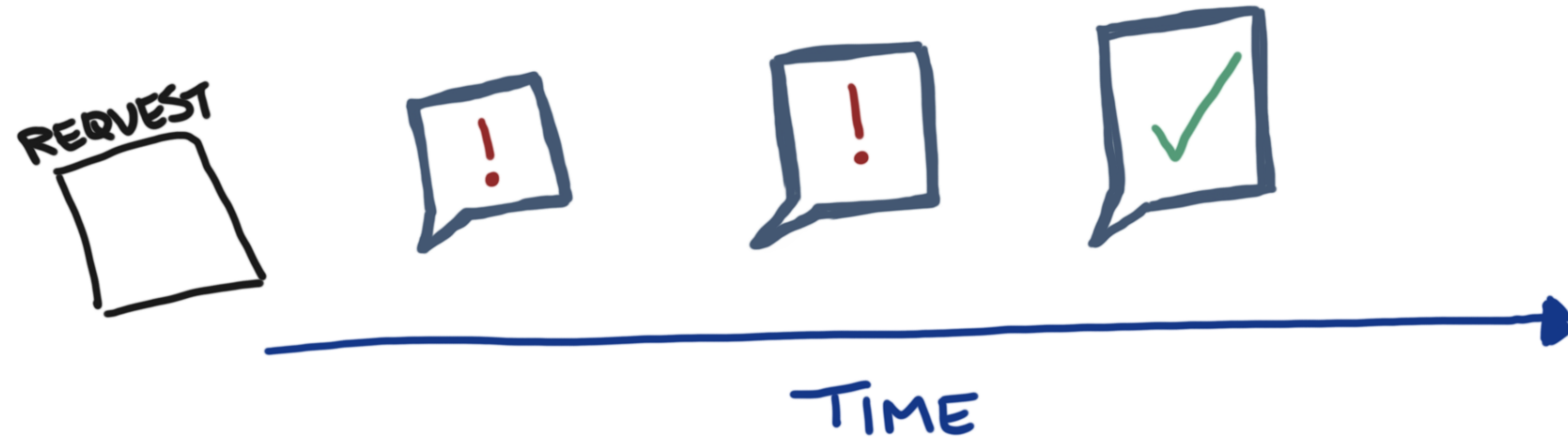
Status is a reflection of something  
that happened

There is ONE of each status +  
reasons/details

Events can record what happened



# THE REQUEST DOESN'T GET STUCK





# ENTER EVENT SOURCING

# DEFINITION EVENT SOURCING

The fundamental idea of Event Sourcing is that of ensuring **every change to the state** of an application **is captured in an event object**, and that these event objects are themselves stored in the sequence they were applied for the same lifetime as the application state itself.

- Martin Fowler

# WHAT'S IMPORTANT ABOUT EVENTS

- Events
- Details of the Event  
(attributes)
- Order/Sequence

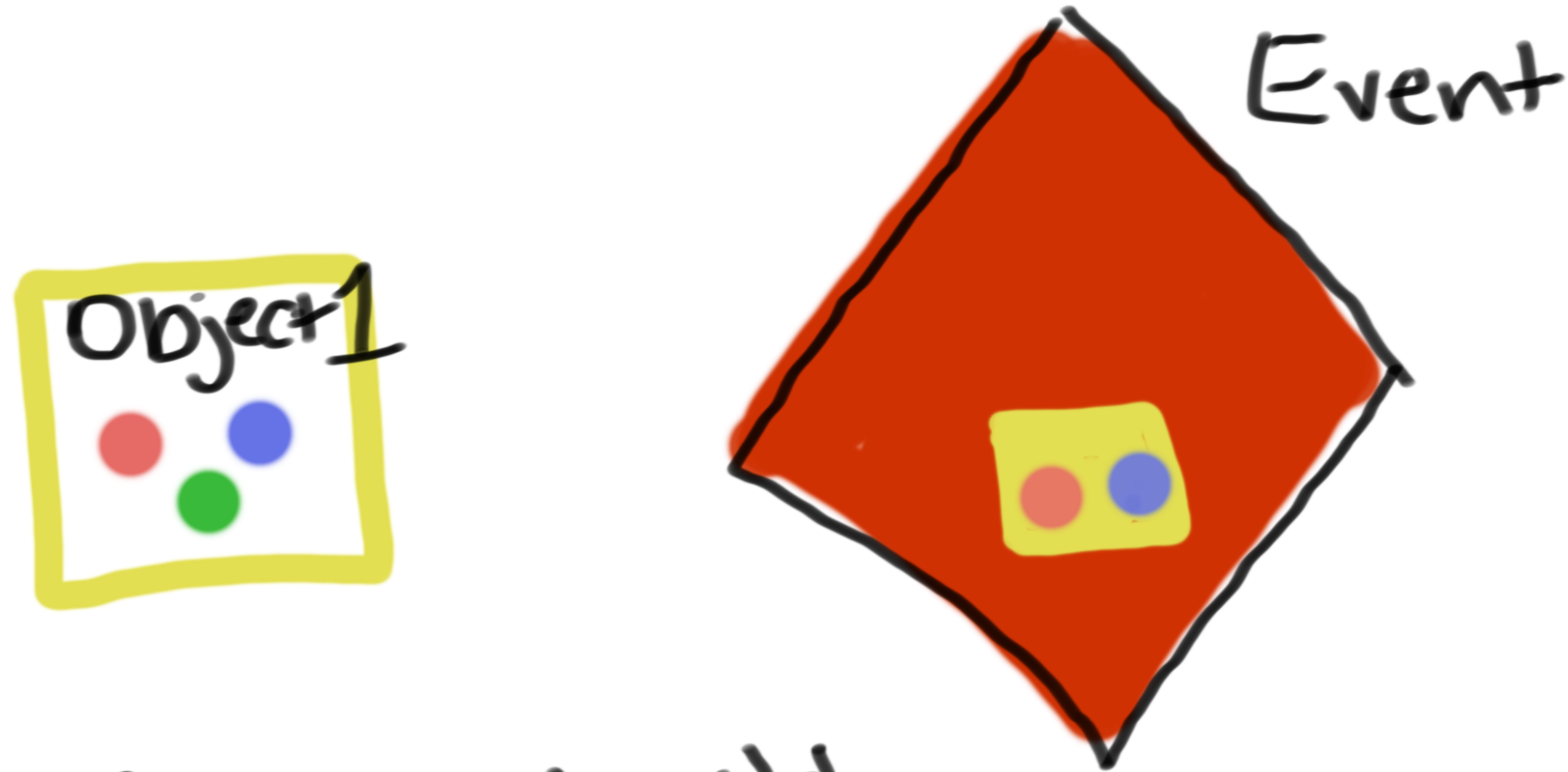
# RULES FOR EVENTS

- RARELY changed
- Never deleted
- Events are usually named as past-tense verbs
- Have attributes that are values
  - never an aggregate root
  - never a model/collection/object

# THE OBJECT CAN CHANGE



# OUR OBJECT DEFINITION CHANGED



Cannot build  
Object from this Event

# EVENTS ARE NOT BIONIC



**THE FACT THAT AN EVENT HAPPENED  
DOESN'T EVER CHANGE EVEN THOUGH THE  
BEHAVIOR AROUND IT MAY HAVE**

# WHY EVENTS?

state transistions are important

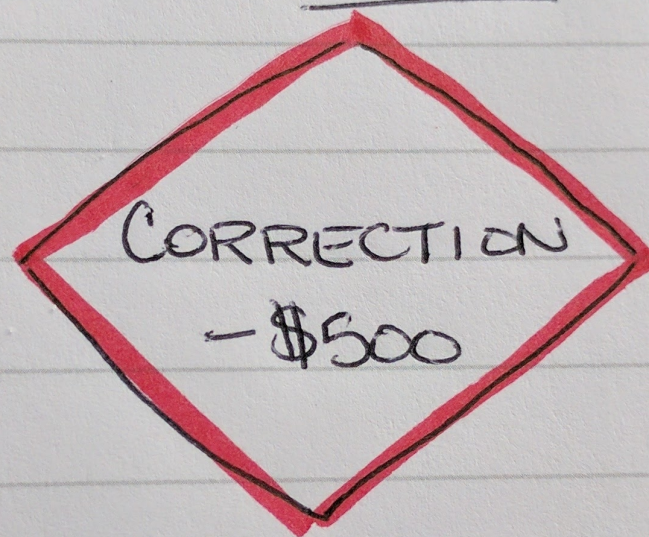
We need an audit log and proof of state

This history is more important than the current state

Able to replay these events to rebuild state



## NEVER DELETE EVENTS

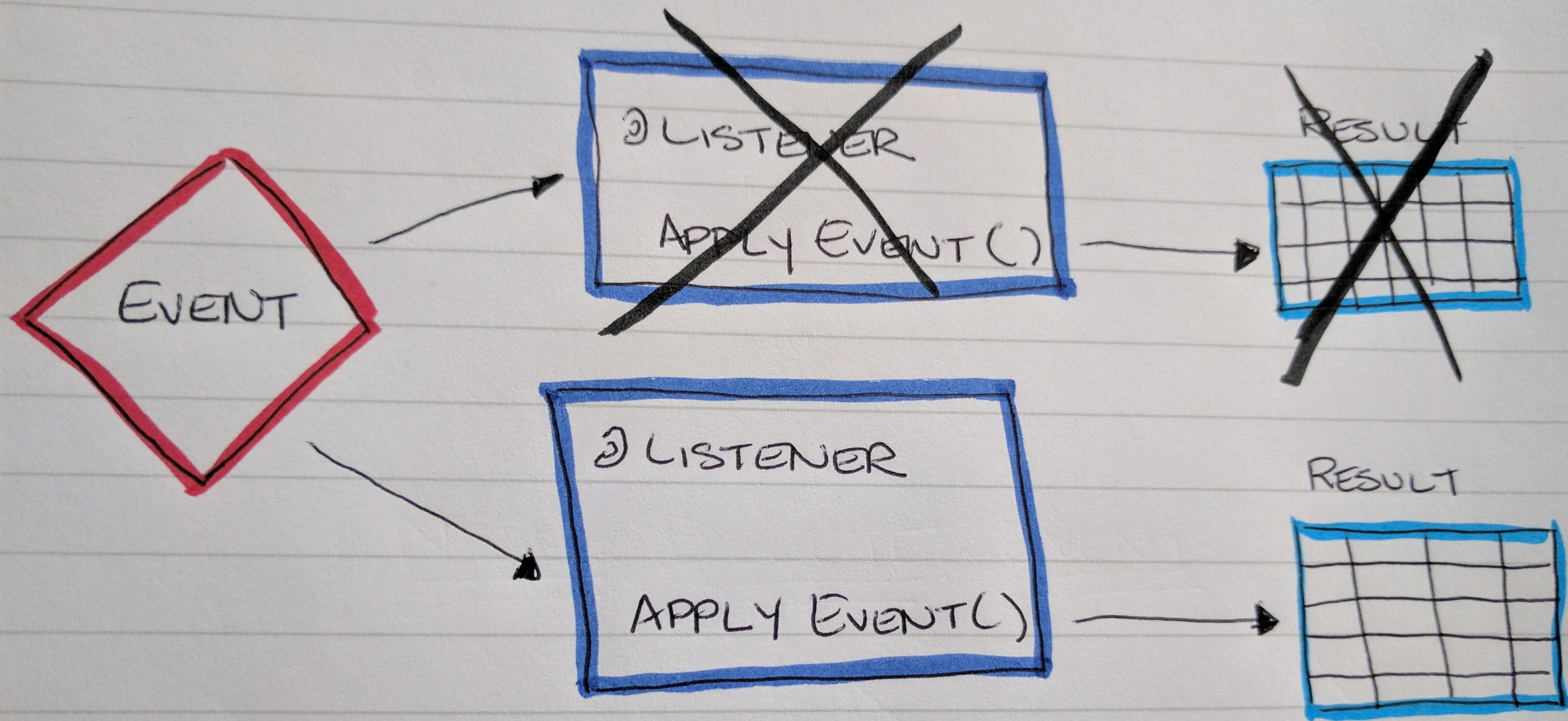


(mostly)











Events don't change

The part of the code that will change is most likely the result that follows that event.

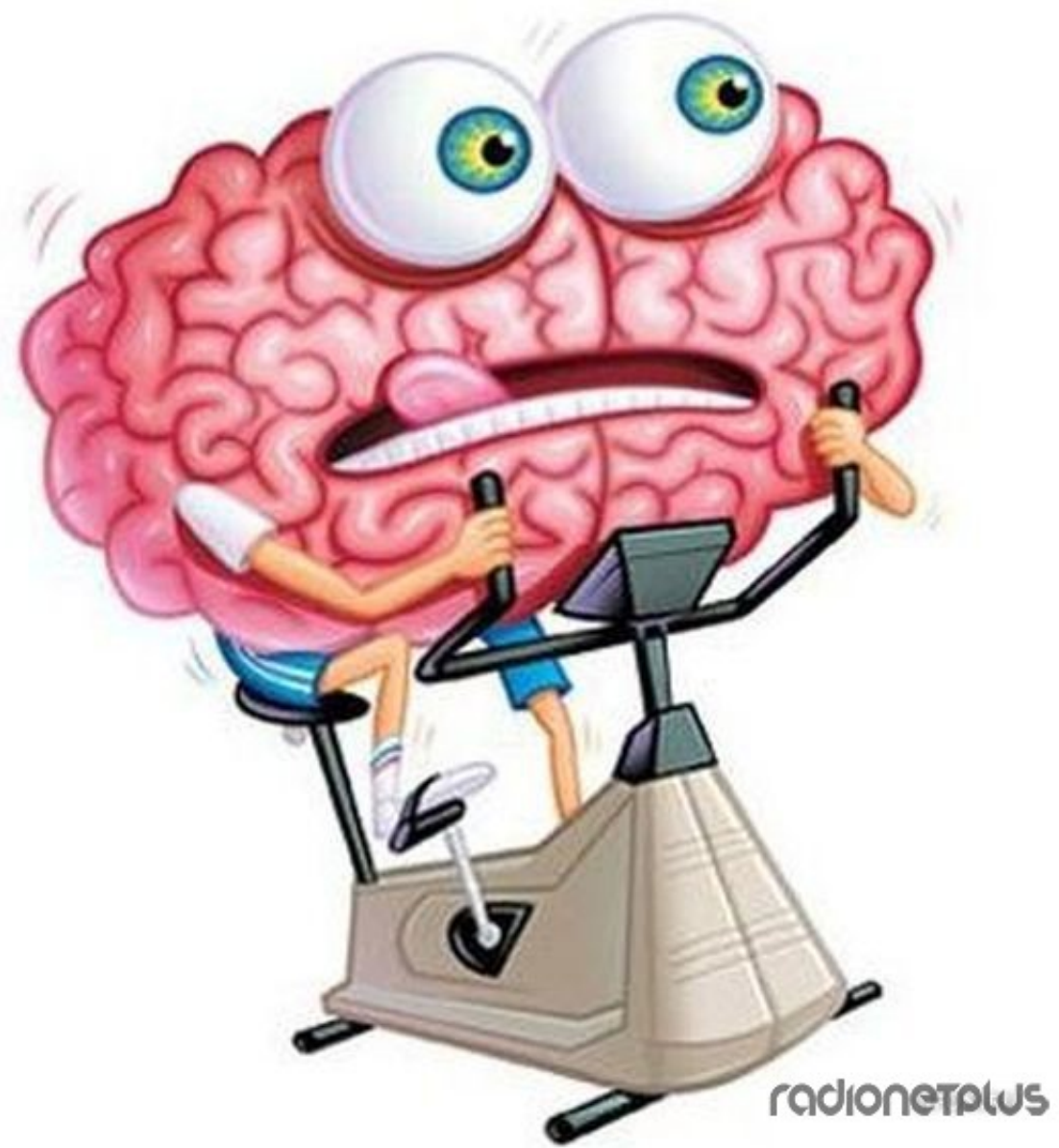
The structure of the resulting data is more likely to change than the behavior

# THE CODE

There are many classes involved:

- Events
- Domain Message
- Classes with Listeners
  - Projections
  - Read Models
- Commands & Handlers (CQRS)







## Enrollment Request Rejected Event

Request ID  
Student ID  
Course ID  
Rejector

```
<?php

namespace App\Enrollment\Domain\Events;

use App\Enrollment\Domain\CourseOfferingId;
use App\Enrollment\Domain\StudentId;
use App\Support\Domain\Uuid;
use App\Support\EventHandling\Event;

class EnrollmentRequestRejected implements Event
{
    /**
     * @var Uuid
     */
```

## ● Domain Message

ID (UUID)

VERSION

PAYLOAD  ← THE EVENT

TIMESTAMP

```
<?php

namespace App\Support\Domain;

use App\Support\EventHandling\Event;
use DateTime;

class DomainMessage
{
    /**
     * @var string
     */
    private $streamId;
```

# EVENT STORE

A domain specific database

A functional database based on a publish-subscribe messages pattern



# EVENTS TABLE - NO WRAPPER

| Field          | Type      |   | Length | U |
|----------------|-----------|---|--------|---|
| id             | INT       | ↕ | 11     |   |
| aggregate_type | VARCHAR   | ↕ | 255    |   |
| aggregate_id   | VARCHAR   | ↕ | 255    |   |
| payload        | LONGBLOB  | ↕ |        |   |
| occurred_on    | TIMESTAMP | ↕ |        |   |





# EVENTS TABLE - NO WRAPPER

| id | aggregate_type   | aggregate_id   | payload   |
|----|--|--|---|
| 1  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 6666661145   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 2  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222222   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 3  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222223   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 4  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222321   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 5  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222600   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 6  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222652   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 7  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222690   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 8  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22223002   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 9  | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222224   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 10 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222225   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 11 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222226   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 12 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222228   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 13 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222229   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 14 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222230   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 15 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | ITECS\Scholarships\StudentApplication\Domain\Student\Student | ication\Domain\Application\                                     |
| 33 | ITECS\Scholarships\StudentApplication\Domain\Student\Student     | 22222238   | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\ |
| 34 | ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount | 661878   | O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initi  |
| 35 | ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount | 661878   | O:70:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Amo    |
| 36 | ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount | 677730   | O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initi  |

```

O:92:"ITECS\Scholarships\Selection\Domain\Scholarship\AwardWasAssignedToCandidateBy
  s:6:"amount"      ;O:39:  "ITECS\Scholarships\Common\Values\Amount":1:{
    s:46:"ITECS\Scholarships\Common\Values\Amountmoney"      ;
    O:11:  "Money\Money":2:{
      s:19:"Money\Moneyamount"      ;i:285000      ;s:21:"Money\M
      O:14:  "Money\Currency":1:{
        s:20:"Money\Currencyname"      ;s:3:"USD"
      }
    }
  }
  s:11:"applicantId"      ;
s:9:"222222235"      ;
s:13:"scholarshipId"      ;
O:61:  "ITECS\Scholarships\Selection\Domain\Scholarship\ScholarshipId":1:{
  s:76:"ITECS\Scholarships\Selection\Domain\Scholarship\ScholarshipIdscholars

```

# EVENTS TABLE - WITH DOMAIN MESSAGE

| Field       | Type    |   | Length |
|-------------|---------|---|--------|
| id          | INT     | ↕ | 10     |
| stream_id   | VARCHAR | ↕ | 255    |
| version     | INT     | ↕ | 10     |
| payload     | TEXT    | ↕ |        |
| recorded_on | INT     | ↕ | 10     |
| type        | VARCHAR | ↕ | 255    |

# EVENTS TABLE - WITH DOMAIN MESSAGE

| id | stream_id    | version | payload  | recorded_on | type   |
|----|--------------|---------|--|-------------|--|
| 1  | sis.students | 0       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"ophe..."}              | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 2  | sis.students | 1       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"mari..."}              | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 3  | sis.students | 2       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"breit..."}             | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 4  | sis.students | 3       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"russ..."}              | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 5  | sis.students | 4       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"smit..."}              | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 6  | sis.students | 5       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"kiera..."}             | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 7  | sis.students | 6       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"zack..."}              | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 8  | sis.students | 7       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"rand..."}              | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 9  | sis.students | 8       | sis.students {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"broo..."} | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 10 | sis.students | 9       | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"moh..."}               | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |
| 11 | sis.students | 10      | ...  | 1469491200  | App\\StudentInformation\\Domain\\Events\\EntityCreated |

```
{
  "namespace": "App\\StudentInformation\\Entities\\Student",
  "identity": "ophelia.zieme",
  "data": {
    "id": "ophelia.zieme",
    "ferpa": "0",
    "personal": {
      "first_name": "Evan",
      "middle_name": "Jalon",
      "last_name": "Armstrong",
      "dob": "2007-06-16",
      "gender": "M"
    },
    "contact": {
```



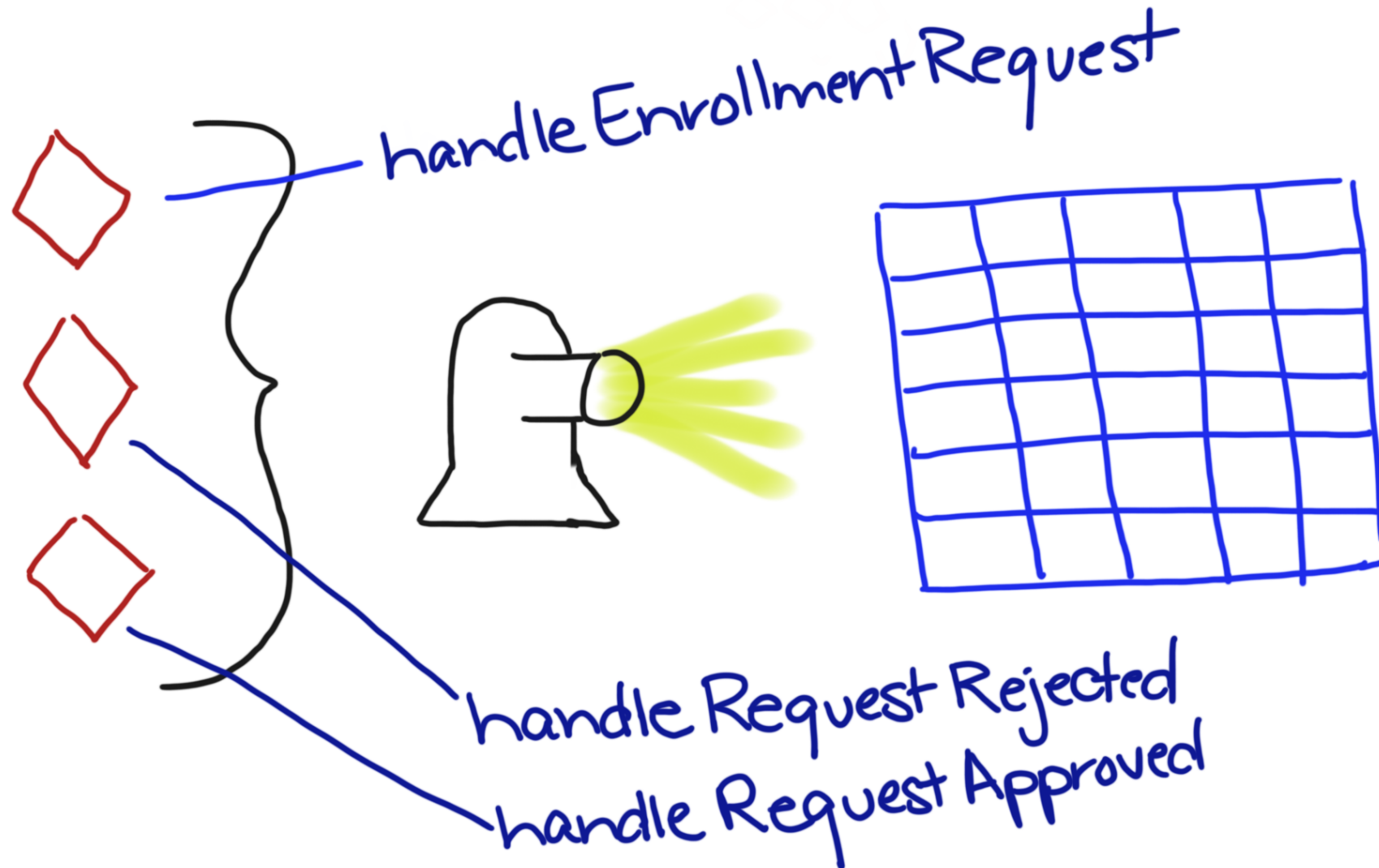
# LISTENERS

HAVE METHODS TO HANDLE  
THE EVENTS THEY CARE  
ABOUT

IGNORES THE REST



# PROJECTOR



# PROJECTOR

```
<?php

namespace App\Enrollment\ReadModel;

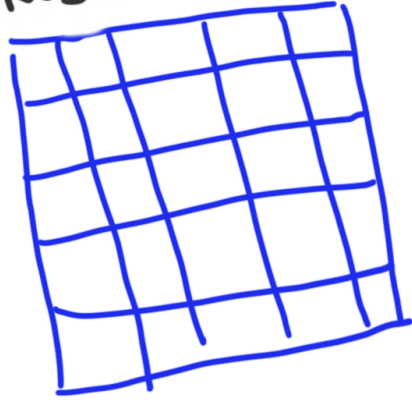
use App\Enrollment\Domain\Events\EnrollmentRequestRejected;
use App\Enrollment\Domain\Events\StudentRequestedEnrollment;
use App\Support\ReadModel\Replayable;
use App\Support\ReadModel\SimpleProjector;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Database\Connection;

class EnrollmentRequestProjector extends SimpleProjector implements Replayable
{
```



# READ MODEL

PROJECTION



ENROLLMENT REQUEST  
READ MODEL

- current ( )
- lookup Requests For (\$student)

# READ MODEL

```
<?php

namespace App\Enrollment\ReadModel;

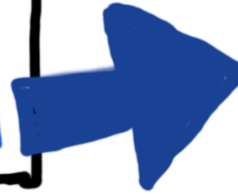
use Carbon\Carbon;
use Illuminate\Database\Eloquent\Model;

/**
 * @codeCoverageIgnore
 */
class EnrollmentRequest extends Model
{
    protected $table = 'proj_enrollment_requests';
    public $incrementing = false;
```

## SCHEDULE ENROLLMENT PERIOD

FORM

| CALENDAR |  |  |  |  |
|----------|--|--|--|--|
|          |  |  |  |  |
|          |  |  |  |  |
|          |  |  |  |  |
|          |  |  |  |  |
|          |  |  |  |  |
|          |  |  |  |  |
|          |  |  |  |  |

CONTROLLER

```
create() {  
  validate  
  new thing  
  save()  
}
```

## SCHEDULE ENROLLMENT PERIOD

FORM

| CALENDAR |  |  |  |  |  |  |
|----------|--|--|--|--|--|--|
|          |  |  |  |  |  |  |
|          |  |  |  |  |  |  |
|          |  |  |  |  |  |  |
|          |  |  |  |  |  |  |
|          |  |  |  |  |  |  |
|          |  |  |  |  |  |  |
|          |  |  |  |  |  |  |


### CONTROLLER

```
submitForm() {  
  → new COMMAND(INPUTS)  
  → handleCommand(COMMAND)  
}
```

# COMMANDS

```
<?php

namespace App\Enrollment\Commands;

use App\Support\CommandHandling\Command;
use App\Common\SemesterTerm;
use DateTime;
use Illuminate\Http\Request;

class ScheduleEnrollmentPeriod implements Command
{
    const DATE_FORMAT = DateTime::ATOM;

    /**
     * @var DateTime
```

# HANDLER

```
<?php

namespace app\Enrollment\Commands;

use App\Enrollment\Domain\EnrollmentPeriod;
use App\Enrollment\IdentityProvider;
use App\Support\CommandHandling\CommandHandler;
use App\Support\Repository\EventSourcingRepository;
use Illuminate\Auth\Access\AuthorizationException;

class EnrollmentPeriodHandler extends CommandHandler
{
    /**
     * @var IdentityProvider
     */
```

# PROS

- maps closely to the process
- flexible to changes in process
- meaning of events can change without altering history
- scholarships; able to back up all events to roll over a new year.

Didn't need to preserve full database.

# CONS

- a lot of classes
- more design patterns to adjust to (complicated)





# LINKS FOR FURTHER READING

- [Greg Young CQRS and Event Sourcing](#)
- [Greg Young - long class](#)
- [Greg Young - A Decade of DDD, CQRS, Event Sourcing](#)
- [PHP Round Table - Event Sourcing \(+2 more\)](#)
- [Broadway - framework for CQRS and ES](#)

# THANK YOU!