

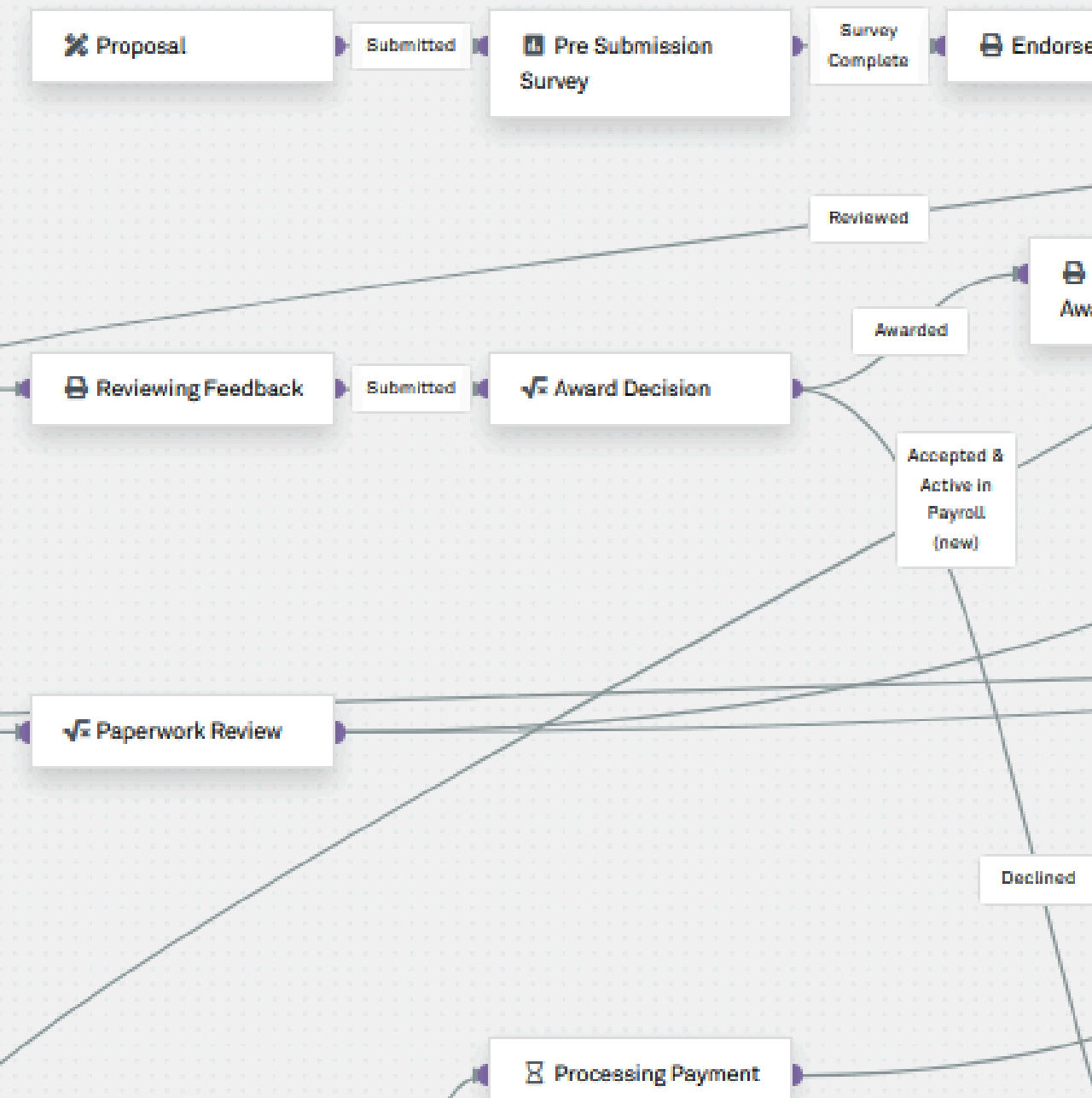


Solving a Perennial Problem

with Dynamic Forms for Laravel

Presented by Nick Evans

Lead Solution Architect @ NUIT



Goal

- We did a cool thing
- I'm going to tell you about the cool thing
- Some of it is open source

Feel free to ask questions as you have them!

Problem

- We have lots of forms in our app
- Users always changes to forms
 - New instructions
 - Change the validations
 - New fields
 - Update a dropdown
 - Whole new forms!

Case Study: SOAP

- Originally: Undergraduate Research Grants
 - 24 grant application forms & workflows
 - *All artisanially hand-crafted ...*
- Goal: Student Opportunity Application Portal
 - Self-service form setup for any step
 - Like using SurveyMonkey/Qualtrics

Solutions?

- 3rd-party low-code tools for self-service?
 - OnBase
 - PerfectForms
 - Google Form & Spreadsheet
 - Microsoft Forms + Power Automate

But...

- Probably need data in **your** app, not 3rd party tool
- Low-code tools often hard to extend, e.g.
 - Need a NetID lookup field
 - Or CAESAR term code dropdown
 - etc...

Form.io

- SaaS company for low-code custom forms
 - Everything is managed
 - Same problem as other 3rd party tools
- **But:** everything is MIT licensed
 - Form builder + renderer
 - Backend

First Name

Enter your first name

Last Name

Enter your last name

Email

Enter your email address

Message

It's easy for anyone to build forms, but the *developers* will love Form.io the most.

```
{
  components: [
    {
      input: true,
      tableView: true,
      inputType: "text",
      inputMask: "",
      label: "First Name",
      key: "firstName",
      placeholder: "Enter your",
      prefix: "",
      suffix: "",
      multiple: false,
      defaultValue: "",
      protected: false,
      unique: false,
      persistent: true,
      validate: {
        required: false,
        minLength: "",
        maxLength: "",
        pattern: ""
      }
    }
  ]
}
```

Capabilities

- File uploads
- Conditional fields
- Rich text editor, richer dropdowns
- Resources
 - Dropdowns options w/ server-side collections, managed any way you like
 - Usable by any form
- Calculated values & advanced logic via JSON Logic

Form Builder Output

```
{
  "components": [
    {
      "label": "First Name",
      "key": "firstName",
      "type": "textfield",
      "input": true
    },
    {
      "type": "button",
      "label": "Submit",
      "key": "submit",
      "disableOnInvalid": true,
      "input": true,
    }
  ]
}
```

Submissions

```
const formSchema = { /* the JSON from the last slide */ };

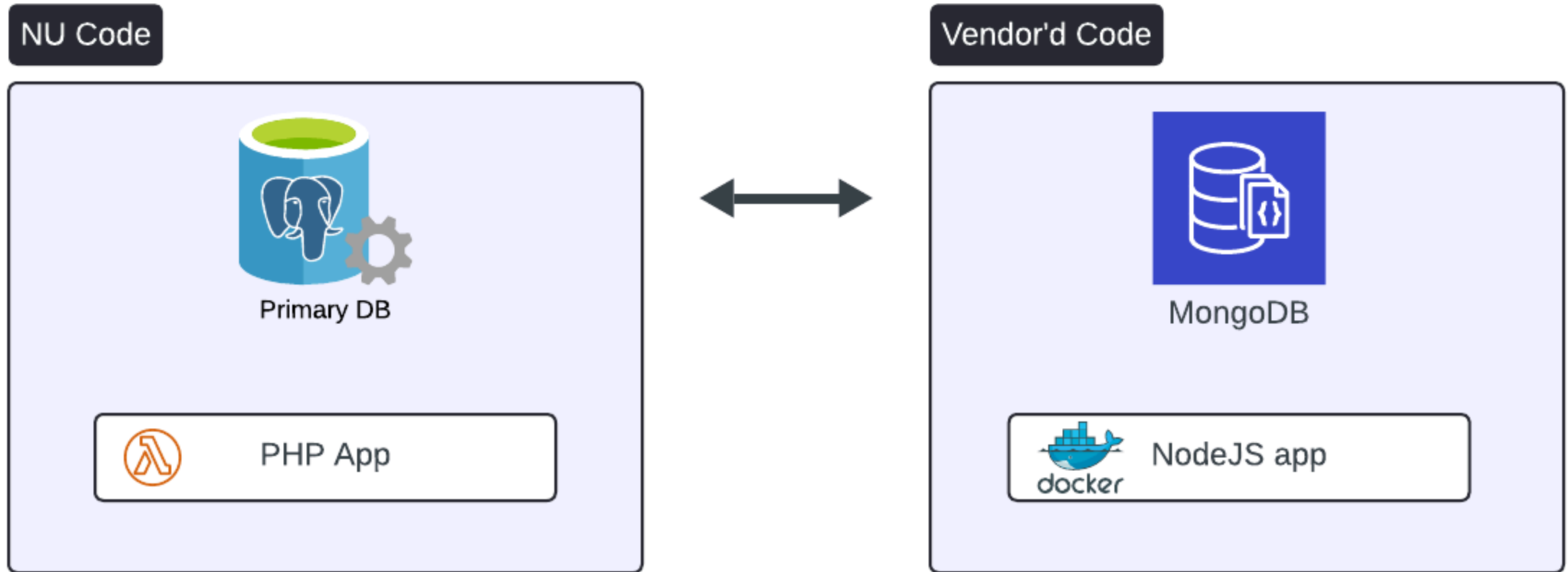
const formContainer = document.getElementById('formio-form');
const editForm = await Formio.createForm(formContainer, formSchema);

// This is the previous submission data (e.g. edit a draft)
// Or just leave it out if it's a brand-new form!
editForm.submission = {
  data: {
    firstName: "Flat Dallas",
  }
};
```

Backend

- Frontend libraries are great
- But, need to validate form data server-side
 - Option A: Run Formio backend NodeJS app + Mongo
 - Option B: Implement a backend in PHP

Option A: Run Formio Backend



Option B: PHP Adapter

```
class FormController extends Controller
{
    public function store(Request $request)
    {
        if ($request->get('state') === 'draft') {
            // Save w/out validating ...
        }

        $data = $request->validateDynamicForm(
            FormDefinition::find(...)->json,
            $request->get('submissionValues')
        );

        dump($data); // Validated form data!
    }
}
```

Wait, this is a library?!?

```
composer require northwestern-sysdev/dynamic-forms  
php artisan dynamic-forms:install  
yarn install && yarn build
```





Implementation

Challenges

1. Extending Formio with Northwestern's field types
2. Customizing File Uploads
3. Storing & querying this data
4. Using the data for emails
5. Complex validations & calculated values

Tech: Extending Formio

- Students pick a faculty sponsor for their project
 - So we need something people can include in a form to collect an NU user
- Call Directory Search API & validate if user exists
- Optional validation for affiliations (e.g. only accept faculty)
- ~750 LoC, lots of boilerplate, based on **Address**
- Use Formio to define form for builder settings
- Implement corresponding server-side validations

Extending Formio (cont)

NU Directory Component

[Display](#) [Data](#) [Validation](#) [API](#) [Conditional](#)

Eligible Primary Affiliation(s)

Faculty × Staff ×

Restricts what types of people can be looked up to faculty, staff, and/or students.

Must be Graduate Faculty

No

Whether the user must have an active Graduate Faculty appointment to be valid.

Always Allow Non-NU Users


Yes

Whether non-NU users that have been invited to the platform should be searchable.

Preview

NU Directory Lookup

nick.evans@northwestern.edu

Nick Evans 

Save

Cancel

Remove

Tech: Customizing File Uploads

- Common to upload a PDF with a grant proposal PDF
- But it looks like this ...

Proposal ★	
File Name	Size
A Cosmic Birthday.pdf	82.79 MB

Tech: Customizing File Uploads

```
<script>
const inlineViewableFiles = [];
ctx.files.forEach(function (file) {
  if (file.type === 'application/pdf') {
    return inlineViewableFiles.push(file);
  }
});
</script>


{% if (ctx.disabled) { %}
<div class="d-print-none">
  {% inlineViewableFiles.forEach(function(file) { %}
  <object type="application/pdf"
    data="{{ file.url }}"?displayObject=1#view=FitH">
    <p>There was a problem displaying the PDF.</p>
  </object>
  {% }) %}
</div>
{% } %}
```



Tech: Customizing File Uploads



Are you submitting this proposal as a group project? [?](#)




No ✕ ▼

Proposal *

[View PDF Full Screen](#) 

 Photo Release

1 / 1 | - 88% + |  

Northwestern University

Photo Release

According to the most recent legal case law, all photographers taking photographs on University property or of University events must obtain a signed Photo Release Form from any student, faculty member, staff person, or member of the public who is visibly recognizable in the photograph. Crowd scenes where no single person is the dominant feature are exempt.

Storing and Querying the Data

- No schema -- basically NoSQL!
- Postgres Just Works(tm)

```
CREATE TEMPORARY TABLE nosql (  
    id SERIAL PRIMARY KEY,  
    data JSON  
);  
  
INSERT INTO nosql ("data") VALUES ('{"foo": 12345}');  
  
SELECT "data"->>'foo' AS bar FROM nosql;  
/* => 12345 */
```

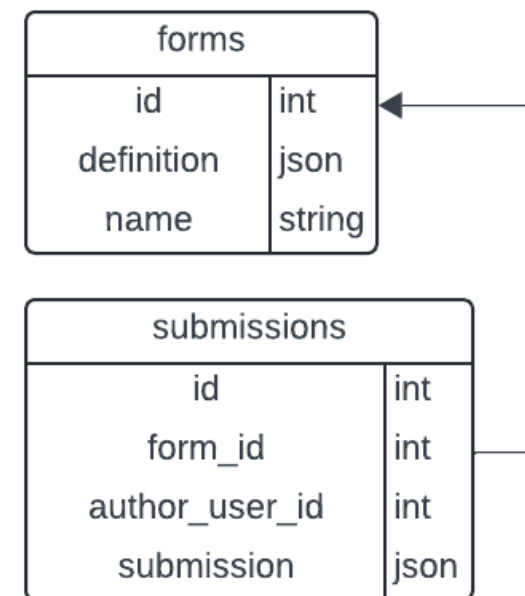
SQL Generation Step 1

```
$form = new DynamicForm($form->definition);

$formFields = collect($form->flatComponents())
    ->filter(function (ComponentInterface $component) {
        return $component->canValidate();
    });

$formFields->first()->label();
//=> "First Name"

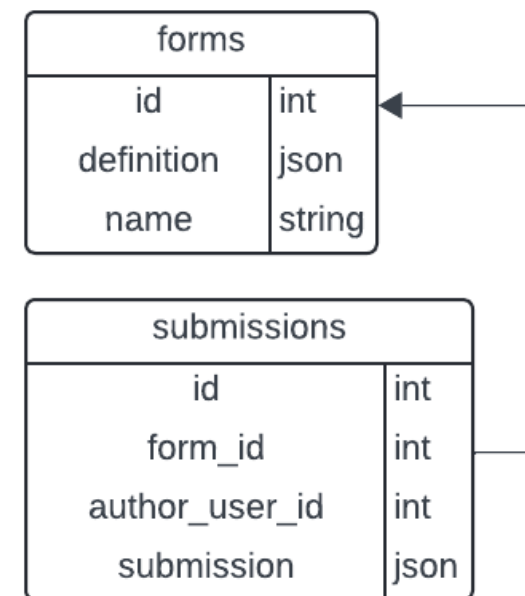
$formFields->first()->key();
//=> "firstName"
```



SQL Generation Step 2

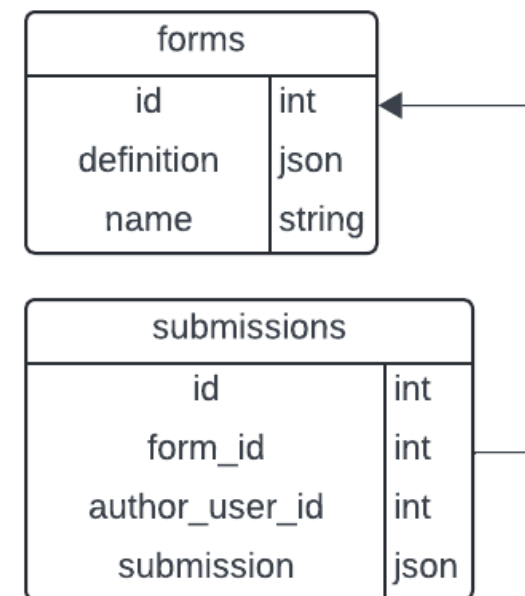
```
$columnNames = $formFields
  ->map(fn ($component) => $component->key())
  ->map(fn ($key) => "submissions.submission->>'{$key}'");

Submission::query()
  ->join('forms', ...)
  ->join('users', ...)
  ->addSelect($columnNames);
```



SQL Generation Step 3

```
SELECT
  forms.name AS form_type,
  users.name AS user_name,
  submissions.submission->>'firstName',
  submissions.submission->>'lastName'
FROM submissions
INNER JOIN forms ON submissions.form_id = forms.form_id
INNER JOIN users ON submissions.user_id = user.id
ORDER BY
  submissions.submission->>'lastName',
  submissions.submission->>'firstName'
```



Displaying the Data

Overview

\$

Academic Year Grant

Bulk Actions

11 columns shown

<input type="checkbox"/>	Reference Number	Organization	Applicant	Current Status	Program	What is your home campus?	Have you received an Academic Year...	Project Title	IRB Submission Number	IRB Exempt Notes
<input type="checkbox"/>	OUR-OUR-ACADEMIC-YEAR-21915	Undergraduate Research Office	Neek Evans	Accept or Decline Award	Academic Year Grant	Evanston	no	Binding and Sliding of Bioactive Peptides on P...	n/a	n/a
<input type="checkbox"/>	OUR-OUR-ACADEMIC-YEAR-21946	Undergraduate Research Office	Willie Wildcat	Accept or Decline Award	Academic Year Grant	Evanston	no	Proof-of-Principal Approach to Modeling Prote...	n/a	n/a

Showing 2 results

Bulk Actions ▾ 7 columns shown ▾

Draft

Full Name

NetID

Student or Employee ID

Email Address

Phone Number

Pronouns

Campus Address

Permanent Address

School(s)

Class

Major(s)

Minor(s)

Expected Graduation

Current Courses

Proposal Title ✓

Columns

- Not all columns are simple
- Scalar fields are easy!
- Dropdown value needs label ...
- Some form fields hold multiple pieces of data
 - Address has lat/long, normalized addr, etc

Fun Fact: Alias Limits



- Did you know: Postgres limits identifier to 63 bytes?
- The below will cut off half-way

```
SELECT
    submissions.submission->>'haveYouEverReceivedAGrantFromOurOfficeBeforeOrFromAnotherOrganizationSuchAsWeinberg'
FROM submissions;
```

```
array_keys($queryResult);
//=> ["haveYouEverReceivedAGrantFromOurOfficeBeforeOrFromAnotherOrgani"]
```

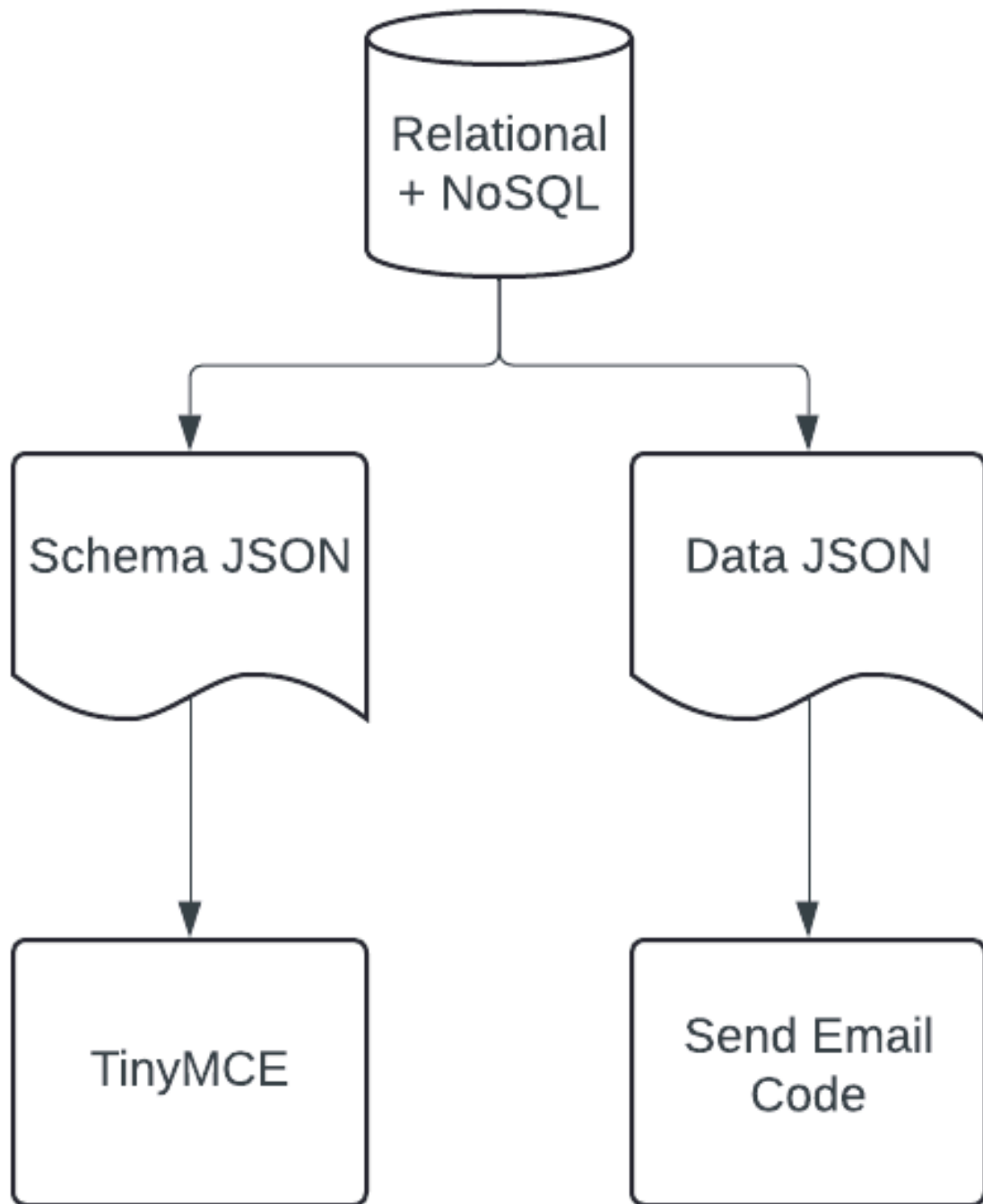
- Alias columns with a hash!
 - `submission->>'foo' AS form_8c736521`

Mega Complicated Query

- We actually don't join *one* form submission for SOAP
 - We join a potentially infinite number
 - Users *also* define the workflow, which can be 5 forms in a row
- Sample query stats
 - 15 joins to `submissions`
 - 161 JSON columns selected
 - Ordered by 2 columns from JSON
- Runs in 38.5ms  

Using the data for emails

- Need to let people use the form data in confirmation emails, approval emails, etc
- Solution: Add more JSON
 - Mustache `{{ variable }}` syntax
 - TinyMCE Plugin to insert the variables



Using the data for emails

- Generate two JSON docs
 1. Schema listing out all the fields/datatypes for a workflow
 2. Student data, with relational + NoSQL stuff combined

Combined JSON Doc

```
{
  "applicationId": 1234,
  "grantProgram": {
    "label": "Summer Research Grant",
  },
  "grantCycle": {
    "name": "Academic Year 2024-25",
  },
  "workflow": {
    "proposal": {
      "submittedAt": "2024-01-01T00:00:00Z",
      "form": { "firstName": "Willie", "lastName": "Wildcat" }
    }
  }
}
```

JSON Field Doc

```
[
  {
    "section": "General",
    "fields": [
      { "label": "Application ID", "type": "int", "path": "applicationId" },
      { "label": "Program", "type": "string", "path": "grantProgram.label" },
      { "label": "Cycle Name", "type": "string", "path": "grantCycle.name" },
    ]
  },
  {
    "section": "Proposal Form",
    "fields": [
      { "label": "Submitted At", "type": "datetime", "path": "workflow.proposal.submittedAt" },
      { "label": "First Name", "type": "string", "path": "workflow.proposal.form.firstName" },
      { "label": "Last Name", "type": "string", "path": "workflow.proposal.form.lastName" },
    ]
  }
]
```



TinyMCE Insert Variable Plugin

Mustache Templates

- Super simple templating language
- Give it data & some `{{ variables }}`
- Modifiers too: `{{ some_array | join }}`
 - `["foo", "bar"] => "foo, bar"`

```
$m = new Mustache_Engine;  
  
$m->render(  
    'Hello {{ student.name }}',  
    json_decode('{"student": { "name": "Willie the Wildcat" } }')  
);  
//=> "Hello Willie the Wildcat"
```


Complex validations & calculated values

- Formio supports complex logic to
 - Show or hide fields conditionally
 - Calculate values (sums, or more complicated things)
 - Validations (sum > 5, etc)
- Formio lets you do "complex" logic in two ways
 - JS 
 - JSONLogic 

JSON Logic

- This type of thing -- easily sandboxed!

```
{
  "if": [
    {
      "<=": [
        { "var": "data.requestedGrantAmountDollars" },
        1500
      ]
    },
    true,
    "Your request cannot exceed $1,500."
  ]
}
```

Travel Health Insurance

\$	0.00	*
----	------	---

Travel Health Insurance Notes *

N/A

Passport Expenses

\$	0.00	*
----	------	---

Passport Expense Notes *

N/A

Only required if traveling internationally and passport is not up-to-date.

Other Funding Sources

Please provide information on how you plan to cover the grant expenses beyond the award amount.

Other Funding Source Notes *

I'm very wealthy and can cover the rest

\$	37.50	*
----	-------	---

Total Conference Expenses

\$	75.00	*
----	-------	---

TOTAL AWARD AMOUNT REQUESTED

\$	37.50	*
----	-------	---

Are Dynamic Forms Good?

- This is a huge architectural choice for your app
- Dynamic forms solve HTML drudgery and empower admins
 - At the cost of **way more complexity** for dev
 - Gotta have all these ways to deal with NoSQL-esque data!
- Sometimes: this trade-off is worth it!
 - A lot of times: *it ain't*.



The End

Thanks for your interest!

Scan the QR code if you'd like
a copy of this deck, or want
the link to the `dynamic-forms`
package.