

# Real World REST & Hands-On Hypermedia

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"When given a name, a  
coordinated set of  
**architectural**  
**constraints**  
becomes an  
**architectural style**"

"REST is software design on

the **scale of decades:**

every detail is intended to promote  
**software longevity** and  
**independent evolution.**

Many of the constraints are  
**directly opposed to short-term  
efficiency."**

# ReST: The Constraints

- Client-server
- Stateless
- Cacheable
- Layered System
- Code-on-demand
- Uniform interface
- Hypermedia as the engine of application state

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- Client-server
- Stateless
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- Layered System
- Code-on-demand
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- Hypermedia as the engine of application state



This bit is optional.

**GET /profiles HTTP/1.1**

200 OK

Content-Type: application/json

```
[
  {
    "username": "ironman",
    "name": "Tony Stark",
  }
]
```

**POST** /profiles HTTP/1.1

```
{  
    "username" : "spidey"  
    "name": "Peter Parker",  
}
```

201 Created

Location: <http://herobook.com/profiles/spidey>

```
{  
    "username": "spidey",  
    "name": "Peter Parker"  
}
```

GET /profiles HTTP/1.1

200 OK

[

{ "username":"ironman", "name":"Tony Stark" }

{ "username":"spidey", "name":"Peter Parker" },

{ "username":"blackwidow", "name":"Natasha Romanoff" },

/\* (2 million users omitted for clarity) \*/

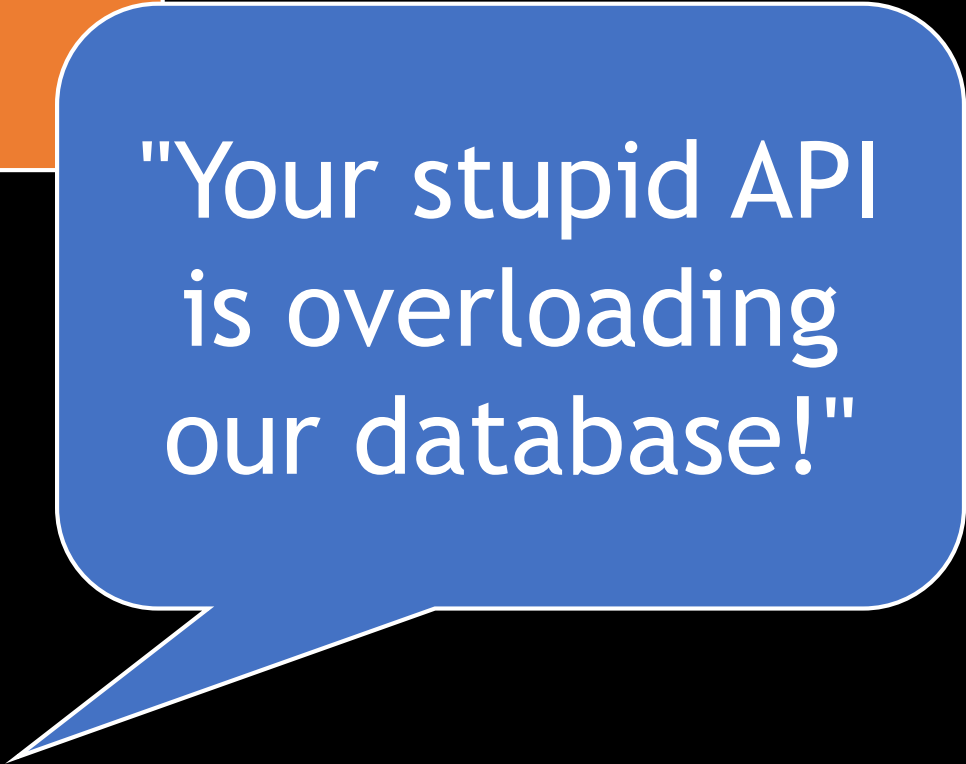
{ "username":"howard", "name":"Howard the Duck" }

]





"Your API is using all  
our bandwidth!"



"Your stupid API  
is overloading  
our database!"

GET /profiles?page=1 HTTP/1.1

200 OK

```
[  
  { "username": "ironman", "name": "Tony Stark" },  
  { "username": "spidey", "name": "Peter Parker" },  
  { "username": "blackwidow", "name": "Natasha Romanoff" },  
  { "username": "cap", "name": "Steve Rogers" },  
  { "username": "hulk", "name": "Bruce Banner" },  
  { "username": "pepper", "name": "Pepper Potts" }  
]
```

GET /profiles?page=2 HTTP/1.1

200 OK

GET /profiles?page=3 HTTP/1.1

200 OK

GET /profiles?page=4 HTTP/1.1

200 OK

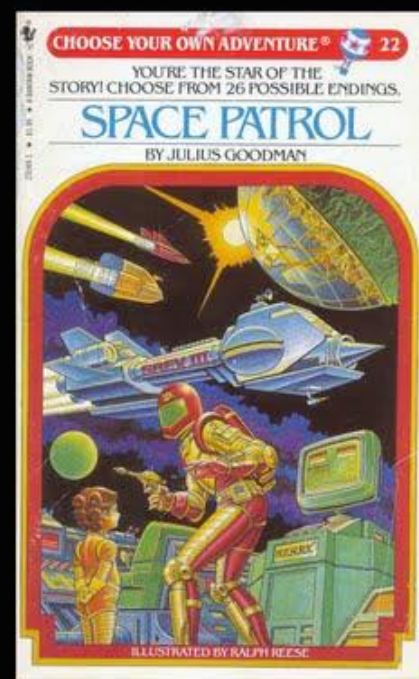
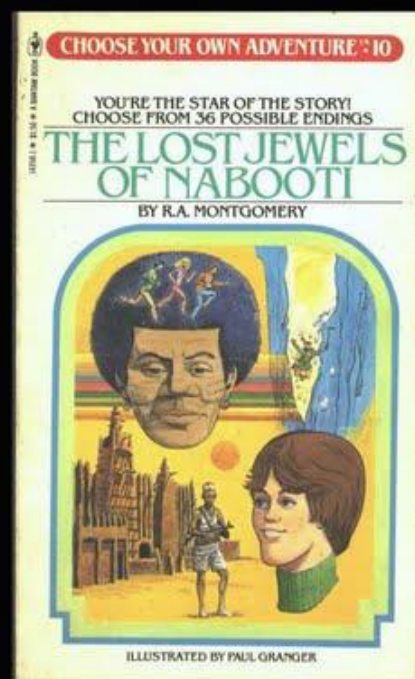
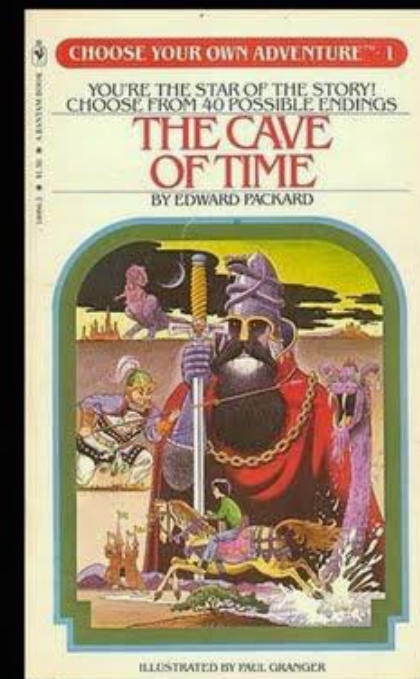
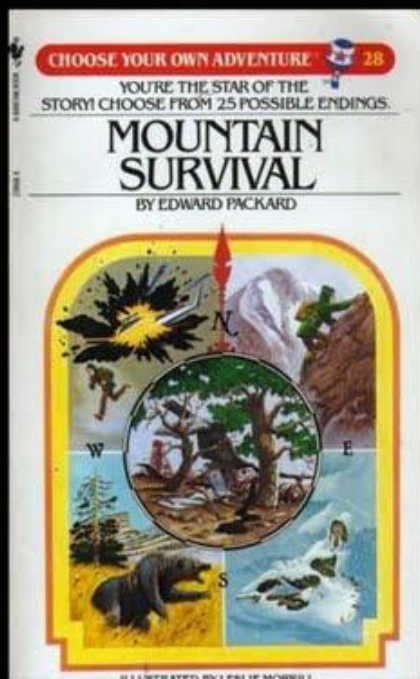
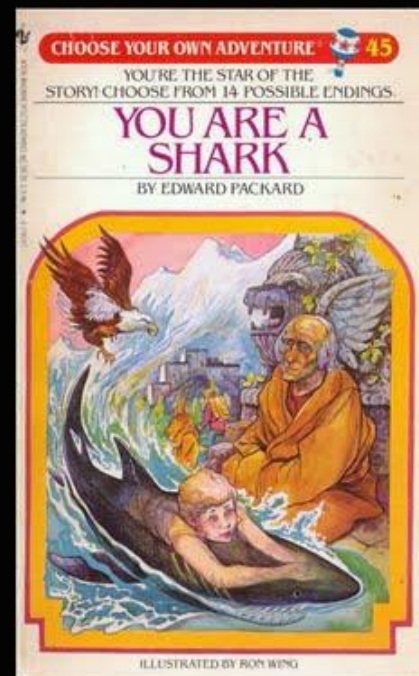
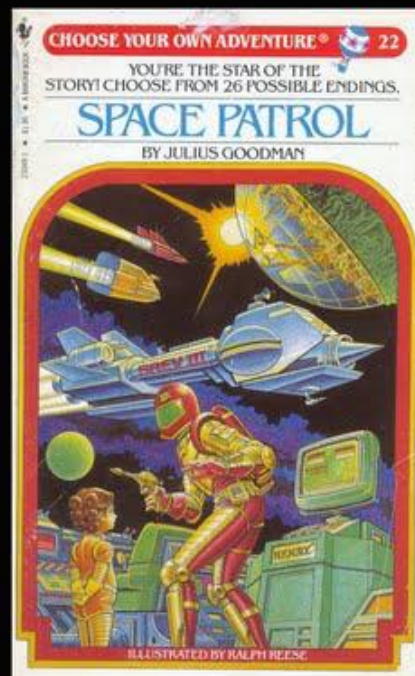
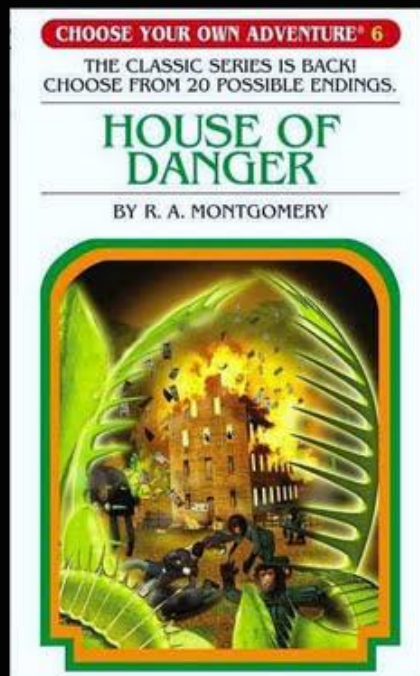
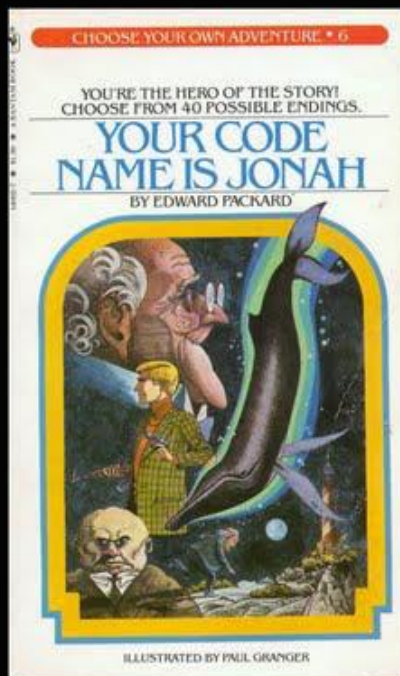
GET /profiles?page=5 HTTP/1.1

204 No Content

**NOT REST**

# ReST: The Constraints

- Client-server
- Stateless
- Cacheable
- Layered System
- Code-on-demand
- Uniform interface
- **Hypermedia as the engine of application state**



Wow! What an amazing talk. Suddenly, you understand everything there is to know about REST and hypermedia! You want to rush straight home and rewrite all your projects, but maybe you should sleep on it first... But hang on! Some of the gang are heading over the road to the Craftsman for a pint - maybe you should chat to them over a beer?

*To go straight home and rewrite*

*all the things, go to page 74*

*If you decide to sleep on it first, go to page 23*

*To go to the Craftsman for a pint, turn to page 41*

**GET /profiles HTTP/1.1**

200 OK

Content-Type: application/hal+json

```
{
  "_links" : {
    "self" : { "href" : "http://herobook.co/profiles?index=0" },
    "next" : { "href" : "http://herobook.co/profiles?index=5" },
    "last" : { "href" : "http://herobook.co/profiles?index=220" }
  },
  "count" : 5,
  "index" : 0,
  "total" : 223,
  "items:" [
    { "username":"ironman", "name":"Tony Stark" },
    { "username":"spidey", "name":"Peter Parker" },
    { "username":"blackwidow", "name":"Natasha Romanoff" },
    { "username":"pepper", "name":"Pepper Potts" }
  ]
}
```



**GET /profiles HTTP/1.1**

200 OK

Content-Type: application/**hal**+json

```
{
  "_links" : {
    "self" : { "href" : "http://herobook.co/profiles?index=0" },
    "next" : { "href" : "http://herobook.co/profiles?index=5" },
    "last" : { "href" : "http://herobook.co/profiles?index=220" }
  },
  "count" : 5,
  "index" : 0,
  "total" : 223,
  "items:" [
    { "username":"ironman", "name":"Tony Stark" },
    { "username":"spidey", "name":"Peter Parker" },
    { "username":"blackwidow", "name":"Natasha Romanoff" },
    { "username":"pepper", "name":"Pepper Potts" }
  ]
}
```



GET /profiles/ironman HTTP/1.1

200 OK

Content-Type: application/json

```
{
  "username": "ironman",
  "name": "Tony Stark",
  "friends" : [
    { "username":"ironman", "name":"Tony Stark" },
    { "username":"spidey", "name":"Peter Parker" },
    { "username":"blackwidow", "name":"Natasha Romanoff" },
    /* another 500 friends here... */
  ]
}
```

GET /profiles/ironman HTTP/1.1

200 OK

Content-Type: application/json

```
{
  "username": "ironman",
  "name": "Tony Stark",
  "friends" : [
    { "username":"hulk", "name":"Bruce Banner" },
    { "username":"spidey", "name":"Peter Parker" },
    { "username":"blackwidow", "name":"Natasha Romanoff" },
    /* another 500 friends here... */
  ],
  "updates" : [
    { "id" : 1234,
      "update" : "Working a new Iron Man suit!",
      "posted" : "2016-02-23T18:25:43.511Z"
    },
    { "id" : 1543,
      "update" : "New suit's gonna have a selfie stick! Oh yeah!",
      "posted" : "2016-04-16T18:25:43.511Z"
    },
    { "id" : 1782,
      "update" : "Selfie stick broke. Oh well. Back to the drawing board",
      "posted" : "2016-04-17T08:26:13.511Z"
    }
  ]
}
```

GET /profiles/ironman HTTP/1.1

200 OK

Content-Type: application/json

```
{
  "username": "ironman",
  "name": "Tony Stark",
  "friends" : [
    { "username":"hulk", "name":"Bruce Banner",
      "updates" : [ { . . . }, { . . . }, { . . . } ] },
    { "username":"spidey", "name":"Peter Parker",
      "updates" : [ { . . . }, { . . . }, { . . . } ] },
    { "username":"blackwidow", "name":"Natasha Romanoff",
      "updates" : [ { . . . }, { . . . }, { . . . } ] },
    /* another 500 friends here... */
  ],
  "updates" : [
    { "id" : 1234,
      "update" : "Working a new Iron Man suit!",
      "posted" : "2016-02-23T18:25:43.511Z"
    },
    { "id" : 1543,
      "update" : "New suit's gonna have a selfie stick! Oh yeah!",
      "posted" : "2016-04-16T18:25:43.511Z"
    },
    { "id" : 1782,
      "update" : "Selfie stick broke. Oh well. Back to the drawing board",
      "posted" : "2016-04-17T08:26:13.511Z"
    }
  ]
}
```

GET /profiles/ironman HTTP/1.1

200 OK

Content-Type: application/json

```
{
  "username": "ironman",
  "name": "Tony Stark",
  "friends" : [
    { "username": "hulk", "name": "Bruce Banner",
      "updates" : [ { . . . }, { . . . }, { . . . } ],
      "friends" : [ { . . . }, { . . . }, { . . . } ] },
    { "username": "spidey", "name": "Peter Parker",
      "updates" : [ { . . . }, { . . . }, { . . . } ],
      "friends" : [ { . . . }, { . . . }, { . . . } ] },
    { "username": "blackwidow", "name": "Natasha Romanoff",
      "updates" : [ { . . . }, { . . . }, { . . . } ],
      "friends" : [ { . . . }, { . . . }, { . . . } ] },
    /* another 500 friends here... */
  ],
  "updates" : [
    { "id" : 1234,
      "update" : "Working a new Iron Man suit!",
      "posted" : "2016-02-23T18:25:43.511Z"
    },
    { "id" : 1543,
      "update" : "New suit's gonna have a selfie stick! Oh yeah!",
      "posted" : "2016-04-16T18:25:43.511Z"
    },
    { "id" : 1782,
      "update" : "Selfie stick broke. Oh well. Back to the drawing board",
      "posted" : "2016-04-17T08:26:13.511Z"
    }
  ]
}
```

GET /profiles/ironman HTTP/1.1

200 OK

Content-Type: application/json

```
{
  "username": "ironman",
  "name": "Tony Stark",
  "friends" : [
    { "username":"hulk", "name":"Bruce Banner",
      "updates" : [ { . . . }, { . . . }, { . . . } ],
      "friends" : [
        {
          "updates" : { . . . }
        },
        {
          "updates" : { . . . }
        },
        {
          "updates" : { . . . }
        }
      ],
    },
    { "username":"spidey", "name":"Peter Parker",
      "updates" : [ { . . . }, { . . . }, { . . . } ]
      "friends" : [
        {
          "updates" : { . . . }
        },
        {
          "updates" : { . . . }
        },
        {
          "updates" : { . . . }
        }
      ],
    },
    { "username":"blackwidow", "name":"Natasha Romanoff",
      "updates" : [ { . . . }, { . . . }, { . . . } ]
      "friends" : [
        {
          "updates" : { . . . }
        },
        {
          "updates" : { . . . }
        },
        {
          "updates" : { . . . }
        }
      ],
    },
    /* another 500 friends here... */
  ],
  "updates" : [
    { "id" : 1234,
      "update" : "Working a new Iron Man suit!",
      "posted" : "2016-02-23T18:25:43.511Z"
    },
    { "id" : 1543,
      "update" : "New suit's gonna have a selfie stick! Oh yeah!",
      "posted" : "2016-04-16T18:25:43.511Z"
    },
    { "id" : 1782,
      "update" : "Selfie stick broke. Oh well. Back to the drawing board",
      "posted" : "2016-04-17T08:26:13.511Z"
    },
  ]
}
```

**"Your API is using  
all our  
bandwidth...  
AGAIN!"**

**"Your API is  
overloading the  
database. Again.**

**...I told you we  
should have just  
stuck with PHP..."**



GET /profiles/ironman HTTP/1.1

200 OK

Content-Type: application/hal+json

```
{
  "_links": {
    "self" : "http://herobook.io/profiles/1",
    "friends" : "http://herobook.io/profiles/1/friends",
    "photos" : "http://herobook.io/profiles/1/photos",
    "updates" : "http://herobook.io/profiles/1/updates"
  },
  "username" : "ironman",
  "name" : "Tony Stark"
}
```



GET /profiles/ironman HTTP/1.1  
200 OK

GET /profiles/ironman/friends HTTP/1.1  
200 OK

GET /profiles/ironman/updates HTTP/1.1  
200 OK

GET /profiles/ironman/photos HTTP/1.1  
200 OK

GET /profiles/ironman/photos/1234 HTTP/1.1  
200 OK

GET /profiles/ironman/photos/1234/comments HTTP/1.1  
200 OK

GET /profiles/ironman/photos/1345 HTTP/1.1  
200 OK

GET /profiles/ironman/photos/1345/comments HTTP/1.1  
200 OK

GET /profiles/ironman/photos/1456 HTTP/1.1  
200 OK

GET /profiles/ironman/photos/1456/comments HTTP/1.1  
200 OK

**"I need to make 50  
API calls just to  
draw a web page!"**

**"Our web server  
crashed because  
the IIS logs filled up  
the C: drive!"**

**We never had this problem  
with PHP..."**

GET /profiles/ironman?expand=updates HTTP/1.1

200 OK

Content-Type: application/json

```
{
  "_links": {
    "self" : "http://herobook.co/profiles/ironman",
    "friends" : "http://herobook.co/profiles/ironman/friends",
    "photos" : "http://herobook.co/profiles/ironman/photos",
    "updates" : "http://herobook.co/profiles/ironman/updates"
  },
  "username" : "ironman",
  "name" : "Tony Stark"
  "_embedded" : {
    "updates" : [
      { "id" : 1234,
        "update" : "Working a new Iron Man suit!",
        "posted" : "2016-02-23T18:25:43.511Z"
      },
      { "id" : 1543,
        "update" : "New suit's gonna have a selfie stick! Oh yeah!",
        "posted" : "2016-04-16T18:25:43.511Z"
      },
      { "id" : 1782,
        "update" : "Selfie stick broke. Oh well. Back to the drawing board",
        "posted" : "2016-04-17T08:26:13.511Z"
      }
    ]
  }
}
```

# Hypermedia support in JSON

# JSON+Hypermedia Formats

- **JSON-LD**
  - Web Standard - <http://www.w3.org/TR/json-ld/>
- **HYDRA**
  - extends JSON-LD with available actions
- **JSONAPI**
  - <http://jsonapi.org/>
- **Collection+JSON**
  - <http://amundsen.com/media-types/collection/>
- **SIREN**
  - <https://github.com/kevinswiber/siren>
- **HAL**
  - [http://stateless.co/hal\\_specification.html](http://stateless.co/hal_specification.html)

# JSON-LD

```
{
  "@context": {
    "name": "https://schema.org/name",
    "alternateName": "https://schema.org/alternateName",
    "image": {
      "@id": "https://schema.org/image",
      "@type": "@id"
    }
  },
  "@id": "https://herobook.io/profiles/ironman",
  "name": "Tony Stark",
  "alternateName": "ironman",
  "image": "https://herobook.io/profiles/ironman/photos/avatar.png"
}
```

```
{
  @id: "http://herobook.io/profiles",
  @type: "http://www.w3.org/ns/hydra/core#Link",
  description: "The collection of all superheroes",
  label: "heroes",
  range: "http://www.w3.org/ns/hydra/core#Collection",
  supportedOperations: [
    {
      @id: "_:id1",
      @type: "http://www.w3.org/ns/hydra/core#Operation",
      label: "Creates a new Issue entity",
      expects: "http://herobook.io/hydra/hero-api/vocab#Hero",
      method: "POST",
      returns: "http://herobook.io/hydra/hero-api/vocab#Hero",
      statusCodes: [ {
        @id: "_:id2",
        description: "If the superhero was added successfully.",
        code: 201
      } ]
    },
    {
      @id: "_:id3",
      @type: "http://www.w3.org/ns/hydra/core#Operation",
      label: "Retrieves all superhero entities",
      expects: null,
      method: "GET",
      returns: "http://www.w3.org/ns/hydra/core#Collection",
      statusCodes: [ ]
    }
  ]
}
```

Collection+JSON



```
{ "collection" :  
  {  
    "version" : "1.0",  
    "href" : "http://herobook.io/profiles/",  
  
    "links" : [  
      {"rel" : "feed", "href" : "http://herobook.io/blogs"},  
      {"rel" : "queries", "href" : "http://herobook.io/profiles/?queries"},  
    ],  
  
    "items" : [  
      {  
        "href" : "http://herobook.io/profiles/ironman",  
        "data" : [  
          {"name" : "username", "value" : "ironman", "prompt" : "Username"},  
          {"name" : "name", "value" : "Tony Stark", "prompt" : "Full Name"}  
        ],  
        "links" : [  
          {  
            "rel" : "friends",  
            "href" : "http://herobook.io/profiles/ironman/friends",  
            "prompt" : "Friends"  
          },  
          {  
            "rel" : "photos",  
            "href" : "http://herobook.io/profiles/ironman/photos",  
            "prompt" : "Photos",  
            "render" : "image"  
          }  
        ]  
      }  
    ]  
  }  
}
```

# JSONAPI

```
{
  "links": {
    "self": "http://herobook.io/posts",
    "next": "http://herobook.io/posts?page[offset]=2",
    "last": "http://herobook.io/posts?page[offset]=10"
  },
  "data": [{
    "type": "posts",
    "id": "1",
    "attributes": { "title": "Iron Man wows crowds with new selfie stick!" },
    "relationships": {
      "author": {
        "links": {
          "self": "http://herobook.io/posts/1/relationships/author",
          "related": "http://herobook.io/posts/1/author"
        },
        "data": { "type": "people", "id": "9" }
      },
      "comments": {
        "links": {
          "self": "http://herobook.io/posts/1/relationships/comments",
          "related": "http://herobook.io/posts/1/comments"
        },
        "data": [
          { "type": "comments", "id": "5" },
          { "type": "comments", "id": "12" }
        ]
      }
    }
  ]
},
  "links": { "self": "http://herobook.io/posts/1" }
}]
```

SIREN

```

{
  "class": [ "mission_list" ],
  "properties": { "username": "ironman" },
  "entities": [
    {
      "class": [ "missions", "collection" ],
      "rel": [ "http://herobook.io/rels/missions" ],
      "href": "http://herobook.io/profiles/ironman/missions"
    },
    {
      "class": [ "hero", "customer" ],
      "rel": [ "http://herobook.io/rels/hero" ],
      "properties": { "username": "ironman", "name": "Tony Stark" },
      "links": [ { "rel": [ "self" ], "href": "http://herobook.io/profiles/ironman" } ]
    }
  ],
  "actions": [
    { "name": "assign-mission",      "title": "Assign Mission",
      "method": "POST",             "href": "http://herobook.io/missions",
      "type": "application/x-www-form-urlencoded",
      "fields": [
        { "name" : "hero", "type" : "hidden", "value" : "ironman" },
        { "name": "latitude", "type": "number" },
        { "name": "longitude", "type": "number" },
        { "name": "time", "type": "datetime" },
        { "name": "objective", "type": "text" }
      ]
    }
  ],
}

```

GET /profiles/1 HTTP/1.1

200 OK

Content-Type: application/json


```
{
  "_links": {
    "self" : "http://herobook.io/profiles/ironman",
    "friends" : "http://herobook.io/profiles/ironman/friends",
    "photos" : "http://herobook.io/profiles/ironman/photos",
    "updates" : "http://herobook.io/profiles/ironman/updates"
  },
  "name" : "Tony Stark",
  "username" : "ironman",
  "height" : 192,
  "weight" : 85,
  "location" : { "lat": 34.02, "lon": -118.77 },
  "status" : "Out saving the world. Again.",
  "hometown" : "Malibu, USA",
  "email" : "tony@stark.com",
  "website" : "www.ironman.com",
  "birthdate" : "1972-01-24",
  "last_modified" : "2015-08-12T19:45:43.511Z"
}
```

# PUT /profiles/1 HTTP/1.1


Content-Type: application/json

```
{  
  "name"      : "Tony Stark",  
  "username"  : "ironman",  
  "height"    : 192,  
  "weight"    : 85,  
  "location"  : { "lat": 34.02, "lon": -118.77 },  
  "status"    : "Just got back from saving the world. Again.",  
  "hometown"  : "Malibu, USA"  
  "email"     : "tony@stark.com",  
  "website"   : "www.ironman.com",  
  "birthdate" : "1972-01-24"  
}
```

## 409 Conflict



**"Why do I need to  
PUT the entire  
profile just to  
update location?"**



**"My updates  
keep failing  
with a 409  
Conflict! Help!"**



**PUT /profiles/ironman/status HTTP/1.1**

"Finished saving the world. I need a drink."

**204 No Content**

The **PATCH** method requests that  
**a set of changes**  
described in the request  
entity be applied to the resource  
identified by the Request-URI.

The set of changes is represented in a format  
called a "patch document" identified by a media  
type.

PATCH /file.txt HTTP/1.1  
Host: www.herobook.io  
Content-Type: application/example  
If-Match: "e0023aa4e"  
Content-Length: 100

**[description of changes]**

```
PATCH /file.txt HTTP/1.1
Host: www.herobook.io
Content-Type: application/example
If-Match: "e0023aa4e"
Content-Length: 100
```

**[description of changes]**

PATCH /profiles/ironman HTTP/1.1

Content-Type: application/x-unix-diff

11c11

<

"status": "Just got home from saving the world.",

---

>

"status": "World saved. I need a drink.",

200 OK

PATCH /profiles/ironman HTTP/1.1

Content-Type: application/**json-patch**+json

If-Match: "abc123"

[

```
{  
  "op": "test",  
  "path": "/last-modified",  
  "value": "2016-05-09T15:25:43.511Z"  
},
```

```
{  
  "op": "replace",  
  "path": "/status",  
  "value": "Finished saving the world. I need a drink."  
},
```

]


**200 OK**

PATCH /profiles/1 HTTP/1.1

Content-Type: image/nickcage+png



202 Accepted



"We need to expose  
forenames and  
surname separately"



"We're replacing  
hometown with  
an ISO3166  
country code"

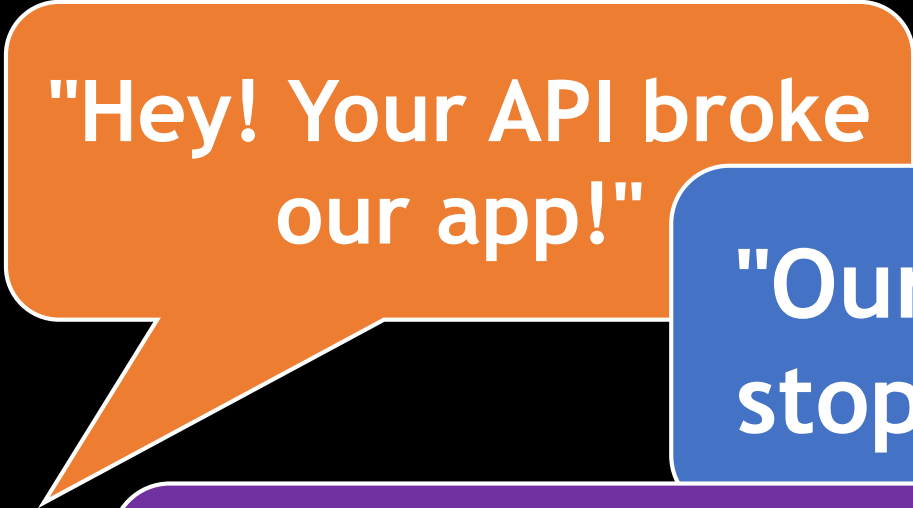


GET /profiles/1 HTTP/1.1

200 OK

Content-Type: application/hal+json

```
{
  "name"      : { "firstname" : "Tony", "lastname" : "Stark" },
  "username"  : "ironman",
  "height"    : 192,
  "weight"    : 85,
  "location"  : { "lat": 34.02, "lon": -118.77 },
  "status"    : "Out saving the world. Again.",
  "hometown"  : {
    "city" : "Malibu",
    "country" : "US"
  },
  "email"     : "tony@stark.com",
  "website"   : "www.ironman.com",
  "birthdate" : "1972-01-24",
  "last_modified" : "2015-08-12T19:45:43.511Z"
}
```



"Hey! Your API broke  
our app!"



"Our website just  
stopped working"



"None of our  
reports work!"



"YOU BROKE THE  
INTERNET."

Oops.

- The easiest thing to do is  
...**never break  
anything!**
- ...but : "REST is software design on  
the **scale of  
decades**"

# API Versioning Done Wrong

(with thanks to  
@troyhunt)

**GET /v2/profiles/ironman**

**Accept: application/json**

**200 OK**

**{ ... }**

GET /profiles/ironman

Accept: application/vnd.myapi.v2+json

200 OK

{ ... }

**GET /profiles/ironman**

**Accept: application/json**

**X-MyApi-Version: 2**

**200 OK**

**{ ... }**



"is **version 2** of a profile  
the **same *resource***  
as **version 1**?"

"Of course they  
are! They  
represent the same  
person!"

"Don't be daft.  
They're completely  
different."

"Of course they are! They represent the same person!"




GET /api/profiles  
Accept: application/**vnd.myapi.v2**+json

"Don't be daft. They're completely different."



GET /api/**v2**/profiles  
Accept: application/json

"Oh, forget ReST! Let's just use custom headers"



GET /api/profiles  
**X-MyApi-Version: 2**

...and on the server?

**Branch the  
codebase for  
separate  
versions?**

**One  
codebase,  
many  
versions?**

```
[VersionedRoute("api/profiles/{name}", 2)]  
[Route("api/v2/profiles/{name}")]  
public Profile GetV2(string name) {  
    /* write your program here! */  
}
```

# THANK YOU!

Feedback:

<https://confocal.io/>

Code: bakery

@dylanbeattie

@TheDevBakery