

STATUS CHANGE: NOW USING EVENT SOURCING

by Emily Stamey

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





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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!



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RELAX, ENJOY THE RIDE!



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SIGN THE WAIVER

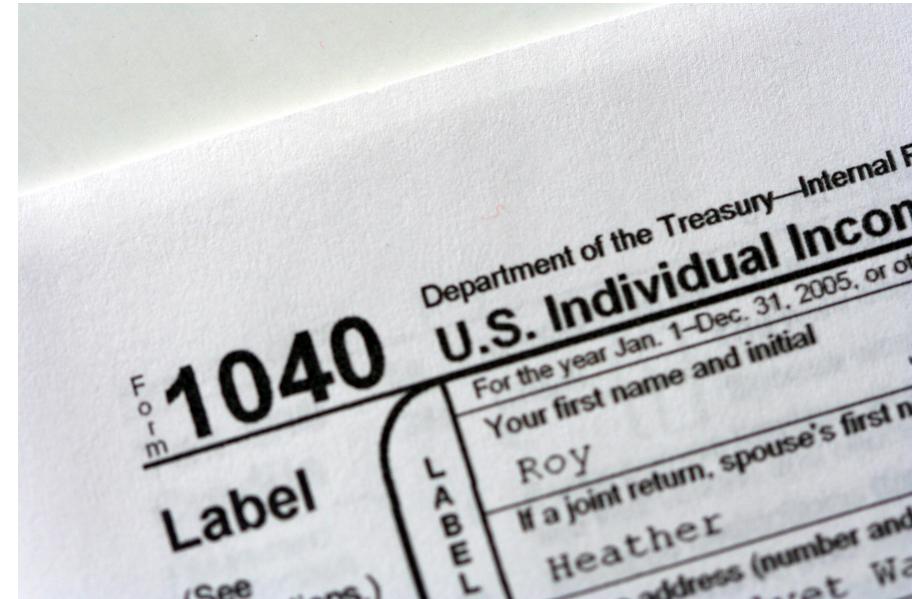
I, __(state your name)__, will not blame Emily if Event Sourcing makes my head explode. I promise I will not leave a bad review. And I promise to be kind to myself as I learn new things.



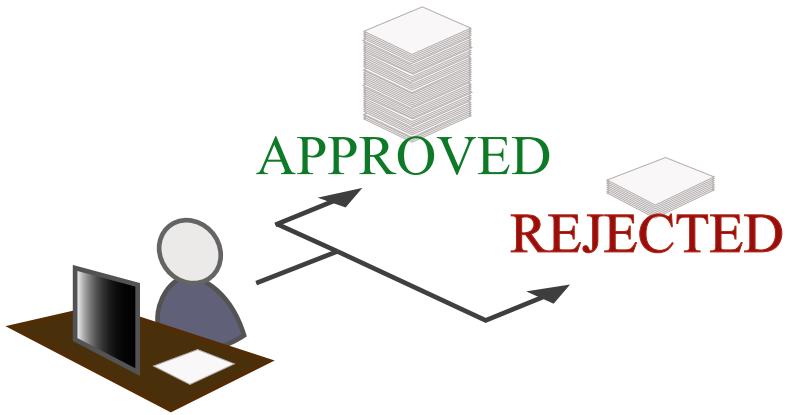
FORMS

A lot of our systems were built to
replace paper processes

They often closely map to this
physical form.



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PAPER FORMS HANDLING STATE



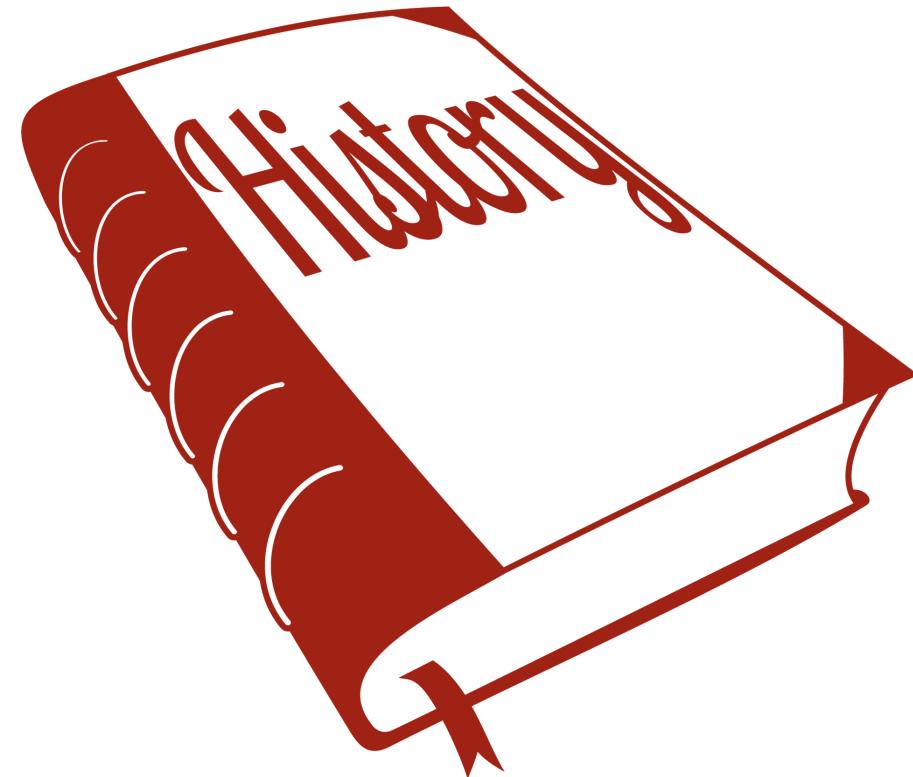
Piles indicate status of the form

PAPER FORMS HANDLING STATE

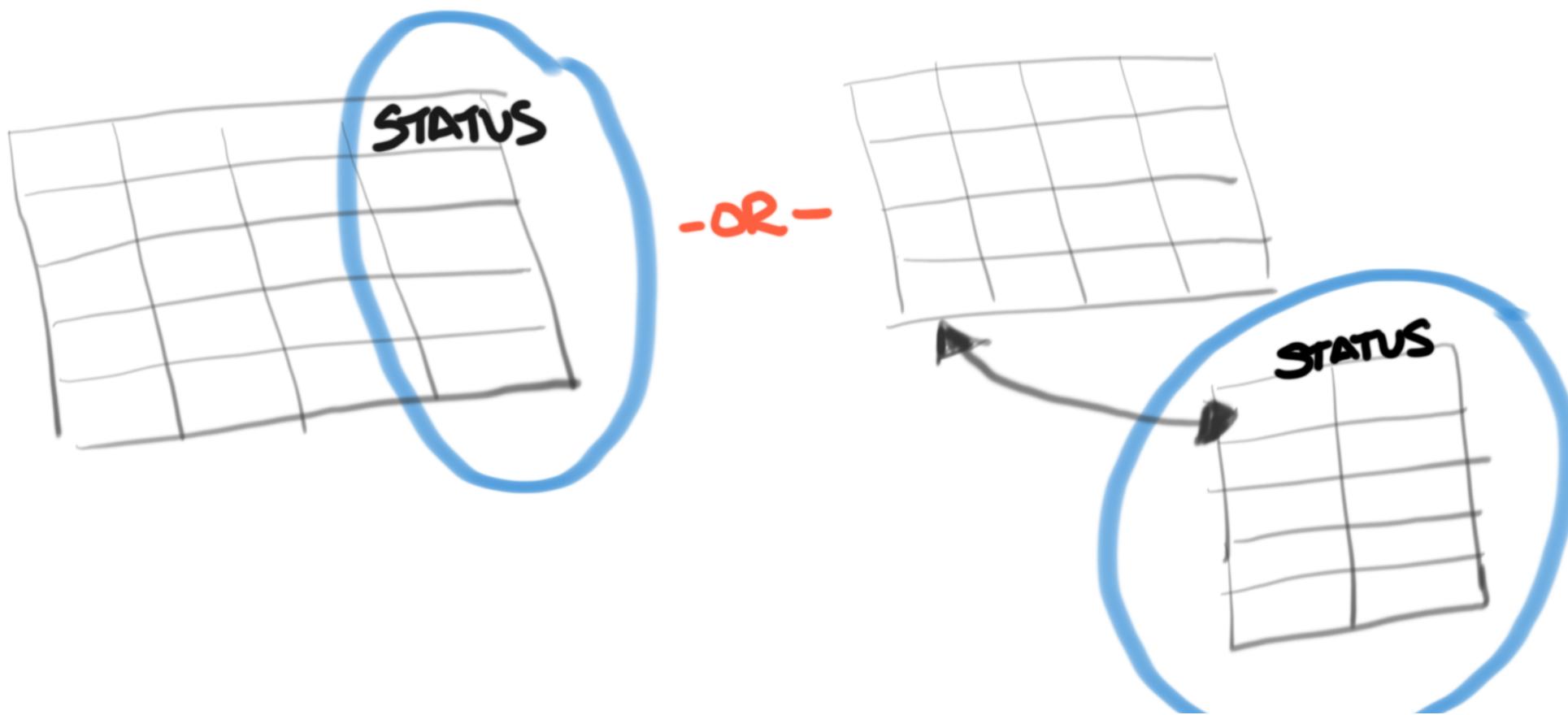


Status doesn't really communicate
why or what happened

WHY ARE THEY IN THE CURRENT STATE?



COMPENSATING MEASURES



HOW WORKFLOWS BECOME COMPLEX

A SIMPLE STATUS DROP-DOWN

RECEIVED ▼

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 HALEYLOCK

SOMETHING HAPPENED

SOMETHING HAPPENED

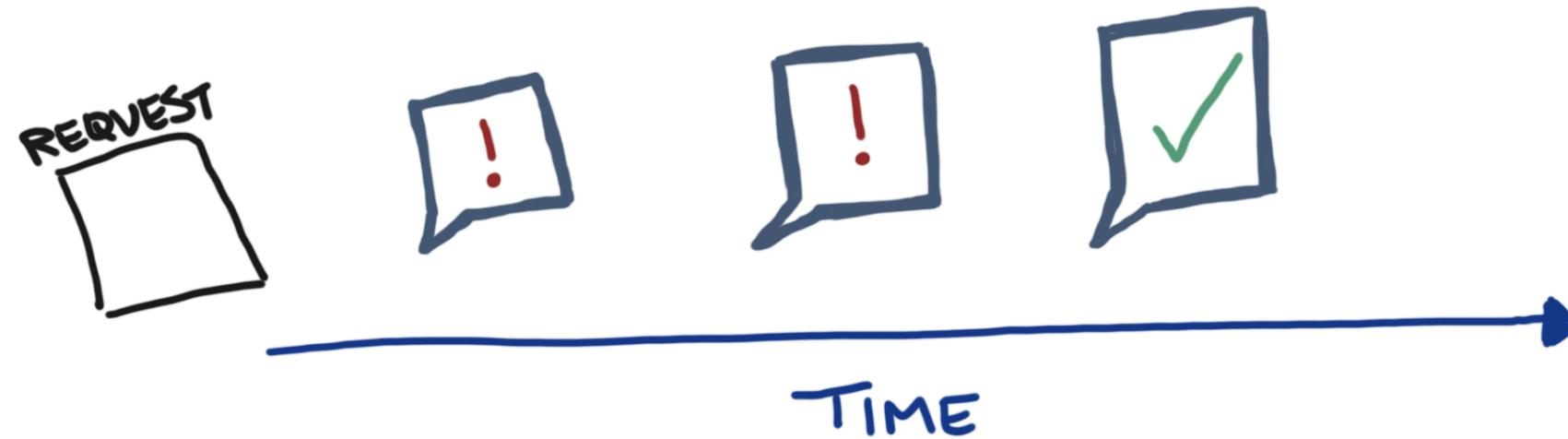
Status is a reflection of something that happened

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

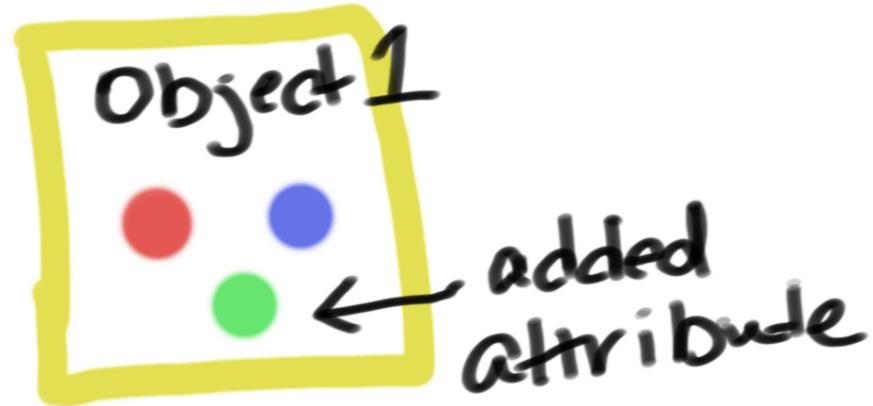
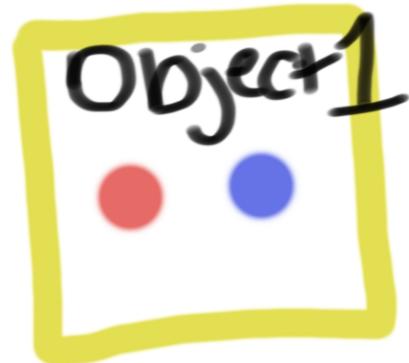
WHAT'S IMPORTANT ABOUT EVENTS

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

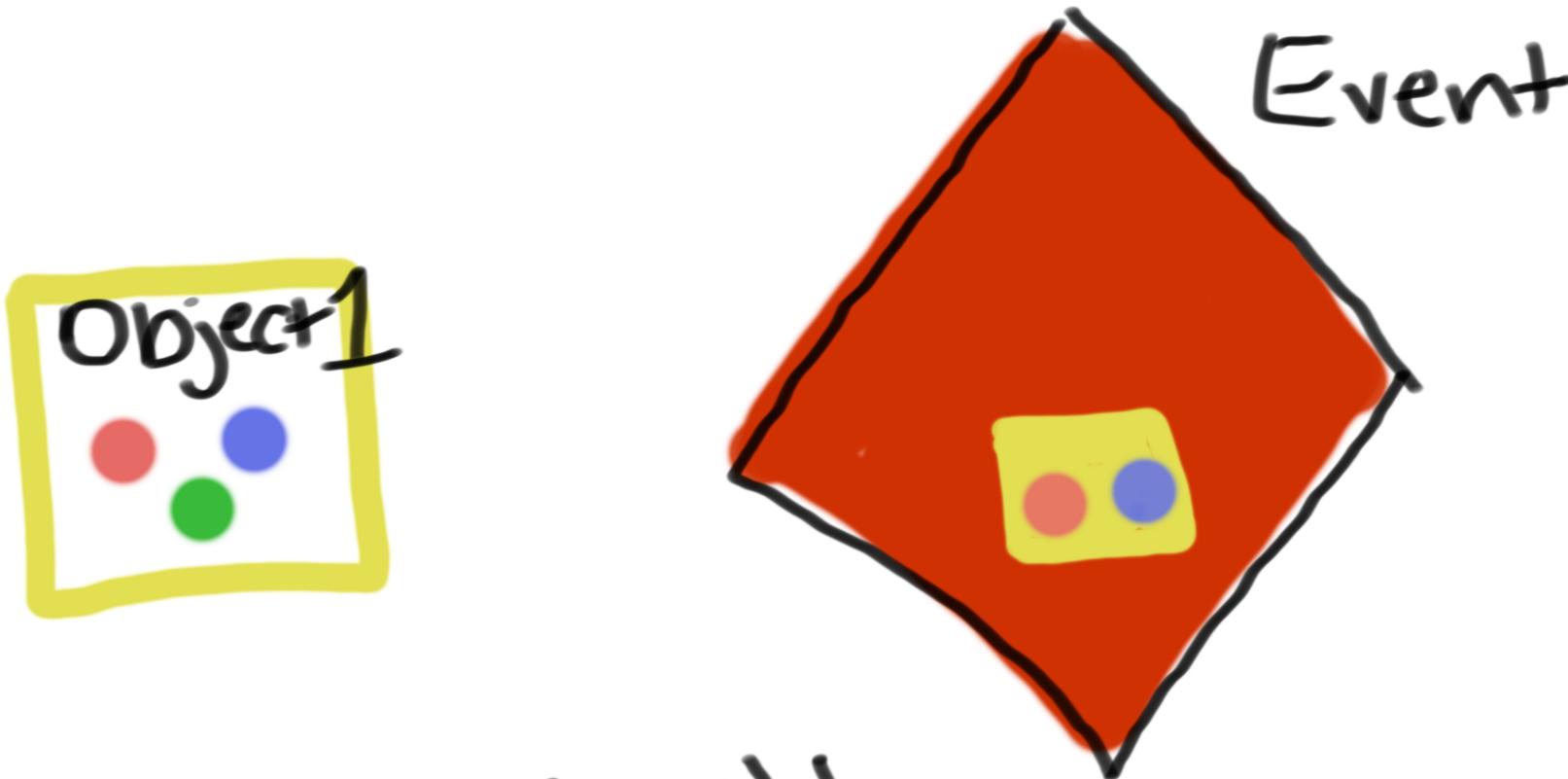
RULES FOR EVENTS

- 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?

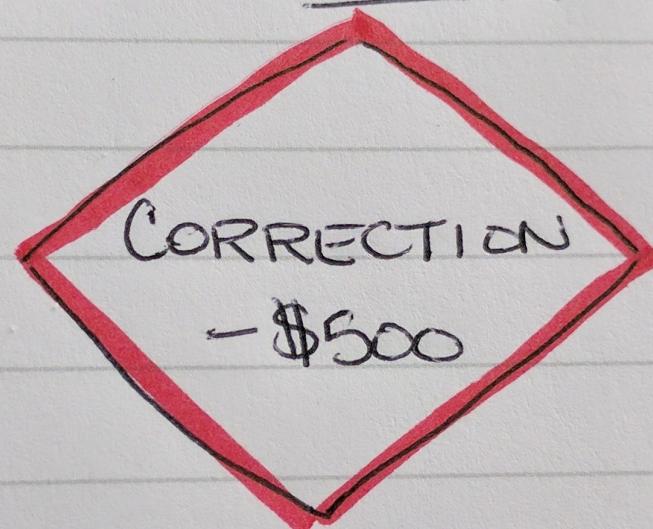
state transitions are important

We need an audit log and proof of state

This history is more important than the current state

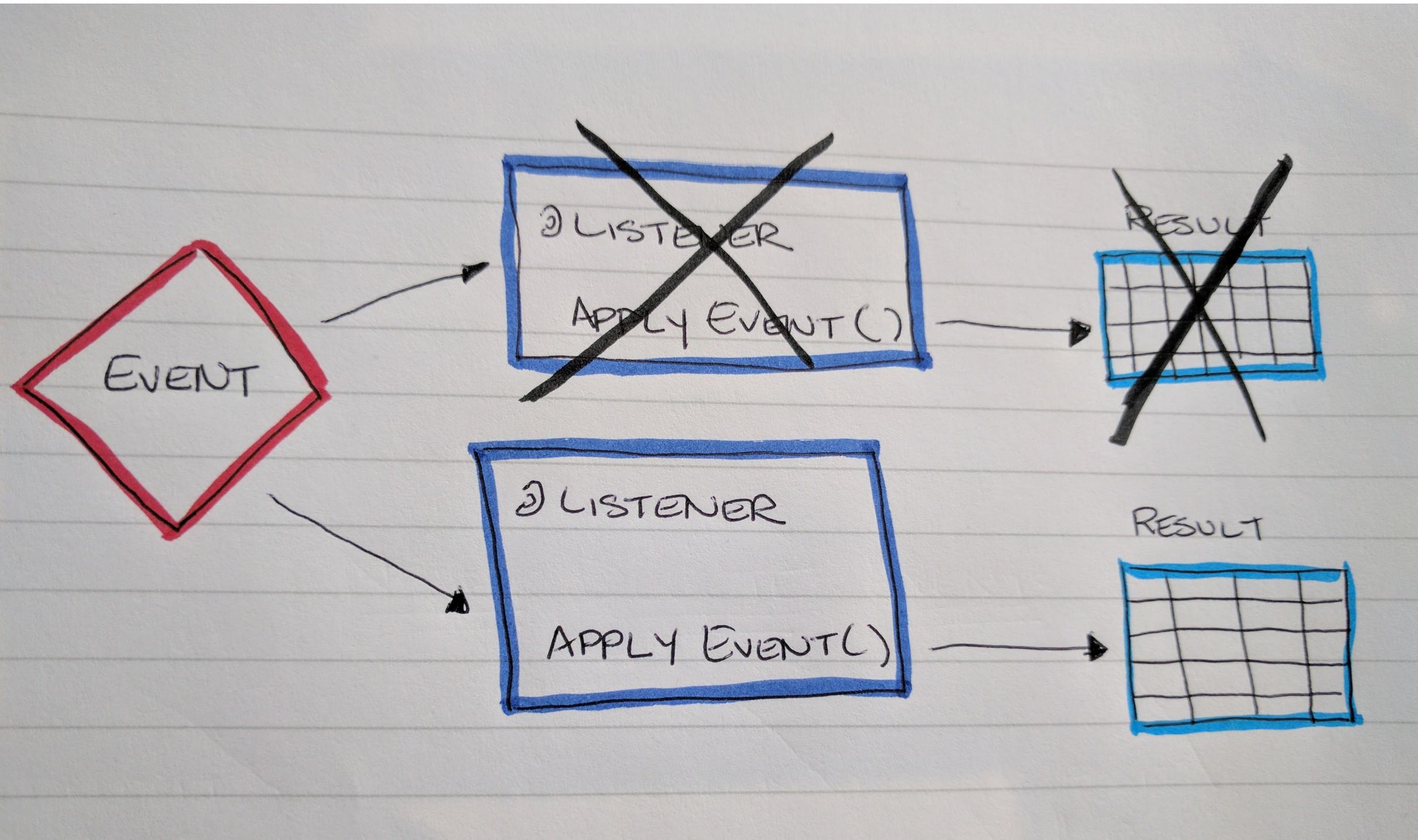
Able to replay these events to rebuild state

NEVER DELETE EVENTS



(mostly)





Events don't change

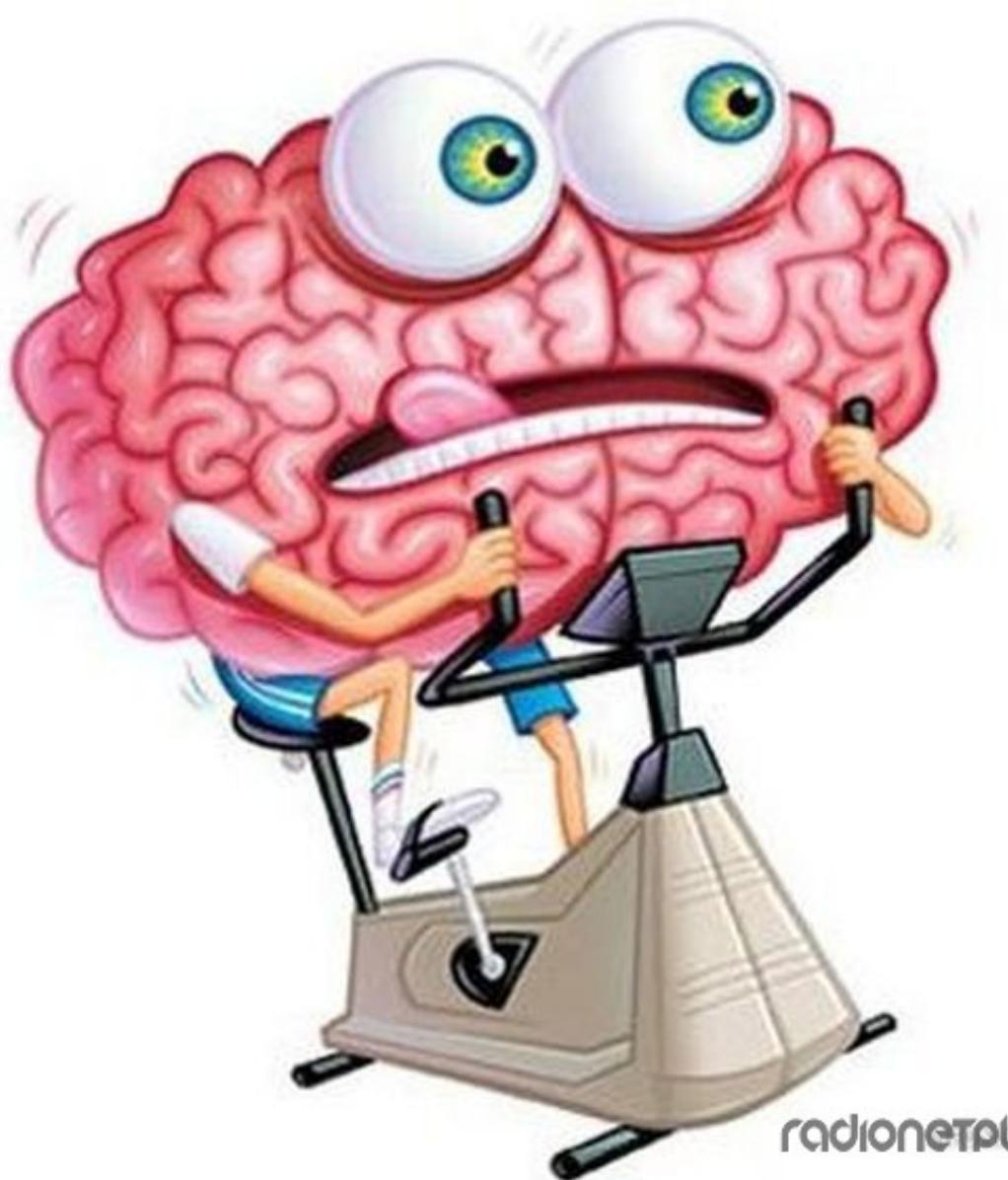
The part of the code that will change is most likely the result that follows that event.

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)



radionetplus



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;

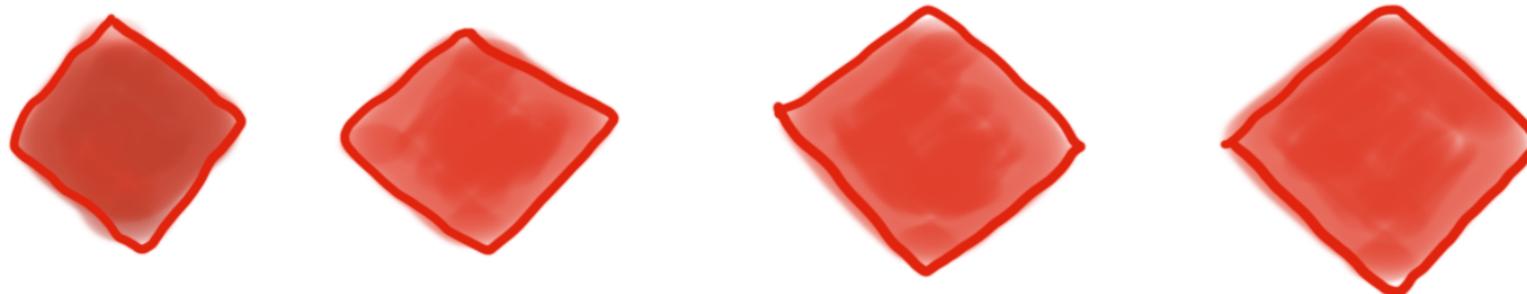
use App\Support\EventHandling\Event;
use DateTime;

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 |
|-----------------------------|-----------|--------|---|
| <code>id</code> | INT | 11 | |
| <code>aggregate_type</code> | VARCHAR | 255 | |
| <code>aggregate_id</code> | VARCHAR | 255 | |
| <code>payload</code> | LONGBLOB | | |
| <code>occurred_on</code> | 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"\A |
| 2 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222222 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 3 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222223 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 4 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222231 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 5 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 222222600 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 6 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 222222652 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 7 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 222222690 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 8 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 222223002 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 9 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222224 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 10 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222225 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 11 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222226 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 12 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222228 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 13 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222229 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 14 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222230 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 15 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | ITECS\Scholarships\StudentApplication\Domain\Student\Student\llication\Domain\Application"\A | |
| 33 | ITECS\Scholarships\StudentApplication\Domain\Student\Student | 22222238 | O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A |
| 34 | ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount | 661878 | O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initia |
| 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\Initia |

```
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:"22222235"      ;  

    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 |
|--------------------------|---------|--------|
| <code>id</code> | INT | 10 |
| <code>stream_id</code> | VARCHAR | 255 |
| <code>version</code> | INT | 10 |
| <code>payload</code> | TEXT | |
| <code>recorded_on</code> | INT | 10 |
| <code>type</code> | 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 | {"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 | {"namespace":"App\\StudentInformation\\Entities\\Student","identity":"juli...} | 1469491200 | App\StudentInformation\Domain\Events\EntityCreated |

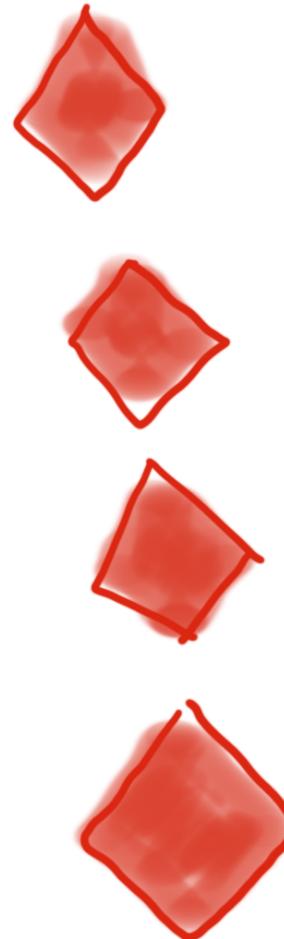
```
{  
    "namespace": "App\\StudentInformation\\Entities\\Student",  
    "identity": "ophelia.zieme",  
    "data": {  
        "id": "ophelia.zieme",  
        "ferpa": "0",  
        "personal": {  
            "first_name": "Evan",  
            "middle_name": "Jalon",  
            "last_name":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



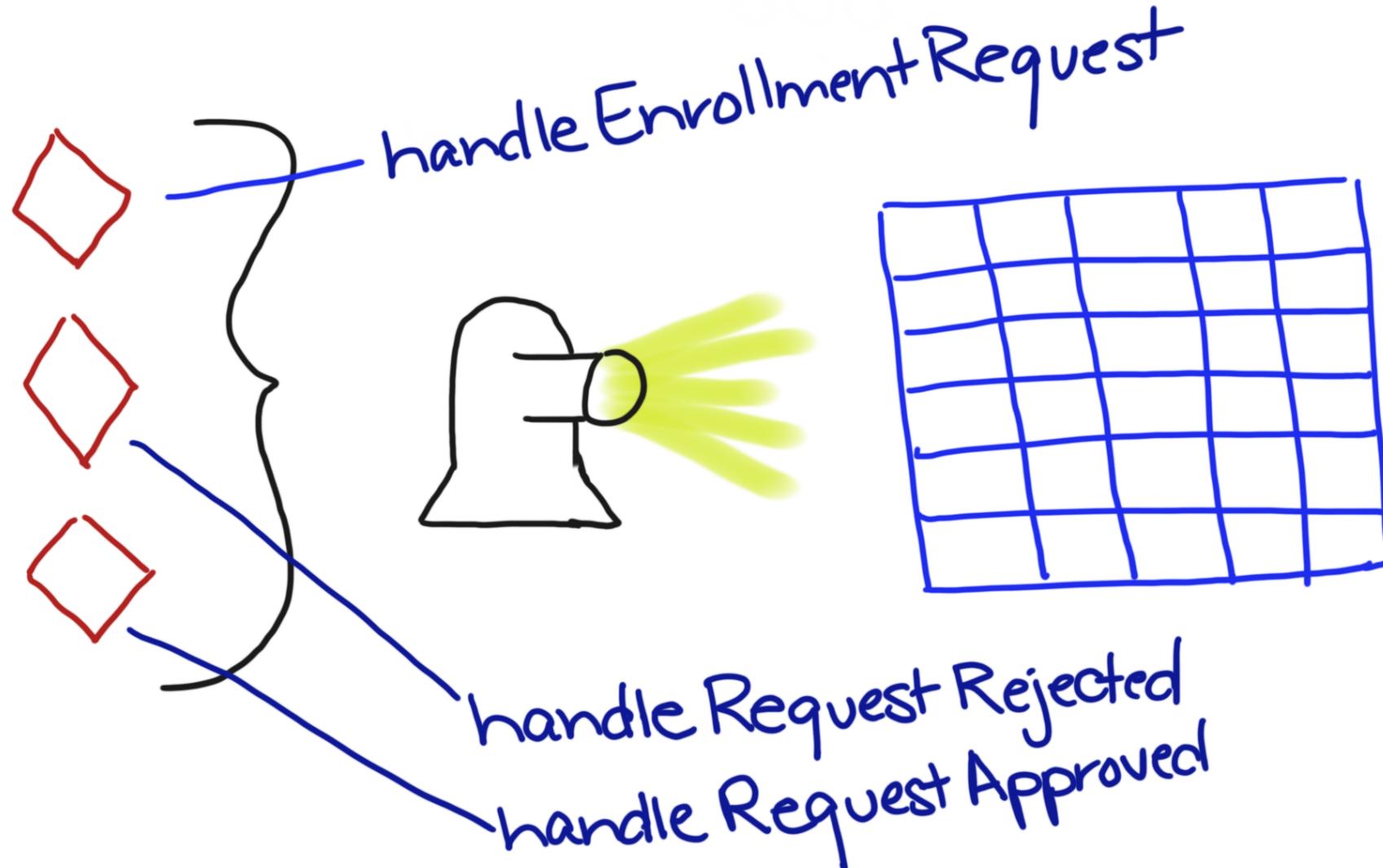
LISTENERS

HAVE METHODS TO HANDLE
THE EVENTS THEY CARE
ABOUT

IGNORES THE REST



PROJECTOR



PROJECTOR

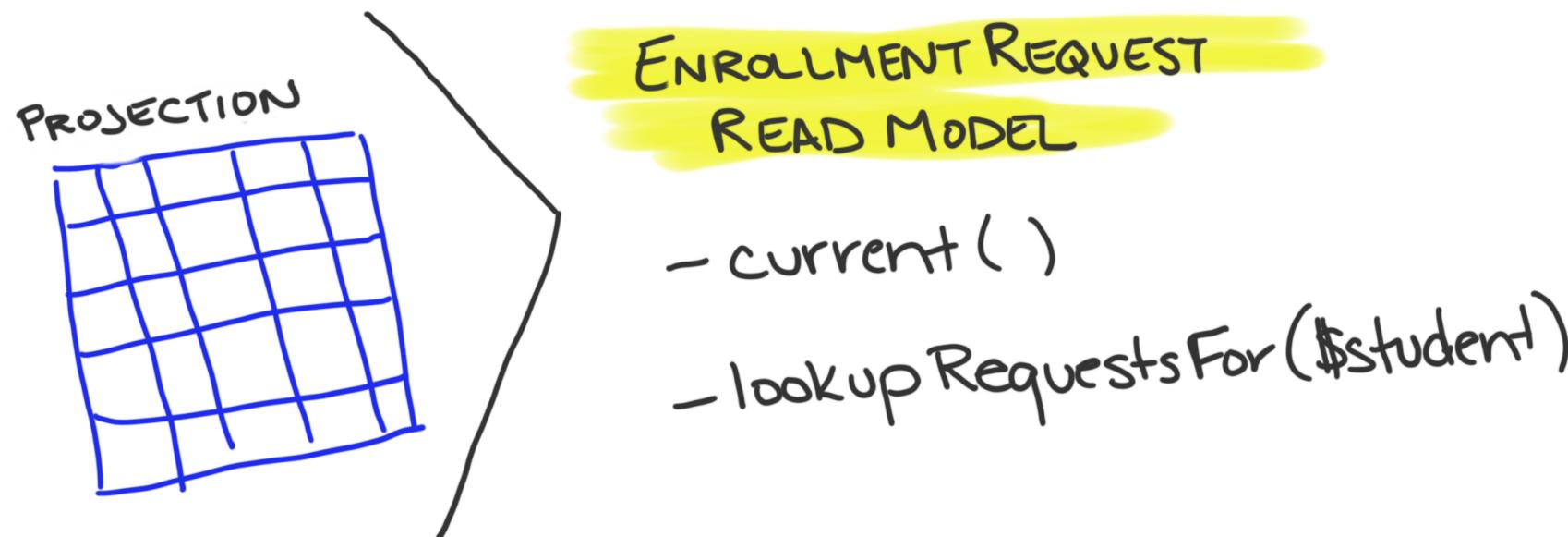
```
<?php

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



READ MODEL

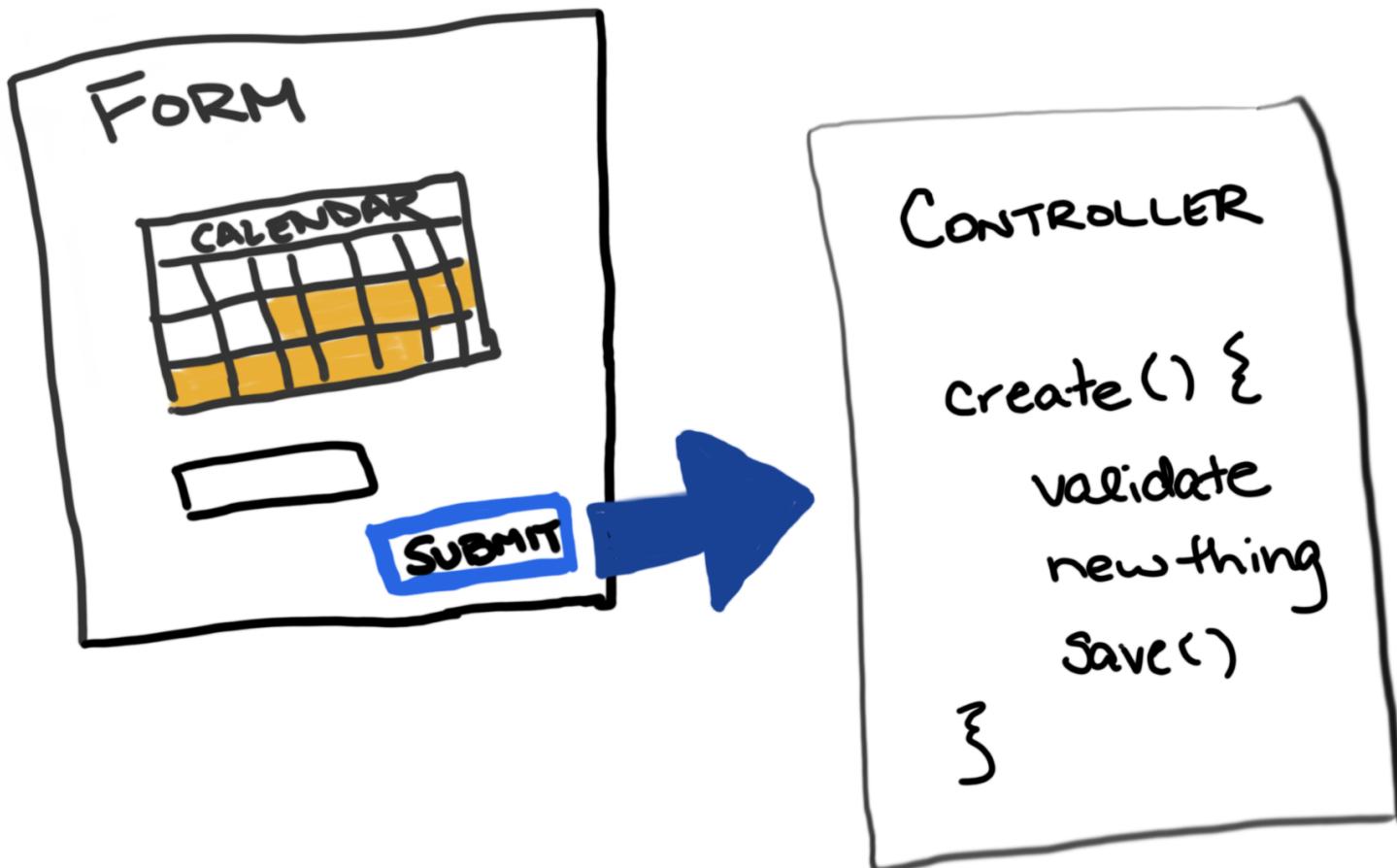
```
<?php

namespace App\Enrollment\ReadModel;

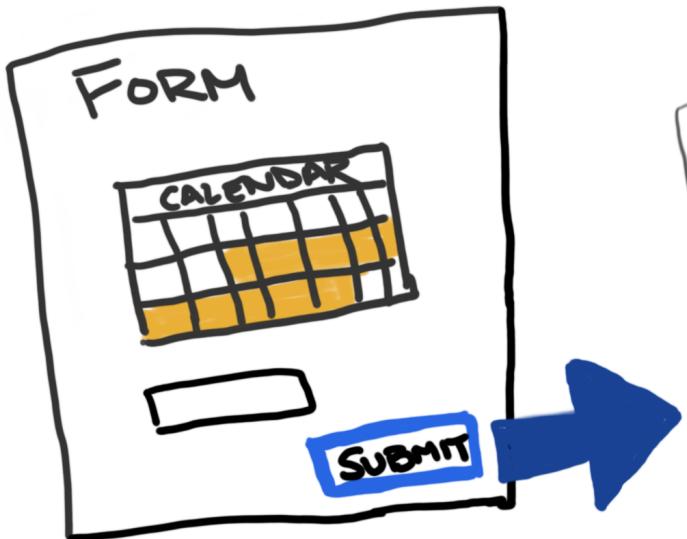
use Carbon\Carbon;
use Illuminate\Database\Eloquent\Model;

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

SCHEDULE ENROLLMENT PERIOD



SCHEDULE ENROLLMENT PERIOD



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!