



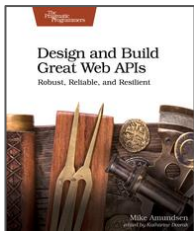
OSLC

Hypermedia Made Easy

Mike Amundsen

@mamund

youtube.com/mamund



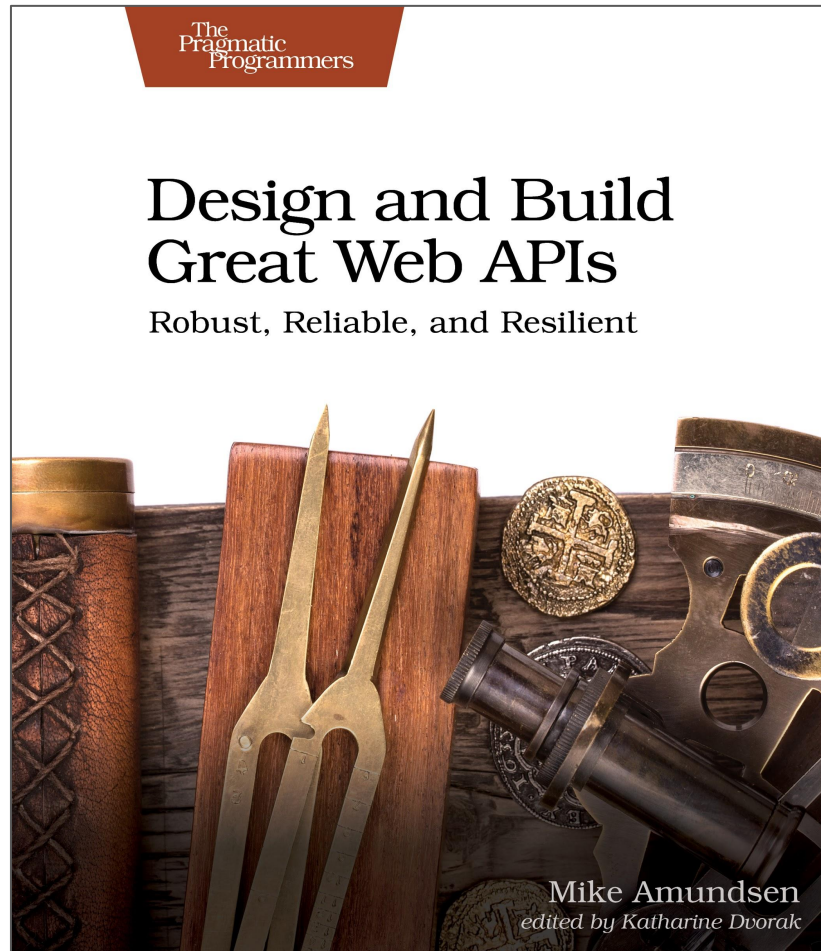
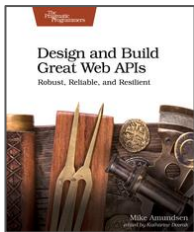


Mike Amundsen
@mamund

g.mamund.com/GreatWebAPIs

"From design to code to test to deployment, unlock hidden business value and release stable and scalable web APIs that meet customer needs and solve important business problems in a consistent and reliable manner."

-- Pragmatic Publishers (2020)

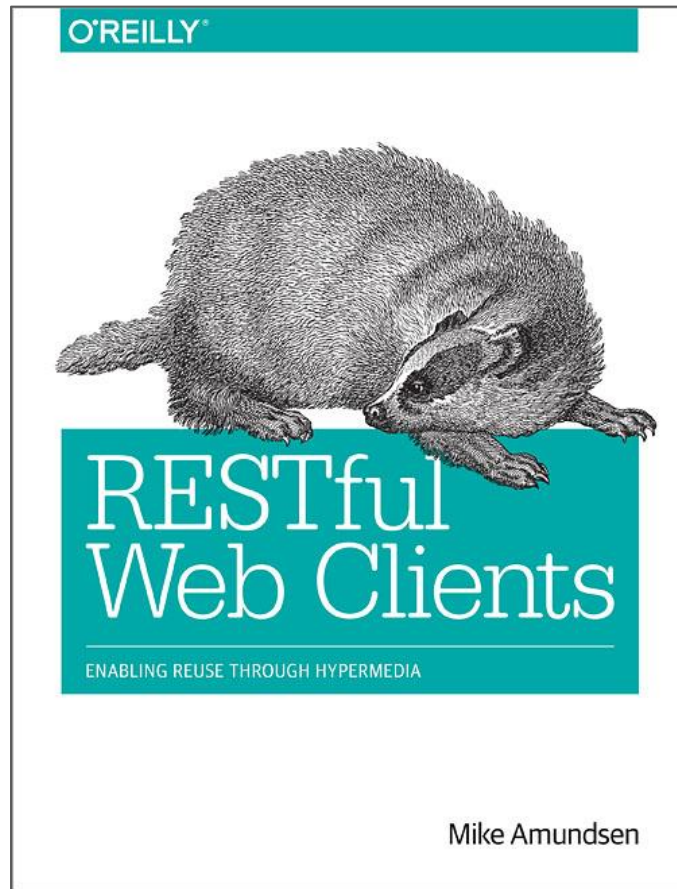
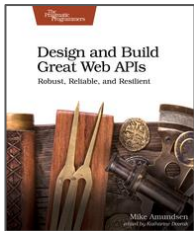


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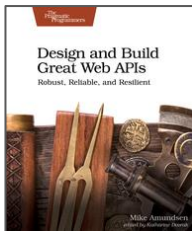
"With this practical guide, you'll learn how to move from one-off implementations to general-purpose client apps that are stable, flexible, and reusable."

-- O'Reilly Media (2017)



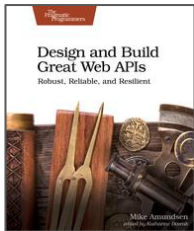
Hypermedia Made Easy : The Big Picture

- Goals
- Consumer View
- Provider View



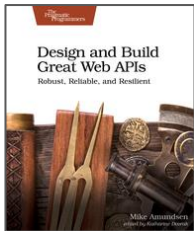


Goals



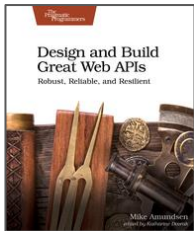
Hypermedia Made Easy : Goals

- Improve Reach
- Increase Usability
- Reduce Code



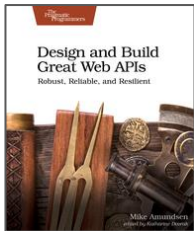
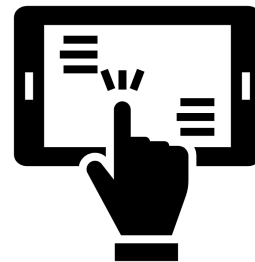
Hypermedia Made Easy : Goals

- Improve Reach
 - HTML/HTTP has massive reach; why?
 - Low barrier of entry, high utility
- Increase Usability
- Reduce Code



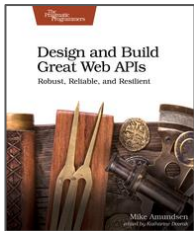
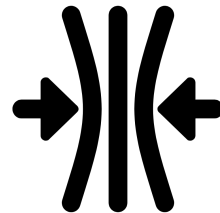
Hypermedia Made Easy : Goals

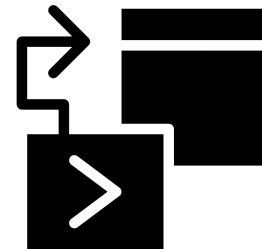
- Improve Reach
- Increase Usability
 - HTML is about documents, not content.
 - Good hypermedia design is about communication
- Reduce Code



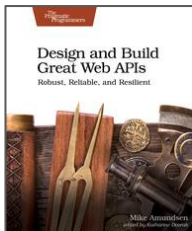
Hypermedia Made Easy : Goals

- Improve Reach
- Increase Usability
- Reduce Code
 - What is not in the message must be in the code
 - Messages are more easily shared than code



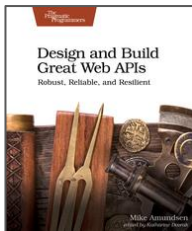
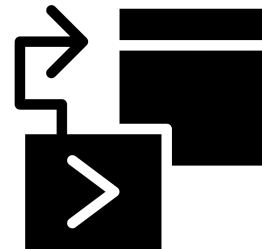


Consumer View



Hypermedia Made Easy: Consumer View

- Quick Tour of Cj
- The Cj SPA client
- Check out the code



TPS - Tasks

Not secure | rwcbook14.herokuapp.co...

HomeTasksUsersNotes

TPS - Tasks

Manage your TPS Tasks here.

You can do the following:

- Add, Edit and Delete tasks
- Mark tasks "complete", assign tasks to a user
- Filter the list by Title, Assigned User, and Completed Status

ReadEditDelete

Assign UserMark CompletedMark Active

ID	119fz7bhaho
Title	extensions
Tags	forms testing
Complete Flag	true
Assigned User	mamund

ReadEditDelete

Assign UserMark CompletedMark Active

ID	1m80s2qgs5
Title	Run client-side tests
Tags	test
Complete Flag	true
Assigned User	alice

Add Task

Title

Tags

CompleteNo ▾

Submit

Queries

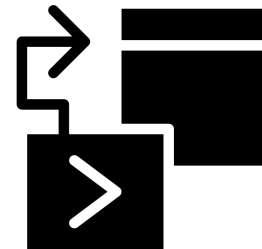
Completed Tasks

Completetrue

Submit

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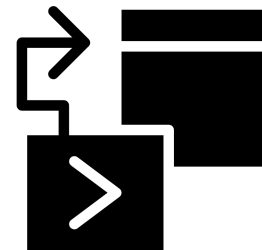
Hypermedia Made Easy: Cj Tour



```
{
  - collection: {
    version: "1.0",
    href: "//rwcbook14.herokuapp.com/task/",
    title: "TPS - Tasks",
    content: "<div class='ui segment'><h3>Manage your TPS Tasks here.
    </h3><p>You can do the following:</p><ul><li>Add, Edit and Delete
    tasks</li><li>Mark tasks 'complete', assign tasks to a user</li>
    <li>Filter the list by Title, Assigned User, and Completed
    Status</li></ul></div>",
    - links: [
      - {
        href: "http://rwcbook14.herokuapp.com/home/",
        rel: "home collection",
        prompt: "Home"
      },
      - {
        href: "http://rwcbook14.herokuapp.com/task/",
        rel: "self task collection",
        prompt: "Tasks"
      },
      + {...},
      + {...}
    ],
  },
}
```



Hypermedia Made Easy: Cj Tour

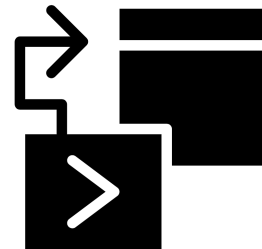


```
{
  - collection: {
    version: "1.0",
    href: "//rwcbook14.herokuapp.com/task/",
    title: "TPS - Tasks",
    content: "<div class='ui segment'><h3>Manage your TPS Tasks here.
    </h3><p>You can do the following:</p><ul><li>Add, Edit and Delete
    tasks</li><li>Mark tasks 'complete' assign tasks to a user</li>
    <li>Filter the Status</li></ul>
  - links: [
    - {
      href: "h
      rel: "ho
      prompt:
    },
    - {
      href: "h
      rel: "se
      prompt:
    },
    + {...},
    + {...}
  ],
}
```

```
- items: [
  - {
    rel: "item",
    href: "//rwcbook14.herokuapp.com/task/119fz7bhaho",
    data: [
      - {
        name: "id",
        value: "119fz7bhaho",
        prompt: "ID",
        display: "true"
      },
      - {
        name: "title",
        value: "extensions",
        prompt: "Title",
        display: "true"
      },
      - {
        name: "tags",
        value: "forms testing",
        prompt: "Tags",
        display: "true"
      },
    ],
  },
]
```



Hypermedia Made Easy: Cj Tour



```
{
  - collection: {
    version: "1.0",
    href: "//rwcbook14.herokuapp.com/task/",
    title: "TPS - Tasks",
    content: "<div class='ui segment'><h3>Manage your T
    </h3><p>You can do the following:</p><ul><li>Add, E
    tasks</li><li>Mark tasks 'complete' assign tasks to
    <li>Filter the
    Status</li></ul>
  - links: [
    - {
      href: "h
      rel: "ho
      prompt:
    },
    - {
      href: "h
      rel: "se
      prompt:
    },
    + {...},
    + {...}
  ],
}
```



+ - View source

```
},
- queries: [
  + {...},
  - {
    rel: "active search",
    href: "http://rwcbook14.herokuapp.com/task/",
    prompt: "Active Tasks",
    - data: [
      - {
        name: "completeFlag",
        value: "false",
        prompt: "Complete",
        type: "text",
        readOnly: "true"
      }
    ]
  },
  - {
    rel: "byTitle search",
    href: "http://rwcbook14.herokuapp.com/task/",
    prompt: "Search By Title",
    - data: [
      - {
        name: "title",
        value: "",
        prompt: "Title",
        type: "text"
      }
    ]
  }
],
+ {...}
}
```

```
- items: [
  - {
    rel: "item",
    href: "//rwcbook14.herokuapp.com/task/",
    - data: [
      - {
        name: "id",
        value: "119fz7bhaho",
        prompt: "ID",
        display: "true"
      },
      - {
        name: "title",
        value: "extensions",
        prompt: "Title",
        display: "true"
      },
      - {
        name: "tags",
        value: "forms testing",
        prompt: "Tags",
        display: "true"
      }
    ]
  },
  - {
    rel: "item",
    href: "//rwcbook14.herokuapp.com/task/",
    - data: [
      - {
        name: "id",
        value: "119fz7bhaho",
        prompt: "ID",
        display: "true"
      },
      - {
        name: "title",
        value: "extensions",
        prompt: "Title",
        display: "true"
      },
      - {
        name: "tags",
        value: "forms testing",
        prompt: "Tags",
        display: "true"
      }
    ]
  }
],
+ {...}
}
```

nts reserved

Robust, Reliable, and Resilient

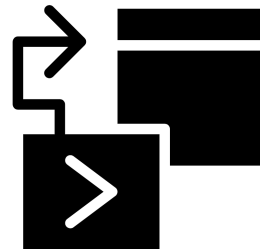
Mike Amundsen
edited by Katherine Dean

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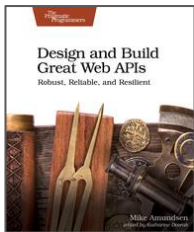
+ - [View source](#)

Hypermedia Made Easy: SPA Markup

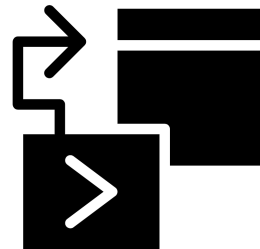


```
TPS - Tasks x view-source:rwcbbook14.herokuapp.com/files/cj-client.html
Not secure | view-source:rwcbbook14.herokuapp.com/files/cj-client.html

24 </head>
25 <body>
26   <div id="links"></div>
27   <div style="margin: 5em 1em">
28     <h1 id="title" class="ui page header"></h1>
29     <div id="content" style="margin-bottom: 1em"></div>
30     <div id="error"></div>
31     <div class="ui mobile reversed two column stackable grid">
32       <div class="column">
33         <div id="items" class="ui segments"></div>
34       </div>
35       <div class="column">
36         <div id="edit" class="ui green segment"></div>
37         <div id="template" class="ui green segment"></div>
38       </div>
39       <div id="queries-wrapper">
40         <h1 class="ui dividing header">
41           Queries
42         </h1>
43         <div id="queries"></div>
44       </div>
45     </div>
46   </div>
47
48   <div>
49     <pre id="dump"></pre>
50   </div>
51 </body>
52 </html>
53 <script src="dom-help.js"></script>
54 <script src="cj-client.js"></script>
55 <script>
56   window.onload = function() {
57     var pg = cj();
58     pg.init("/", "TPS - Task Processing System");
59   }
60 </script>
61 </html>
```



Hypermedia Made Easy: Code Tour



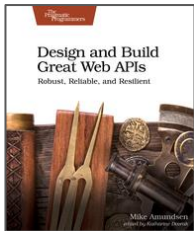
```
TPS - Tasks x rwcbook14.herokuapp.com/files x +
← → ↻ ⌂ ⓘ Not secure | rwcbook14.herokuapp.com/files/cj-client.js

function cj() {
  var d = domHelp();
  var g = {};

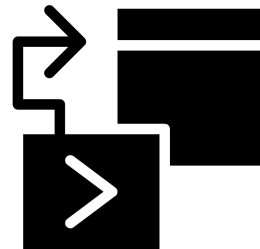
  g.url = '';
  g.cj = null;
  g.ctype = "application/vnd.collection+json";

  // init library and start
  function init(url, title) {
    if(!url || url==='') {
      alert('*** ERROR:\n\nMUST pass starting URL to the Cj library');
    }
    else {
      g.url = url;
      g.title = title||"Cj Client";
      req(g.url,"get");
    }
  }

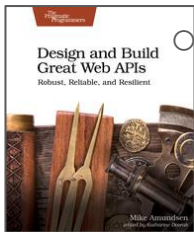
  // primary loop
  function parseCj() {
    dump();
    title();
    content();
    links();
    items();
    queries();
    template();
    error();
    cjClearEdit();
  }
}
```

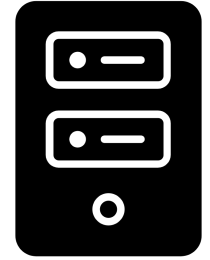


Hypermedia Made Easy: Consumer View

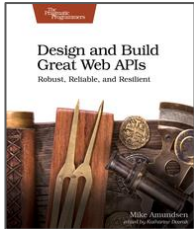


- Quick Tour of Cj
 - Highly structured message type
 - `meta, links, items, queries, template, error`
- The Cj SPA client
 - < 100 lines of semantic HTML
 - Easily styled via semantic css
- Check out the code
 - < 400 lines of JS
 - Easy to add support for extensions



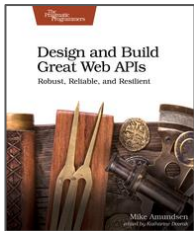
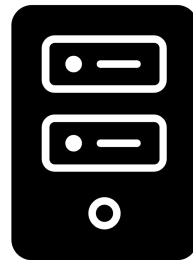


Provider View

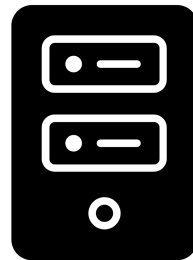


Hypermedia Made Easy: Provider View

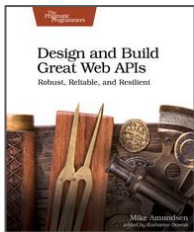
- Quick Tour of NodeJS Server
- DARRT model for implementation
- Decoupled and extensible



Hypermedia Made Easy: Top-Level NodeJS



```
26 // shared vars
27 var root      = '';
28 var port      = (process.env.PORT || 8181);
29
30 var htmlType  = "text/html";
31 var jsonType  = "application/json";
32 var halType   = "application/vnd.hal+json";
33 var wstlType  = "application/vnd.wstl+json";
34 var sirenType = "application/vnd.siren+json";
35 var cjType    = "application/vnd.collection+json";
36
37 var csType    = '';
38 var csAccept  = '';
39
40 // routing rules
41 var reRoot = new RegExp('^/$', 'i');
42 var reFile = new RegExp('^\\/files\\/.*', 'i');
43 var reHome = new RegExp('^\\/home\\/.*', 'i');
44 var reTask = new RegExp('^\\/task\\/.*', 'i');
45 var reUser = new RegExp('^\\/user\\/.*', 'i');
46 var reNote = new RegExp('^\\/note\\/.*', 'i');
47 var reWstl = new RegExp('^\\/wstl\\/.*', 'i');
48
49 // request handler
50 function handler(req, res) {
51   var segments, i, x, parts, rtn, flg, doc, url;
52 }
```



Hypermedia Made Easy: DARRT Model



```
23 function main(object, mimeType, root) {
24   var doc;
25
26   // clueless? assume JSON
27   if (!mimeType) {
28     mimeType = defaultFormat;
29   }
30
31   // dispatch to requested representor
32   switch (mimeType.toLowerCase()) {
33     case "application/vnd.wstl+json":
34       doc = wstljson(object, root);
35       break;
36     case "application/json":
37       doc = json(object, root);
38       break;
39     case "application/vnd.hal+json":
40       doc = haljson(object, root);
41       break;
42     case "application/vnd.siren+json":
43       doc = siren(object, root);
44       break;
45     case "application/vnd.collection+json":
46       doc = cj(object, root);
47       break;
48     default:
49       doc = cj(object, root);
50       break;
51   }
52 }
```

```
19 function cj(object, root) {
20   var rtn;
21
22   rtn = {};
23   rtn.collection = {};
24   rtn.collection.version = "1.0";
25
26   for(var o in object) {
27     g.tvars = {}; // clear item state
28     g.profile = utils.profile(o);
29     rtn.collection.href = root+"/"+o+"/".replace(/\//, "http://");
30     rtn.collection.title = getTitle(object[o]);
31     rtn.collection.content = getContent(object[o]);
32     rtn.collection.links = getLinks(object[o].actions);
33     rtn.collection.items = getItems(object[o], root);
34     rtn.collection.queries = getQueries(object[o].actions);
35     rtn.collection.template = getTemplate(object[o].actions);
36     rtn.collection.related = getRelated(object[o]);
37
38     // move template href to document level
39     if(rtn.collection.template && rtn.collection.template.href)
40       rtn.collection.href = rtn.collection.template.href;
41     delete rtn.collection.template.href;
42   }
43
44   // handle any error
45   if(object.error) {
46     rtn.collection.error = getError(object.error);
47   }
48
49   // send results to caller
50   return JSON.stringify(rtn, null, 2);
51 }
```

```
291 // edit task
292 trans.push({
293   name : "taskFormEditPost",
294   type : "unsafe",
295   action : "append",
296   kind : "task",
297   prompt : "Edit Task",
298   target : "item edit form post",
299   inputs : [
300     {name : "id", prompt : "ID", value : "", readOnly : true},
301     {name : "title", prompt : "Title", value : ""},
302     {name : "completeFlag", prompt : "Complete", value : "false",
303       pattern : "true|false",
304       type : "select",
305       suggest : [{value : "false", text : "No"}, {value : "true", text : "Yes"}]
306   ]
307 });
308
309 // remove task
310 trans.push({
311   name : "taskFormRemove",
312   type : "unsafe",
313   action : "remove",
314   kind : "task",
315   prompt : "Remove Task",
316   target : "item edit hal siren",
317   inputs : [
318     {name : "id", prompt : "ID", readOnly : true}
319   ]
320 });
321 }
```

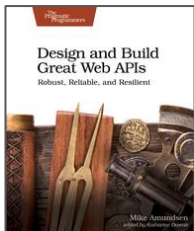


Hypermedia Made Easy: Extensibility

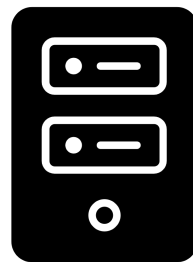
```
113 // task handler
114 try {
115     if(flag===false && reTask.test(req.url)) {
116         flag = true;
117         doc = task(req, res, parts, handleResponse);
118     }
119 }
120 catch(ex) {}
121
122 // user handler
123 try {
124     if(flag===false && reUser.test(req.url)) {
125         flag = true;
126         doc = user(req, res, parts, handleResponse);
127     }
128 }
129 catch(ex) {}
130
131 // note handler
132 try {
133     if(flag===false && reNote.test(req.url)) {
134         flag = true;
135         doc = note(req, res, parts, handleResponse);
136     }
137 }
138 catch(ex) {}
139
```

```
100 function updateTask(elm, id, task, props) {
101     var rtn, check, item;
102
103     check = storage(elm, 'item', id);
104     if(check===null) {
105         rtn = utils.exception("File Not Found", "No record on file", 404);
106     }
107     else {
108         item = check;
109         item.id = id;
110         item.tags = (task.tags===undefined?check.tags:task.tags);
111         item.title = (task.title===undefined?check.title:task.title);
112         item.assignedUser = (task.assignedUser===undefined?check.assignedUser:task.assignedUser);
113         item.completeFlag = (task.completeFlag===undefined?check.completeFlag:task.completeFlag);
114         if (item.title === "") {
115             rtn = utils.exception("Missing Title");
116         }
117         else {
118             storage(elm, 'update', id, utils.setProps(item, props));
119         }
120     }
121
122     return rtn;
123 }
124
125 function removeTask(elm, id) {
126     var rtn, check;
127
128     check = storage(elm, 'item', id);
129     if(check===null) {
130         rtn = utils.exception("File Not Found", "No record on file", 404);
131     }
132     else {
133         storage(elm, 'remove', id);
134     }
135 }

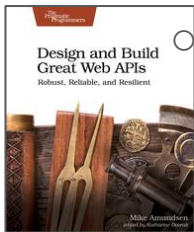
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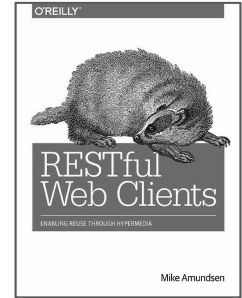


Hypermedia Made Easy: Provider View

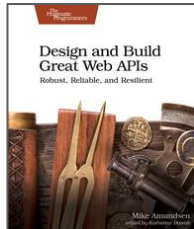


- Quick Tour of NodeJS Server
 - Relies on representer pattern for responses
 - Common internal model, negotiated external message formats
- DARRT model for implementation
 - Data, Action, Resource, Representation, Transitions
 - DA are internal RRT are external
- Decoupled and extensible
 - Internal and external models are loosely coupled
 - Easy to add support for new objects (internal) and messages (external)



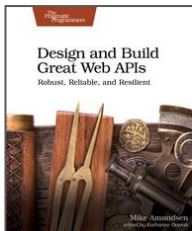


And So ...



Hypermedia Made Easy

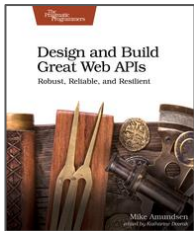
- Goals
- Consumer View
- Provider View



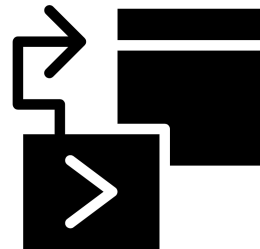
Hypermedia Made Easy



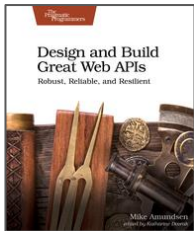
- Goals
 - Extend reach through structured messages
 - More in the message means less in the code
- Consumer View
- Provider View



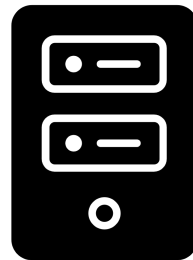
Hypermedia Made Easy



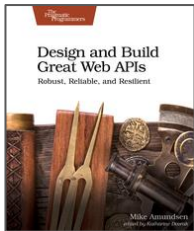
- Goals
- Consumer View
 - Clients are tightly bound to messages, not content
 - Easy to extend as features are added to the message model
- Provider View



Hypermedia Made Easy



- Goals
- Consumer View
- Provider View
 - DARRT model for server implementation
 - Decouple internal models (DA) from external models (RRT)

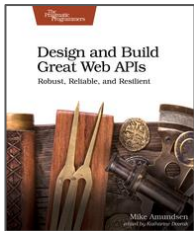


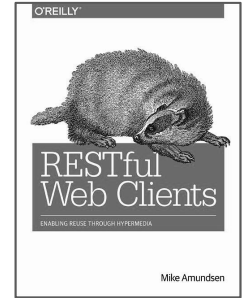
Hypermedia Made Easy : Futures



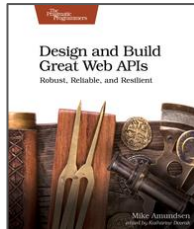
We need more ...

- Highly structured message models (media types)
- Generic clients (no code, just messages)
- Negotiated vocabularies (ALPS)
- Runtime discovery (openDISCO)



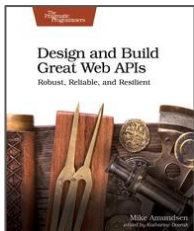


That's all there is!



Resources

- "Design and Build Great Web APIs"
`g.mamund.com/greatwebapis`
- "RESTful Web Clients"
`g.mamund.com/rwcbook`
- This talk (slides, links, etc.)
`g.mamund.com/2020-05-oslcfest`





OSLC

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