

Schema Driven Interfaces

Schema Driven Interfaces

A Pattern for Extensibility

Plugin

- Tasks and Replies
- REST API based

Plugin - Routes

→ pm/v1/tasks

→ GET POST

→ pm/v1/tasks/{task}

→ GET PUT DELETE

→ pm/v1/tasks/{task}/replies

→ GET POST

Plugin

- Tasks and Replies
- REST API based
- JavaScript Single Page Application

Forms

PHP - Display

```
do_action( 'my_form_before', $model );  
  
<label>  
    Task Title  
    <input name="title" value="<?php echo esc_attr( $title ); ?>">  
</label>  
  
do_action( 'my_form_after', $model );
```

PHP - Validation

```
$error = new WP_Error();

if ( strlen( $data['title'] ) < 5 )
    $error->add( 'title_min_length', __( 'The title is too short' ) );

$error = apply_filters( 'edit_task_validate', $error );

if ( $error->get_error_codes() )
    render_errors( $error );

$data = apply_filters( 'edit_task_data', $data );

save_task( $model_id, $data );
```

Imperative

JavaScript

```
<form id="edit-task"></form>

const { doAction } = wp.hooks;

const form = document.getElementById( 'edit-task' );

doAction( 'pm/edit-task/display', form, model );
```

JavaScript

```
const data = serialize( form ), errors = [];  
  
if ( data.title.length < 6 )  
    errors.push( __( 'Title too short' ) );  
  
doAction( 'pm/edit-task/save', data, errors );
```

JavaScript

```
registerFormField( 'title', {
  render( model, update ) {
    return <TextInput value={model.myValue} onChange={update} />;
  },
  validate( data ) {
    if ( data.length < 6 )
      return _( 'Title too short' )
  }
} );
```

Imperative Pros

→ Free-form

Imperative Pros

- Free-form
- Familiar to WordPress developers

Imperative Cons

→ Free-form

Free Form

- Anything goes
- Difficult to migrate/upgrade

Cons

- Free-form
- Another language

Cons

- Free-form
- New language
- Still requires backend PHP

Still Requires PHP

- Validation
- Persistence

Cons

- Free-form
- New language
- Still requires backend PHP
- Portability

Portability

- Mobile App
- 3rd-party interfaces
- CLI

Cons

- Free-form
- New language
- Still requires backend PHP
- Portability
- Repetitive

Repetitive

- Custom code for every field
- Duplicate validation in our REST API

Declarative

Declarative

```
$config = [  
    'priority' => [  
        'label' => __( 'Priority' ),  
        'type' => 'dropdown',  
        'choices' => [  
            'high' => __( 'High' ),  
            'normal' => __( 'Normal' )  
        ],  
        'meta_key' => '_task_priority'  
    ]  
];  
$config = apply_filters( 'pm_task_form', $config );  
new Form( $config );
```

Imperative

- Well-defined behavior
- Portable
- Only needs PHP

JSON Schema

```
register_rest_route( 'pm/v1', 'tasks', [
    'schema' => function() {
        return [
            '$schema' => '...',
            'type' => 'object',
            'properties' => [ /* ... */ ]
        ];
    },
] );
```

```
register_rest_field( 'page', 'my_field', [
    'schema' => function() {
        return [ 'type' => 'string' ];
    },
] );
```

```
// New in WordPress 4.9.8!
register_post_meta( 'page', 'my_field', [
    'show_in_rest' => [
        'schema' => function() {
            return [ 'type' => 'string' ];
        },
    ],
] );
```

JSON Schema

- Validation
- Documentation

Schema Forms

JSON Schema Refresher

Main Schema

```
{  
  "$schema": "http://json-schema.org/json-schema-04/",  
  "type": "object",  
  "properties": {}  
}
```

Main Schema

```
{  
  "$schema": "http://json-schema.org/json-schema-04/",  
  "type": "object",  
  "properties": {}  
}
```

Properties

```
{  
  "title": {  
    "title": "Task Title",  
    "type": "string",  
    "description": "A quick summary of the task",  
  },  
  "completed": {  
    "title": "Completed",  
    "type": "boolean",  
    "description": "Is the task complete?"  
  },  
}
```

Properties

```
{  
  "title": {  
    "type": "string",  
    "title": "Task Title",  
    "description": "A quick summary of the task",  
  },  
  "completed": {  
    "type": "boolean",  
    "title": "Completed",  
    "description": "Is the task complete?"  
  },  
}
```

Basic Fields

- Schema type gives an indication
 - string, integer, number, boolean, array, object or null.

Basic Fields

- Schema type gives an indication
- string for simple text

TASK TITLE

Fix button styles on mobile

A quick summary of the task

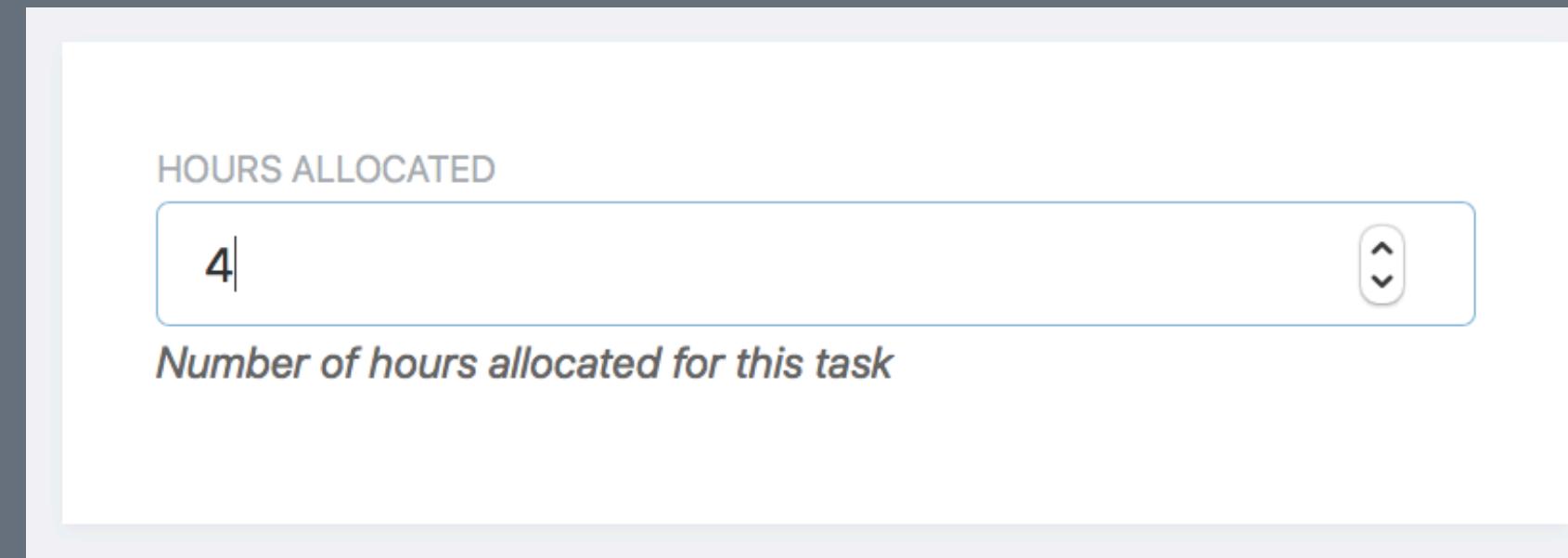
Basic Fields

- Schema type gives an indication
- string for simple text
- number or integer for number fields

HOURS ALLOCATED

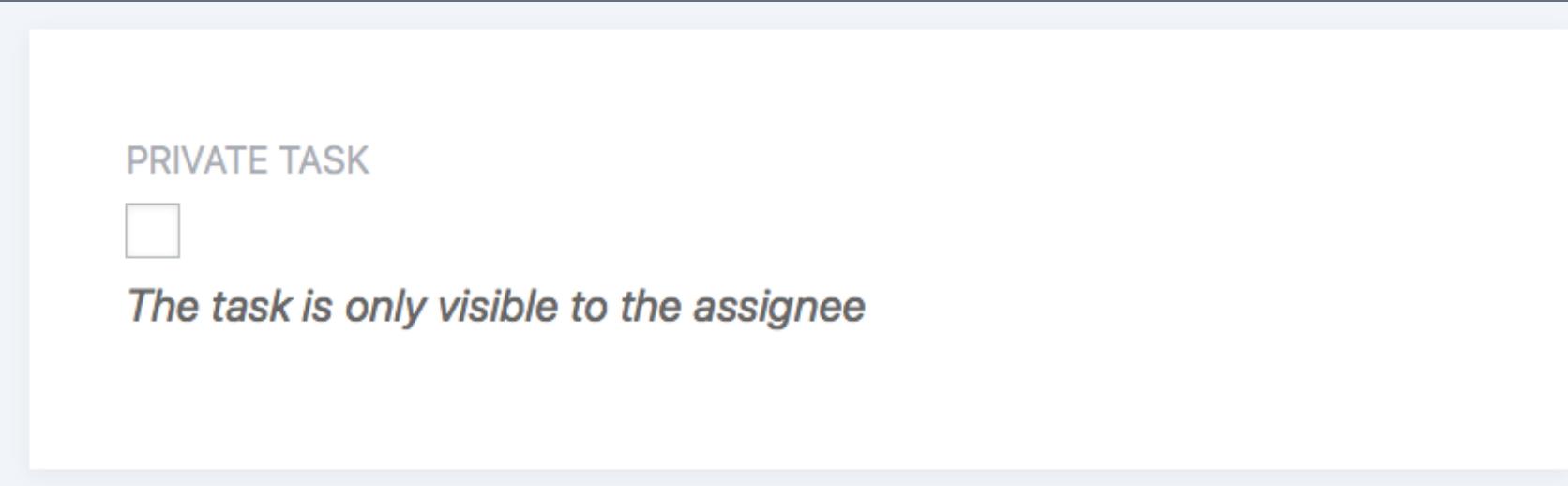
4

Number of hours allocated for this task



Basic Fields

- Schema type gives an indication
- `string` for simple text
- `number` or `integer` for number fields
- `boolean` for checkboxes



Complex Strings

- email, uri, date-time, ip
- Requires a string type
- Customizable

Formats

```
{  
  "contact": {  
    "title": "Contact Email",  
    "type": "string",  
    "format": "email",  
  }  
}
```

Formats

```
{  
  "issue_location": {  
    "title": "Issue Location",  
    "type": "string",  
    "format": "uri",  
    "description": "Where the issue can be seen"  
  }  
}
```

CONTACT EMAIL

reporter@example.com

ISSUE LOCATION

<https://example.org/contact-us>

Where the issue can be seen

HTML

```
{  
  "description": {  
    "title": "Description",  
    "type": "string",  
    "format": "html"  
  }  
}
```

DESCRIPTION

B *I*

The buttons on mobile devices are using the built-in colors, not the ones specified in the customizer.



HTML

```
{  
  "text": {  
    "title": "Text",  
    "type": "string",  
    "format": "html",  
    "formatAllowedHtml": ["a", "strong", "em"]  
  }  
}
```

DESCRIPTION



B *I*

Only a *limited* set of HTML is **allowed** now.



The following HTML is allowed: a, strong, em

Dropdown enum

```
{  
  "priority": {  
    "title": "Priority",  
    "type": "string",  
    "enum": [ "urgent", "high", "normal", "low" ]  
  }  
}
```

PRIORITY

high



urgent

high

normal

low

Dropdown oneOf

```
{  
  "priority": {  
    "title": "Priority",  
    "type": "string",  
    "oneOf": [  
      {  
        "title": "Urgent",  
        "enum": ["urgent"]  
      },  
      {  
        "title": "High",  
        "enum": ["high"]  
      },  
    ]  
  }  
}
```

PRIORITY

High

Urgent

High

Normal

Low



Resource Fields

- References another resource (user, post, etc...)
- Validation schema is not sufficient

Resource Fields

```
{  
  "assignee": {  
    "title": "Assignee",  
    "type": "integer",  
    "minimum": 0  
  }  
}
```

Resource Fields

- References another resource (user, post, etc...)
- Validation schema is not sufficient
- What does the integer represent

ASSIGNEE
3

Resource Fields

```
{  
  "assignee": {  
    "links": [  
      {  
        "rel": "search",  
        "href": "ibd.io/wp-json/wp/v2/users{?search}&_fields=id,name"  
      }  
    ]  
  }  
}
```

Resource Fields

```
{  
  "assignee": {  
    "links": [  
      {  
        "rel": "search",  
        "href": "ibd.io/wp-json/wp/v2/users{?search}&_fields=id,name"  
      }  
    ]  
  }  
}
```


ASSIGNEE

sit



Site Administrator

Multiple Values

- type of array is a list of items
- items keyword adds constraints

Deliverables

Deliverable

Home Page Mockups

Remove

Deliverable

Add

Remove

Deliverables

Deliverable

Name

Home Page Mockups

Due Date

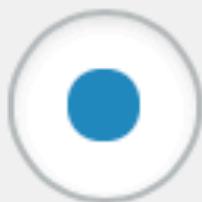
2018-09-16

Remove

Add

Conditional Fields

Task Type



Bug



Feature

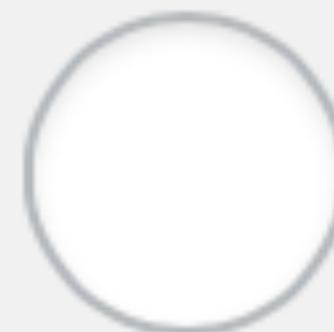
Location

<https://example.org/contact-us>

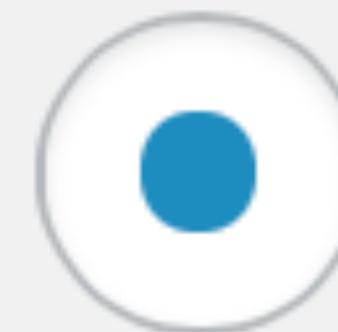
Browser

Safari

Task Type



Bug



Feature

Summary

- Cross platform form definitions
- Not for critical views
- Can be used partially

HATEOAS

HATEOAS

Hypermedia as the Engine of Application State.

HATEOAS

Generic way of consuming an API. We follow links instead of making assumptions about the API.

HATEOAS

```
const url = 'https://ibd.io/wp-json/wp/v2/users/' + post.author;  
  
{  
  "id": 42,  
  "_links": {  
    "author": [  
      {  
        "href": "https://ibd.io/wp-json/wp/v2/users/1"  
      }  
    ]  
  }  
}
```

Parts of a Link

- href: URL to the resource
- rel: The type of link

Examples

→ prev

→ <https://ibd.io/wp-json/wp/v2/posts?page=3>

→ replies

→ <https://ibd.io/wp-json/wp/v2/comments?post=5>

→ <https://api.w.org/term>

→ <https://ibd.io/wp-json/wp/v2/tags/5>

→ <https://ibd.io/wp-json/wp/v2/tags/11>

Locations

- Response Body
- Response Header
- Schema

Response Body

```
{  
  "id": 5,  
  "_links": {  
    "replies": [  
      {  
        "href": "https://ibd.io/wp-json/wp/v2/comments?post=5"  
      }  
    ]  
  }  
}
```

Response Body

```
$href = add_query_arg(  
    'post',  
    $id,  
    rest_url( 'wp/v2/comments' )  
);  
  
$response->add_link( 'replies', $href );
```

Response Header

HTTP/2 200

Link: <<https://ibd.io/wp-json/wp/v2/posts?page=1>>; rel="prev"

Response Header

```
$href = add_quer_arg(  
    'page',  
    $page - 1,  
    rest_url( 'wp/v2/posts' )  
);  
  
$response->link_header( 'prev' , $href );
```

Schema

```
{  
  "$schema": "http://json-schema.org/draft-04/schema#",  
  "type": "object",  
  "properties": {},  
  "links": [  
    {  
      "rel": "self",  
      "href": "https://ibd.io/wp-json/wp/v2/posts/{id}"  
    },  
    {  
      "rel": "replies",  
      "href": "https://ibd.io/wp-json/wp/v2/comments{?id}"  
    }  
  ]  
}
```

Filters

Bulk Actions



Apply

All dates



All Categories



Filter

Title

This is a new post. — Draft

My Post — Draft

PHP

```
add_action( 'restrict_manage_posts', function( $type ) {
    if ( 'pm_task' === $type ) {
        echo '<label>' . __( 'Assignee' );
        wp_dropdown_users();
        echo '</label>';
    }
} );
```


SEARCH

Browser

STATUS

Completed

ASSIGNEE

Begin typing to search

Filter

views

All (13) | Published (3) | Drafts (10)

Bulk Actions

Apply

All dates

All Categories

Filter



Title



This is a new post. — Draft



My Post — Draft

PHP

```
add_filter( 'views_edit-post', function ( $views ) {  
    $url = esc_url( admin_url( 'admin.php?page=tm&view=unassigned' ) );  
    $view = '<a href="' . $url . '">' . __( 'Unassigned' ) . '</a>;  
    $views['unassigned'] = $view;  
  
    return $views;  
} );
```

REST

```
[  
  { "id": 1 },  
  { "id": 2 },  
  { "id": 3 }]  
]
```

REST

```
{  
  "data": [  
    { "id": 1 },  
    { "id": 2 }  
  ],  
  "links": {}  
}
```

Link Headers

Link:

```
<https://ibd.io/wp-json/pm/v1/tasks>;  
  rel="https://p.ibd.io/l/view"; title="All"; count=19,  
<https://ibd.io/wp-json/pm/v1/tasks?status=assigned>;  
  rel="https://p.ibd.io/l/view"; title="Assigned"; count=15
```

Link Header - PHP

```
$response->link_header(  
    'https://p.ibd.io/l/view',  
    add_query_arg( rest_url( 'pm/v1/tasks' ), 'status', 'assigned' ),  
    [ 'count' => 15, 'title' => __( 'Assigned' ) ]  
);
```

All (24) | **Assigned** (14) | **Completed** (3)

Bulk Actions ▾

Apply

Search



Key

Software

Quick Actions



Gutenberg

[Deactivate](#) | [Troubleshoot](#)

Printing since 1440



Health Check & Troubleshooting

[Deactivate](#) | [Troubleshoot](#)

Checks the health of your site



Hello Dolly

[Activate](#) | [Delete](#)

This is not just a theme, it's a plugin. Once you've activated it, you will be able to use its features.

PHP – Row Actions

```
add_filter( 'post_row_actions', function( $actions, $post ) {  
    if ( can_do_action( $post ) ) {  
        $actions['my-action'] = sprintf(  
            '<a href="%s">%s</a>',  
            get_action_link( $post ),  
            esc_html__( 'My Action' )  
        );  
    }  
  
    return $actions;  
} );
```

Linking targetSchema

```
{  
  "rel": "edit",  
  "title": "Complete",  
  "href": "https://ibd.io/wp-json/pm/v1/task/{id}",  
  "targetSchema": {  
    "type": "object",  
    "properties": {  
      "title": {},  
      "assignee": {},  
      "status": {}  
    }  
  }  
}
```


Conditional Actions?

```
if ( 'in-progress' === $task->status ) {
    $response->add_link( 'edit', rest_url( "pm/v1/task/{$id}" ), [
        'title'          => __( 'Complete' ),
        'targetSchema'   => [
            'type'        => 'object',
            'properties'  => [
                'status'     => [
                    'enum'      => [ 'completed' ],
                ],
            ],
        ],
    ],
] );
}
```

Inline Edit

QUICK EDIT

Title

Hello world!

Slug

hello-world

Date

05-May 18, 2017 @ 20:42

Author

Site Administrator (admin)

Password

—OR—

Private

Cancel

Update

Title

Author

Categories

Tags



Date

Categories

Test Category

Uncategorized

Tags

Allow Comments Allow Pings

Status Published Make this post sticky

Quick Create

B**I** $\frac{1}{2} =$ 

I think this would be a *great* idea!

**Reply**

Permissions

PHP

```
if ( current_user_can( 'your-cap' , $post_id ) ) {  
    // Show ui  
}
```

GET <https://ibd.io/wp/v2/users/1?context=edit>

```
{  
  "capabilities": {  
    "edit_others_pages": true,  
    "edit_published_pages": true,  
    "publish_pages": true,  
    "delete_pages": true  
  },  
  "extra_capabilities": {  
    "administrator": true,  
    "edd_subscriber": true  
  }  
}
```

PHP - Filters

- map_meta_cap
- user_has_cap

Resource Level Checks

Allow Header

```
HEAD /wp-json/wp/v2/posts/1 HTTP/1.1
Host: https://w.org/
Authorization: Basic d29yZGNhbXBueWM6MjAx0A==
```

```
HTTP/1.1 200 OK
Allow: GET, PUT, DELETE
```

Allow Header

- Great for individual views
- Doesn't scale to lists

Target Hints

Target Hints

```
{  
  "_links": {  
    "self": [  
      {  
        "href": "https://ibd.io/wp-json/pm/v1/tasks/5",  
        "targetHints": {  
          "allow": [ "GET" , "PUT" ]  
        }  
      }  
    ]  
  }  
}
```

Target Hints

```
$allow = [ 'GET' ];

if ( current_user_can( 'edit_tasks' ) )
    $allow[] = 'PUT';

$response->add_link( 'self', rest_url( "pm/v1/{$id}" ), [
    'targetHints' => [
        'allow' => $allow,
    ],
] );
```

Individual Properties or Actions

- Mark as complete?
- Change the assignee?

Links

```
{  
  "rel": "https://api.w.org/action-publish",  
  "description": "The current user can publish this post.",  
  "href": "https://w.org/wp-json/wp/v2/posts/{id}",  
  "targetSchema": {  
    "type": "object",  
    "properties": {  
      "status": {  
        "type": "string",  
        "enum": [ "publish", "future" ]  
      }  
    }  
  }  
}
```

Links

```
if ( current_user_can( $post_type->cap->publish_posts ) ) {  
    $response->add_link(  
        'https://api.w.org/action-publish',  
        rest_url( trailingslashit( $base ) . $post->ID )  
    );  
}
```

Links

```
{  
  "id": 1,  
  "_links": {  
    "wp:action-publish": [  
      {  
        "href": "https://ibd.io/wp-json/wp/v2/posts/1"  
      }  
    ]  
  }  
}
```

Takeaways

- Imperative vs Declarative
- Extensibility
- Multi-platform
- Keep changes in sync

Takeaways

JSON Schema is a great platform-independent, declarative option and you're probably already using it for your API

Takeaways

- Can build most types of forms
- Use custom formats when necessary and valid
- Links can be used to generically define interactions
- Use http mechanics for defining permissions

Resources

- json-schema.org
- [JSON Schema and the WordPress REST API](#)
- [Mozilla: React JSON Schema Form](#)
- [URI Templates](#)