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What are we doing today?

Image credit: Tory Townsend

Today

Today we demonstrate tools and platforms that let you focus on the job in hand.

These tools remove boiler-plate coding and configuration effort.

They aren't a substitute for understanding!

They need investigation before being used.

Today

Tools Two:

- JAM – Javascript, APIs, Markup - new Stack!
  - Javascript throughout the stack
  - API fronts server-side functionality
  - Single Page Web App / Progressive Web App / Cordova App
- Introducing REST APIs – make micro services in seconds! (small lie)
  - RESTful Web Services
  - IDLs and the Open API Specification
  - IDL Tools
  - Security
- Introducing PaaS – people making amazing useful stuff for free, so you don't have to!
  - GitHub Pages
  - Restlet
  - Heroku
  - Auth0
- Introducing your Case Studies - look at amazingly useful examples!
  - The Urban Wild
  - Time Series Data Capture
  - LittleList

Let’s Fly!

Image credit: Tory Townsend

JAM Stack

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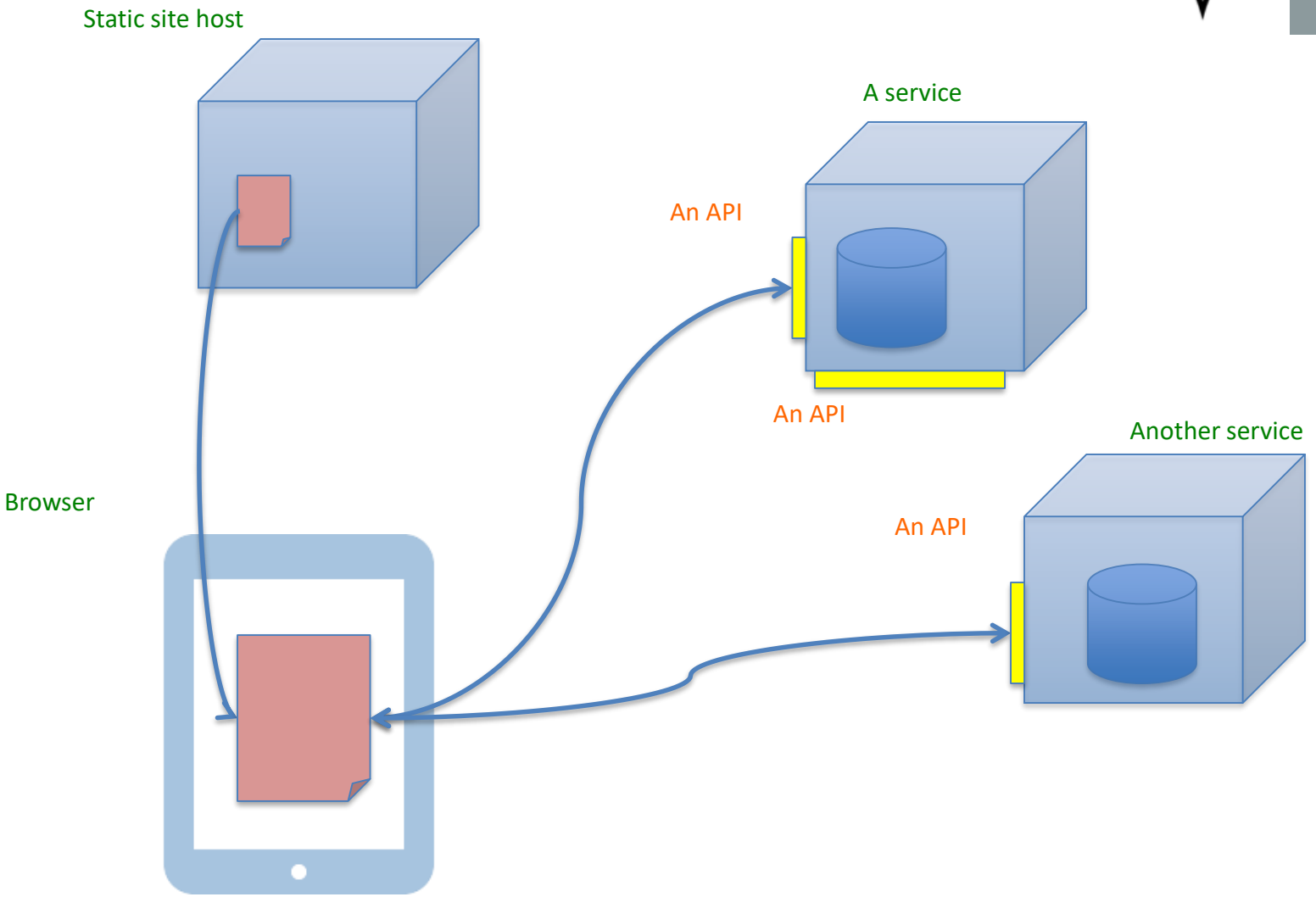
Yet another way to develop web applications:

Javascript, APIs, Markup

JAM Stack

- A single set of Markup files (a web app) is served to a browser
  - Or
- Client is pre-built (mobile app)
- Javascript is used to control the application and its UI.
- The web app gets its data from web services, via their APIs

JAM Stack


Static site host
A service
An API
An API
Another service
An API
Browser

JAM Stack

What's an API?

- Application Programming Interface
- Sits between a service and its clients
- Imposes a predictable communication between them
- More here!

JAM Stack

What's an API?

Quick example

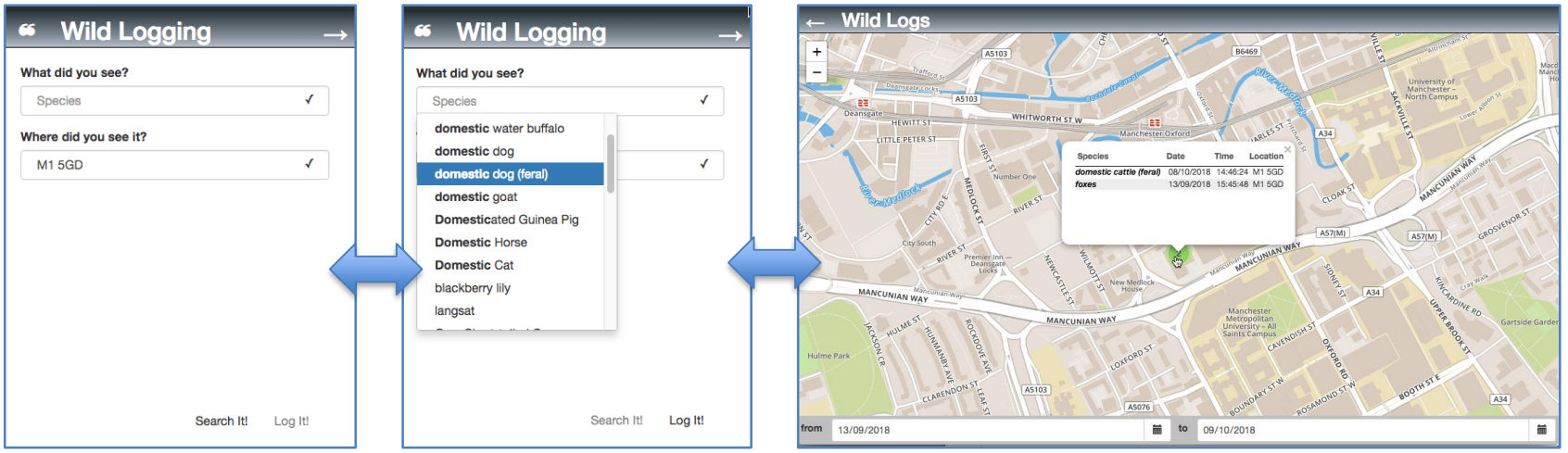
- The Urban Wild - Wildlife logging app
  - User logs wildlife sightings at their location
  - User searches wildlife sightings at other locations

JAM Stack

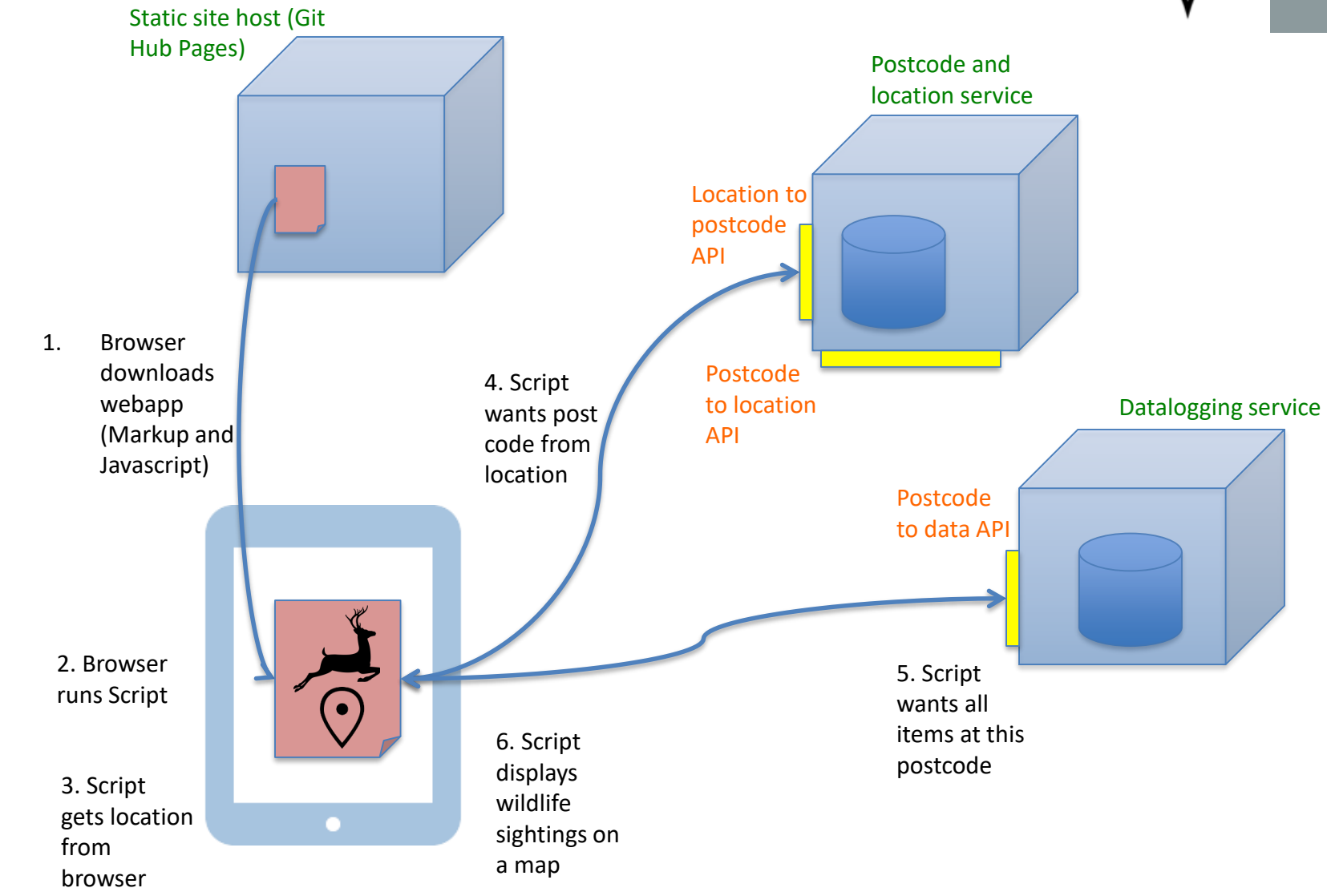
What's an API?

Quick example

- [The Urban Wild](#) - Wildlife logging app



JAM Stack


Static site host (Git Hub Pages)
Postcode and location service
Location to postcode API
Postcode to location API
Datalogging service
Postcode to data API
1. Browser downloads webapp (Markup and Javascript)
2. Browser runs Script
3. Script gets location from browser
4. Script wants post code from location
5. Script wants all items at this postcode
6. Script displays wildlife sightings on a map

JAM Stack

What makes a ‘Good’ API?

- Efficient
  - Minimise calls
  - Minimise bandwidth
- Scalable
  - Larger datasets
  - Many users
- Well documented
  - Essential
  - Accurate
- Easy to use
  - KISS *

APIs are *designed*:

Operations

Data

*Keep It Simple Stupid. Attributed to Kelly Johnson, Lead Engineer at Lockheed Martin’s Skunk Works

Introducing REST APIs

Communicating with the Service

- Clients communicate with a service via a protocol:
  - REST (Representational State Transfer)
  - SOAP (Simple Object Access Request Protocol)
  - Lots of Others
- Pass data over the API as a payload of the protocol:
  - JSON
  - XML
  - Lots of Others

  - (you can even use CSV)

Introducing REST APIs

RESTful Web Services

There are lots of protocols which can be used to communicate between clients and web services.

We use REST, because it makes development easier:

- Simple, yet rich
- Everywhere
- Well-tooled
- Not fast, not slow
- Not too verbose
- Easily debugged

Introducing REST APIs

RESTful Web Services

What's REST?

- REST (Representational State Transfer)
  - set of architectural principles
    - Sits on HTTP 1.1
    - Developed with HTTP 1.1 in 2000 by Roy Feilding
    - Clients interact with the service, using links and operations
  - A URL points to a resource:
    - Here's one for a collection:
      - https://www.cars.com/registrations/
    - Here's one for an item:
      - https://www.cars.com/registrations/AB45PRZ/
    - How about a postcode lookup?
      - https://postcodesrus.com/postcodes/

Introducing REST APIs

RESTful Web Services

- HTTP used to interact with service's resources
- Request methods used to do this:
  - POST – creates
  - PUT – updates completely
  - GET (safe method)
  - DELETE – removes
  - PATCH – changes
- Standard HTTP responses returned

Introducing REST APIs

RESTful Web Services

- The MIME type tells the client what data to expect in the response.
- Often:
  - application/json
  - application/xml

Introducing REST APIs

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RESTful Web Services

POST http://postcodesrus.com/postcodes

```
Request Body:
{
    "lat":"53.474300",
    "lon":-2.246820"
}
```

```
Response Header:
{
  "content-type": "application/json"
}
Response Body:
{
    "composite”:"M1 5GD”
}
```

Introducing REST APIs

RESTful Web Services

Q: How did I know the service would do that?

Introducing REST APIs

RESTful Web Services

Q: How did I know the service would do that?

A: It was documented, using an Interface Definition Language

IDL

Introducing REST APIs

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REST IDL

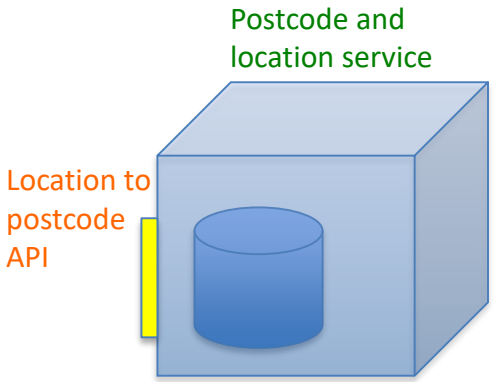
- Interface Definition Language
- Formal definition of an API
  - Operations
  - Data
- Accompanies the protocol
  - SOAP -> WSDL
  - REST -> OAS (swagger)
  - gRPC -> Protocol Buffers
  - Lots of others!
- *Advertises the capabilities of a service*
- *Enables generation of boiler-plate code*

Introducing REST APIs

REST IDL

Example

- Postcode and Location Service
  - Location to Postcode API
    - Defines the data types
      - ‘location’
      - ‘postcode’
    - Advertises resources
      - /postcode
    - Advertises parameters
      - Location
    - Advertises responses
      - Postcode



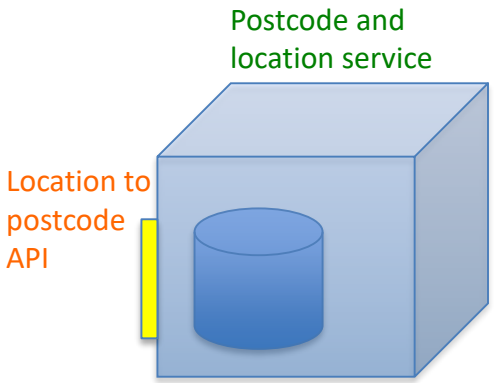
Introducing REST APIs

REST IDL

OAS

- Open API Specification
- Previously called Swagger 2.0
- Based on YAML
- (YAML Ain't Markup Language)

```
---
swagger: "2.0"
info:
  description: "A simple API for looking -up postcodes, given a location"
  version: "1.0.0"
  title: "Postcode Lookup"
host: "postcodesrus.com"
schemes:
- "https"
consumes:
- "application/json"
produces:
- "application/json"
paths:
  /postcodes:
    post:
      summary: "lookup request"
      description: "creates a request to lookup a postcode"
      consumes: []
      parameters:
      - name: "body"
        in: "body"
        required: true
        schema:
          $ref: "#/definitions/Location"
      responses:
        200:
          description: "Lookup successful"
          schema:
            $ref: "#/definitions/Postcode"
        400:
          description: "Not a recognised location"
        404:
          description: "No postcode at this location"
definitions:
  Postcode:
    type: "object"
    required:
    - "composite"
    properties:
      composite:
        type: "string"
        description: "the postcode as seen on an address"
    description: "A UK Postcode"
  Location:
    type: "object"
    required:
    - "lat"
    properties:
      lat:
        type: "number"
        description: "Latitude"
      lon:
        type: "number"
        description: "Longitude"
    description: "A geographical location"
```



Introducing REST APIs

Tools

- swagger.io
- OpenAPI GUI V2

These will help you define an API, using an IDL.
These will generate code from an IDL.
You can create a Java EE / NodeJS server from an interface definition.
OpenAPI GUI V2 lets you define your API graphically

Introducing REST APIs

Security

HTTP supports authentication
HTTPS allows secure transmission
IDL allows definition and advertising of the security scheme

Introducing REST APIs

Security

HTTP supports authentication
HTTPS allows secure transmission
IDL allows definition and advertising of the security scheme

A properly defined and constructed API will ensure:

- secure transmission of data
- immediate rejection of unauthorised requests

Introducing REST APIs

Security

Why do I need security?

- If you deal with any kind of user data, then you need to be aware of:
  - The Information Commissioner's Office (ICO)
  - The Data Protection Act
  - The General Data Protection Regulations

If you don't need to, don't store personally attributable / identifiable information AT ALL. EVER.

Introducing REST APIs

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Security

Securing websites and databases is tricky

- It is an arms race.
- Use Platforms As A Service to delegate:
  - Complex configuration
  - User Authentication

Introducing PaaS

Platform as a Service

A server system which provides a set of services, accessible online.

In particular for us:

- Database Hosting (Mongo, MySQL, Postgres…)
- API services hosting
- User accounts and authentication

Introducing PaaS

We use Heroku as our easy-to-use service provider.

Why?

- Much of the configuration previously seen with webservers is hidden.
- That means it's more difficult to make mistakes

Introducing PaaS

We use Auth0 as our easy-to-use authentication provider.

Why?

- We can delegate all user accounts to experts
- They provide a robust method by which we can authenticate users.
- That means it's more difficult to make mistakes

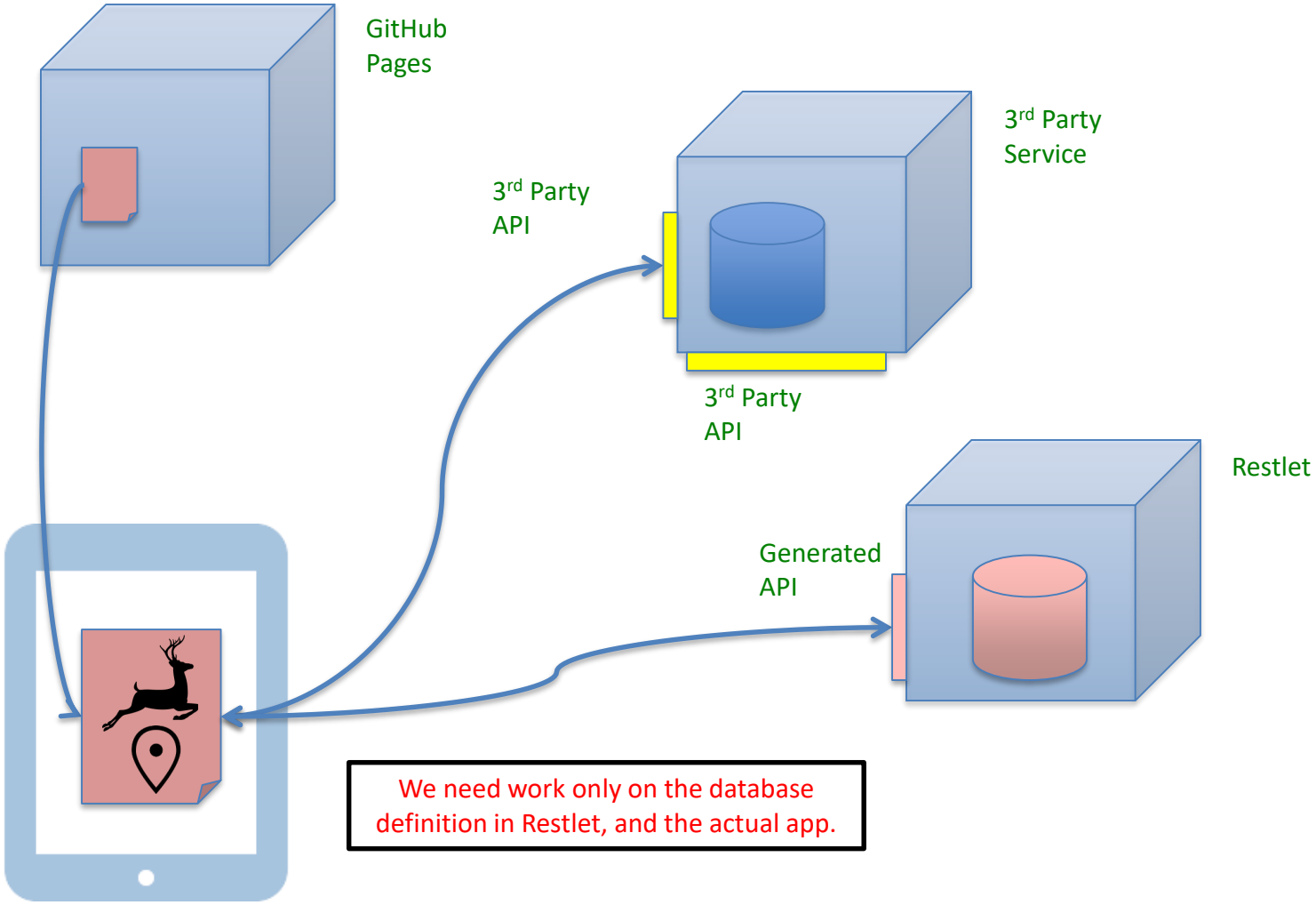
Introducing PaaS

We use GitHub Pages as our easy-to-use front-end provider.

Why?

- It's easy.
- We can host static web pages which authenticate through a third-party, and then access data via an API. Oo! JAM!
- Pushed immediately from our GitHub repo

Introducing PaaS



Case Studies

We have produced a set of Case Studies and example code to help you as you design and construct your Live Project:

- The Urban Wild
  - Project: Github
  - Diary: DigitalLabs Post
  - Web App: Angular JS
  - Host: GitHub Pages
  - APIs
    - Postcode
    - IT IS
    - Restlet PaaS
- Time Series Data Capture
- LittleList

The Urban Wild

- Demo Project
- Let's try and push the limits of what we can do without creating our own server, just using PaaS.
- Allow casual users to add wildlife sightings to a map.
- Allow them to search on location and date for other sightings.
- 65 Hour rush job.

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  - Project: Github
  - Diary: DigitalLabs Post
  - Web App: Angular JS, D3
  - Host: GitHub Pages
  - APIs
    - TimeSeriesDataCapture_ImportSource
    - TimeSeriesDataCapture_BrowseData
    - Microsoft OneDrive
    - Auth0
- LittleList

Time Series Data Capture

- Scientists like to save their data in CSV files
- Then they put it on OneDrive
- … can't find anything!
- This system imports data to Mongo DB
- Adds preview, tagging, annotation, search, visualisation.
- This was a 60 Day project, by a Mentored Summer Student

Case Studies

We have produced a set of Case Studies and example code to help you as you design and construct your Live Project:

- The Urban Wild
- Time Series Data Capture
- LittleList
  - Project: Github
  - Mobile App: GitHub, Ionic1, Cordova
  - Web App: GitHub, Angular JS, Ionic1,
  - Host: GitHub Pages
  - APIs

LittleList

- A tiny project for you to fork
- Use it as a basis for anything which gets a bunch of items from a search
- Easy demo of concepts like
  - Changing UI States
  - Asynchronous calls
- How-to for mobile works out-of-the box on Lab PCs.

Things To Do

Image credit: Fabi Fliervoet

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