

Real World REST & Hands-On Hypermedia

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Siteimprove

"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

ReST: The Constraints

- Client-server
- Stateless
- Cacheable
- Layered System
- Code-on-demand
- Uniform interface
- 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" },

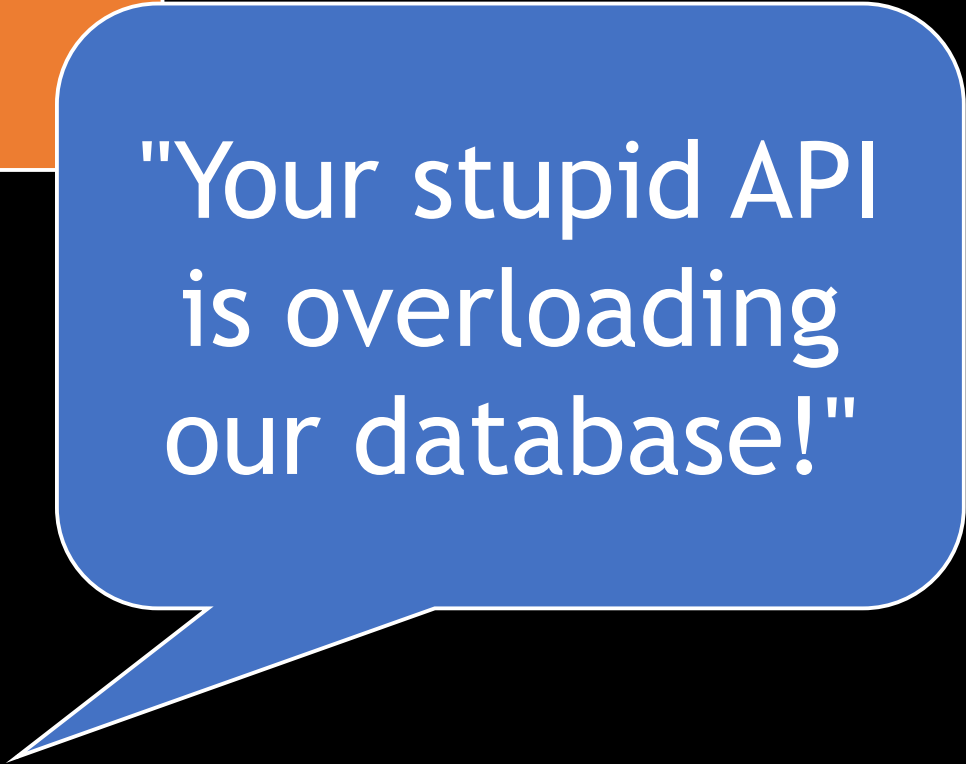
/* (2 million users omitted for clarity) */

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

]

An orange speech bubble with a white outline and a tail pointing towards the bottom-left.

"Your API is using all
our bandwidth!"

A blue speech bubble with a white outline and a tail pointing towards the bottom-left.

"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

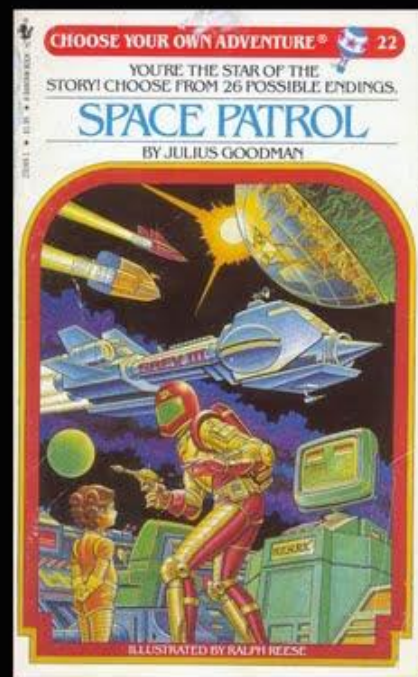
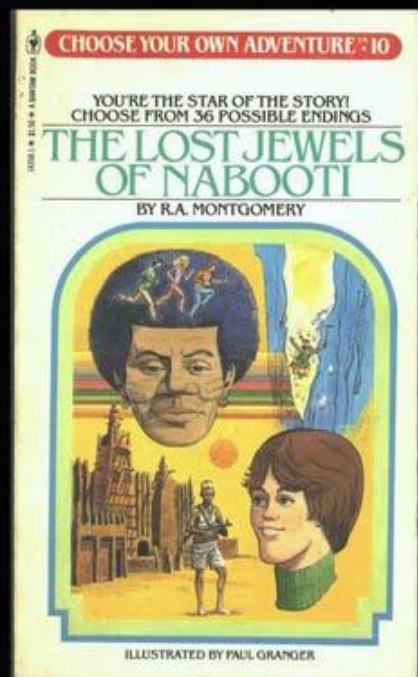
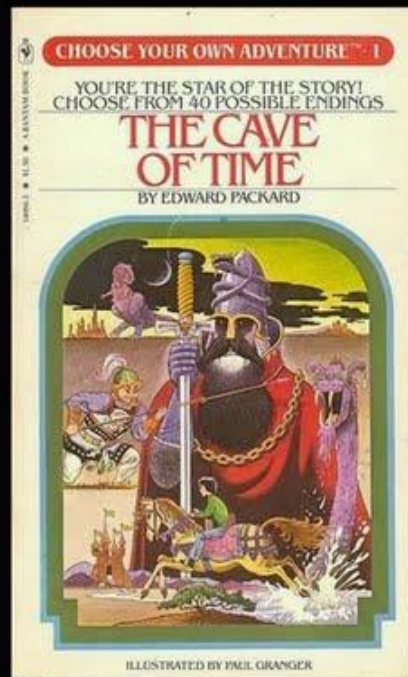
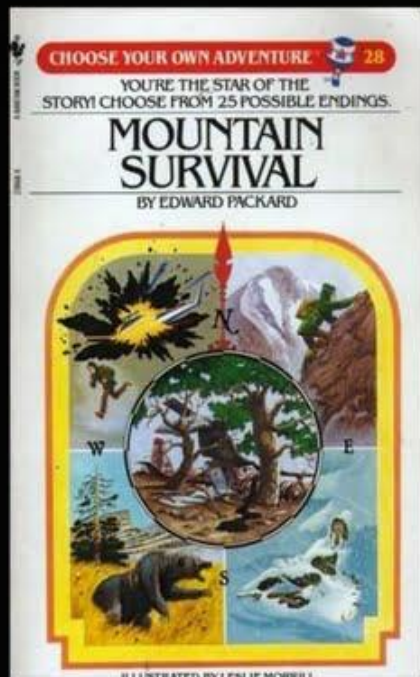
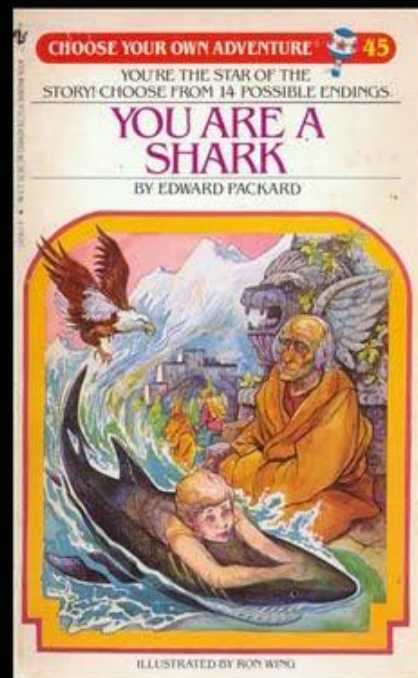
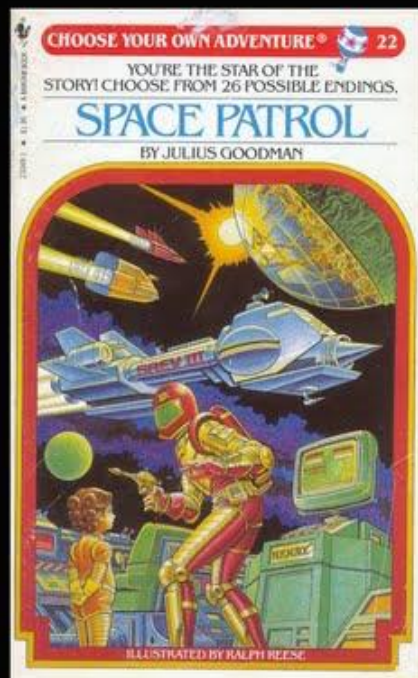
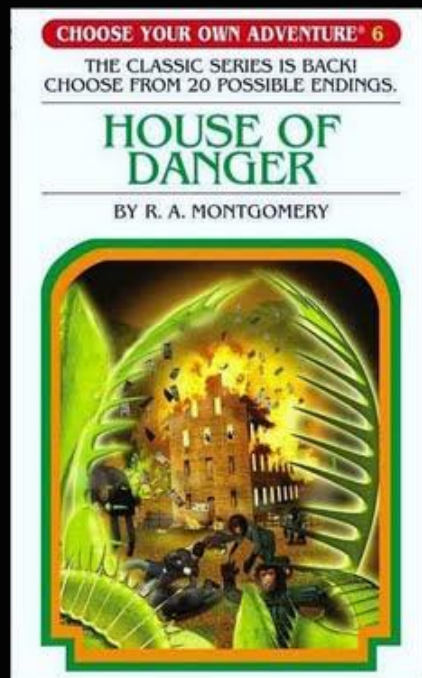
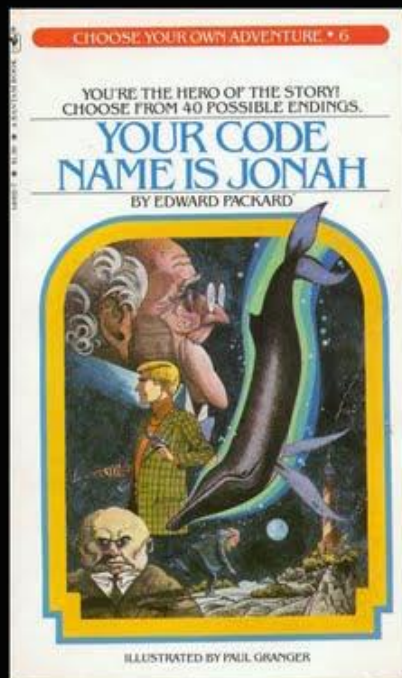
GET /profiles?page=5 HTTP/1.1

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. Also, some people are going to Warpigs to drink beer and eat ribs... maybe you should go along with them?

*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 Warpigs for ribs and beer, 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

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"
}
```

HYDRA

```
{
  @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"



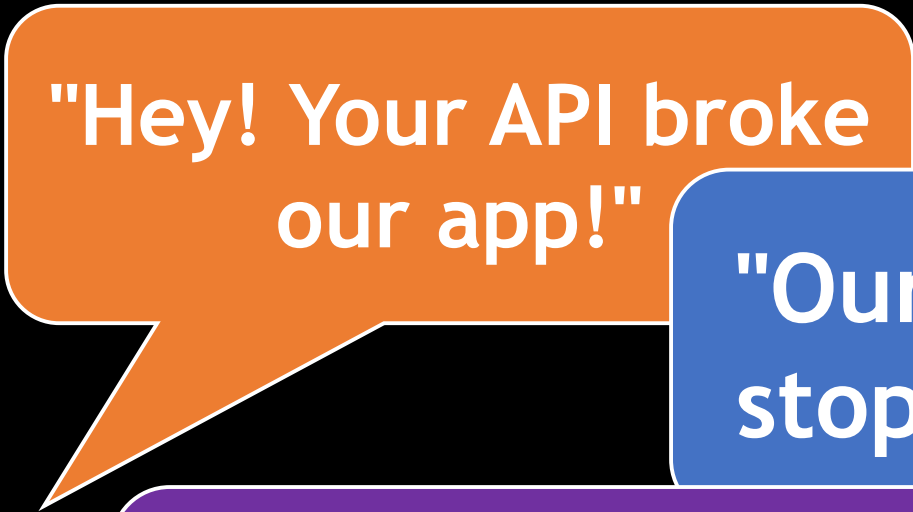
"We're replacing
hometown with
an ISO3166
country code"

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: cph

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Siteimprove