RESTful Clojure

Siva Jagadeesan

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“I am getting frustrated by the number of people calling any HTTP-based interface a REST API”

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“I am getting frustrated by the number of people calling any HTTP-based interface a REST API”

Roy T. Fielding

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“I am getting frustrated by the number of people calling any HTTP-based interface a REST API”

Roy T. Fielding

Introduced and defined REST

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"so-called REST APIs ... choose some other buzzword for your API."

Roy T. Fielding

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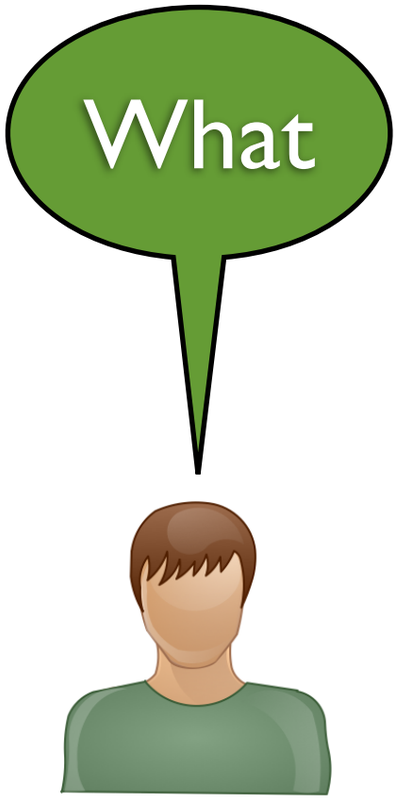

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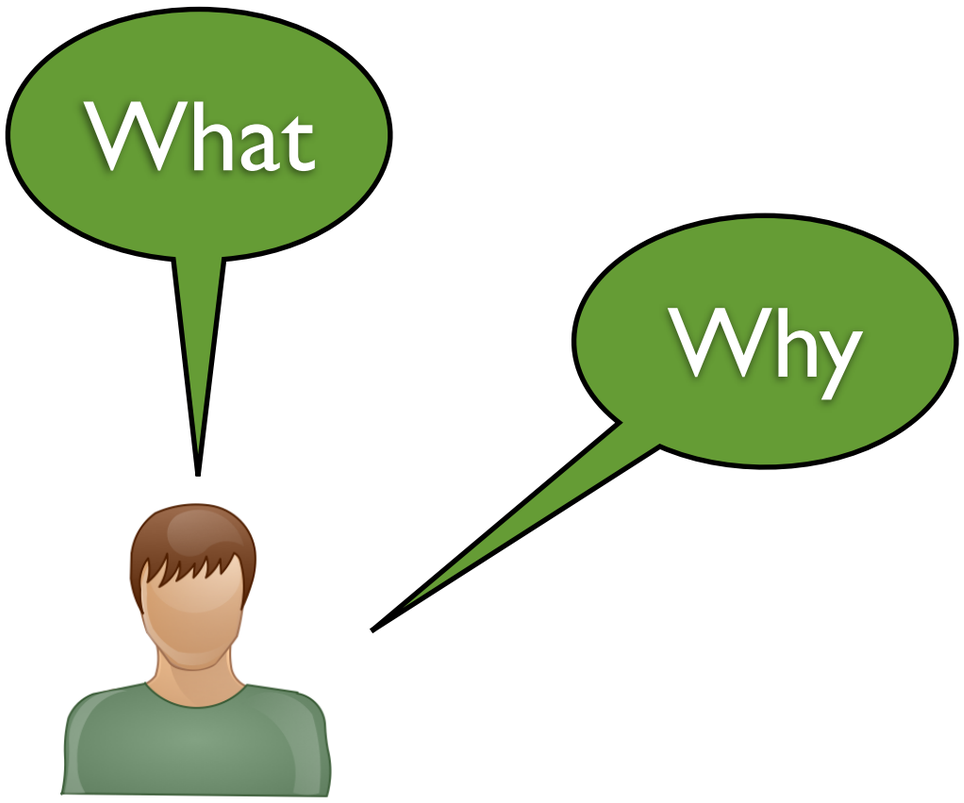

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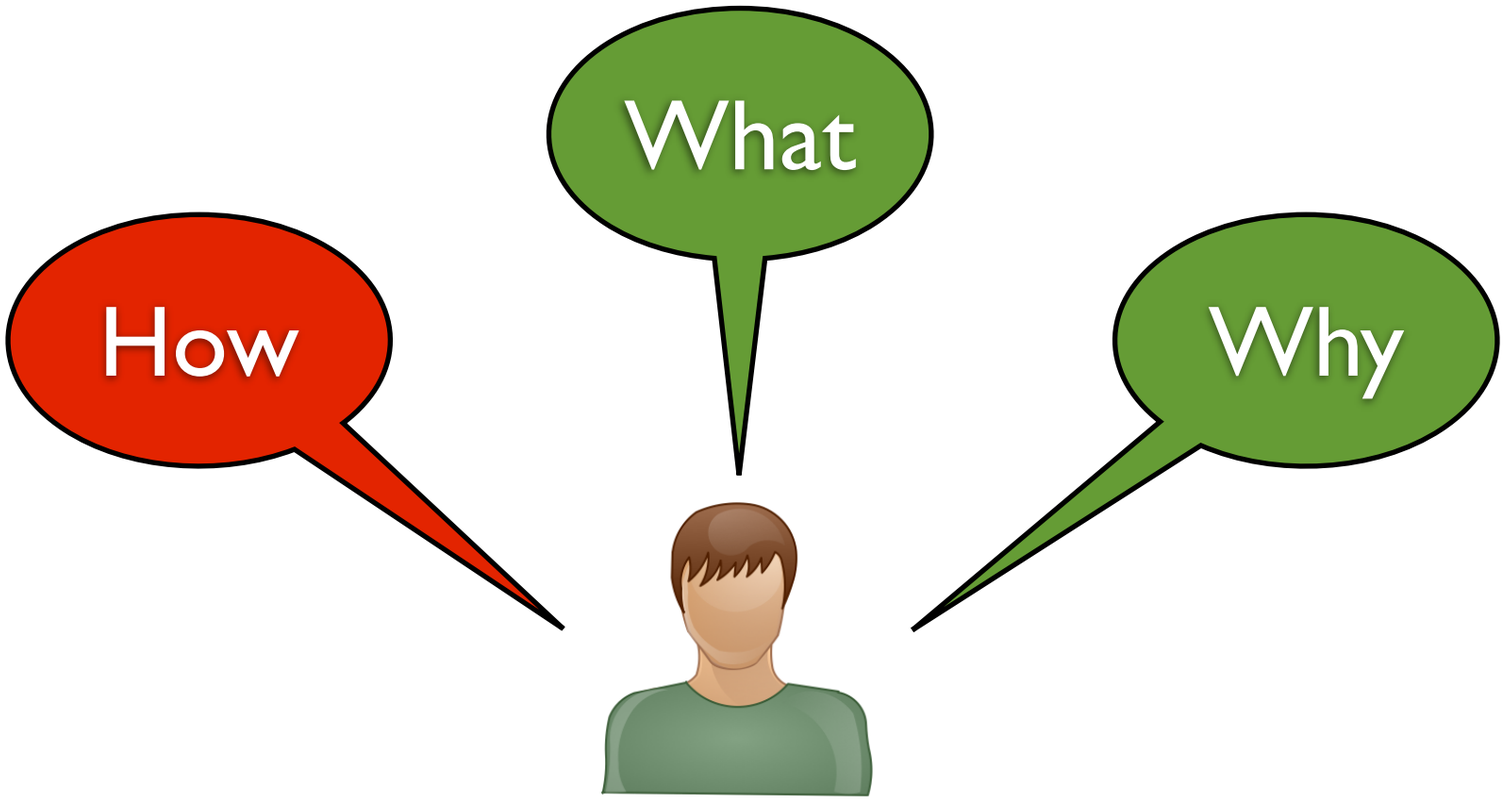

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Who am I?

Siva Jagadeesan

Interests

- Clojure
- REST
- Datomic
- Continuous Deployment
- TDD
- Startups

About Me

- Founder & CTO, Zolo Labs Inc
- Director of Engineering, Runa Inc
- @sivajag
- siva@zololabs.com
- http://blog.zololabs.com
- http://techbehindtech.com

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- first product from Zolo Labs
- Your digital assistant
- helps with professional networking and relationships
- *(and personal ones too!)*

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Example App

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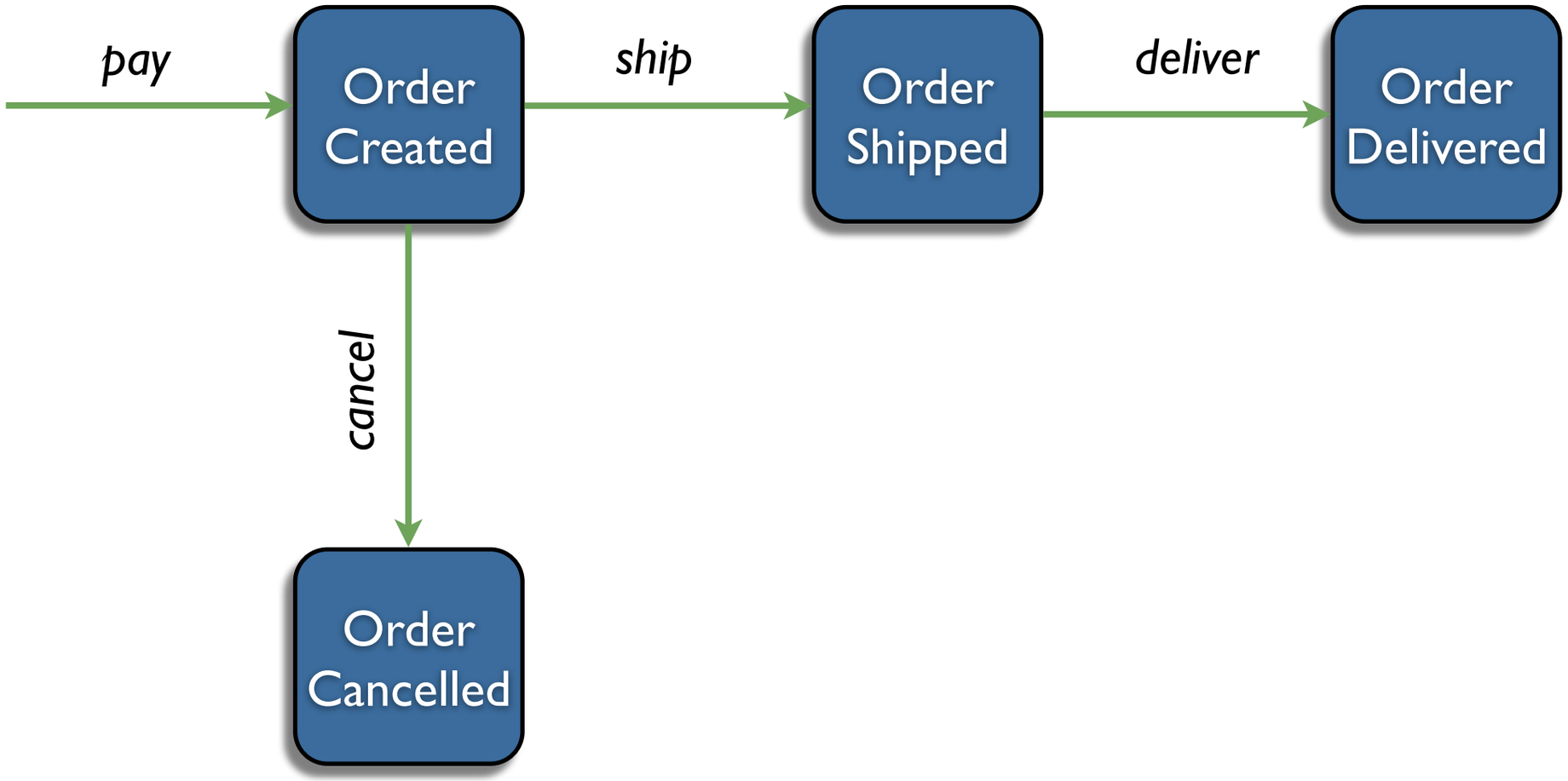
Order State Flow



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OMS

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Goals

- Maintainable
- Scalable
- Recoverable
- Loosely Coupled
- Secure

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Goals

- Maintainable
- Scalable
- Recoverable
- Loosely Coupled
- ~~Secure~~

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Lets build ...

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API v1.0

- GET **/api**?action=create_order&products=p1,p2
- GET **/api**?action=list_orders
- GET **/api**?action=view_order&order_id=o1
- GET **/api**?action=cancel_order&order_id=o1

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API v1.0 - core

```
(defroutes application-routes

  (GET "/api" [action & params] (web/json-response (api/perform action params)))

  (route/not-found "Page not found"))
```

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API v1.0 - api

```
(defn perform [action params]
  (condp = (keyword action)
    :create_order (order/create-order params)
    :list_orders (order/find-all)
    :view_order (order/find-order (:order_id params))
    :cancel_order (order/delete (:order_id params))))
```

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API v1.0
Use Cases

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List Orders

```
(clj-http.client/get "http://localhost:4000/api" {:query-params {"action" "list_orders"}
                                                  :as :json})
```

```
{:body
 [{:status "PAID", :products ["p1" "p2" "p3"], :id "1"}
  {:status "DELIVERED", :products ["p3" "p6" "p9"], :id "3"}
  {:status "SHIPPED", :products ["p2" "p4" "p6"], :id "2"}],
 :status 200}
```

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Find Existing Order

```
(clj-http.client/get "http://localhost:4000/api" {:query-params {"action" "view_order"
                                                                 "order_id" "1"}
                                                  :as :json})
```

```
{:body {:status "PAID", :products ["p1" "p2" "p3"], :id "1"},
 :status 200}
```

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Cancel Order

```
(clj-http.client/get "http://localhost:4000/api" {:query-params {"action" "cancel_order"
                                                                 "order_id" "1"}
                                                  :as :json})
```

```
{:body {}, :status 200}
```

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Find Cancelled Order

```
(clj-http.client/get "http://localhost:4000/api" {:query-params {"action" "view_order"
                                                                 "order_id" "1"}
                                                  :as :json})
```

```
{:body {:error "Order is not present with given ID"}, :status 200}
```

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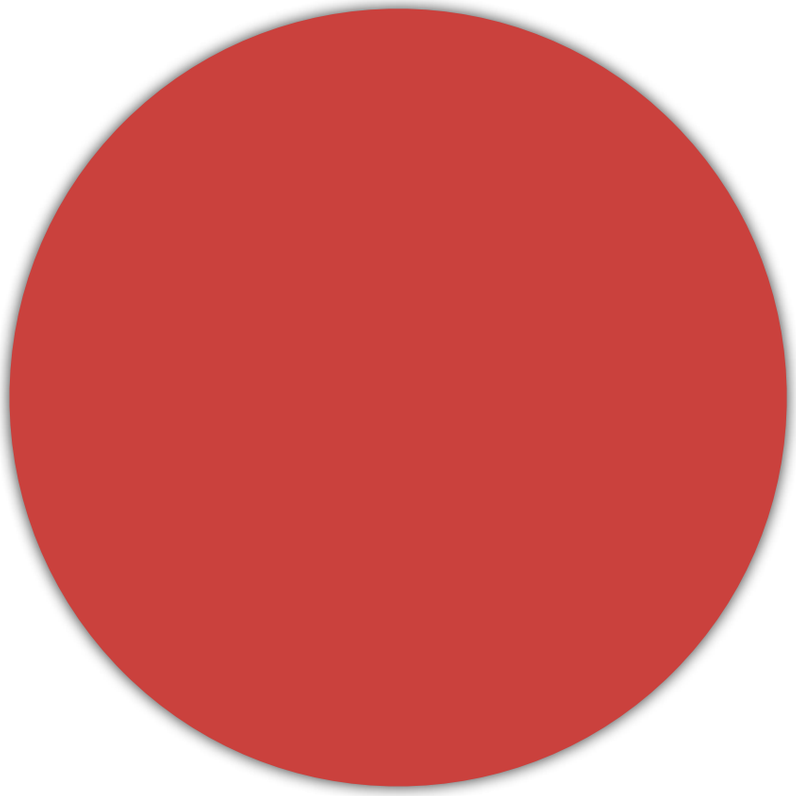
API v1.0
Goals Reached?

- Maintainable
- Scalable
- Recoverable
- Loosely Coupled



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API v1.0
Goals Reached?

- Maintainable
- Scalable
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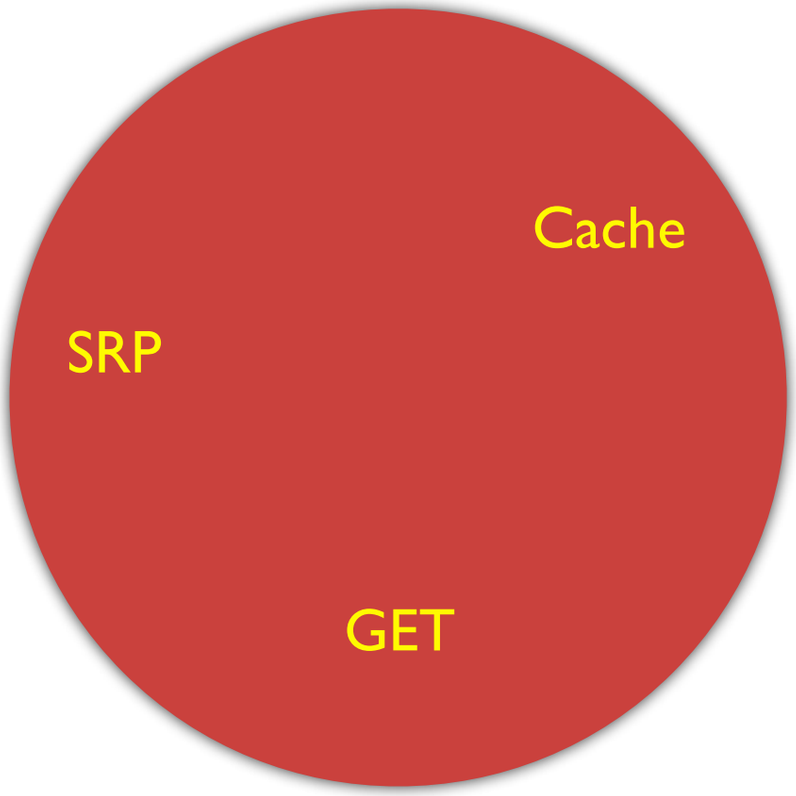

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Improving API v1.0

Single URI

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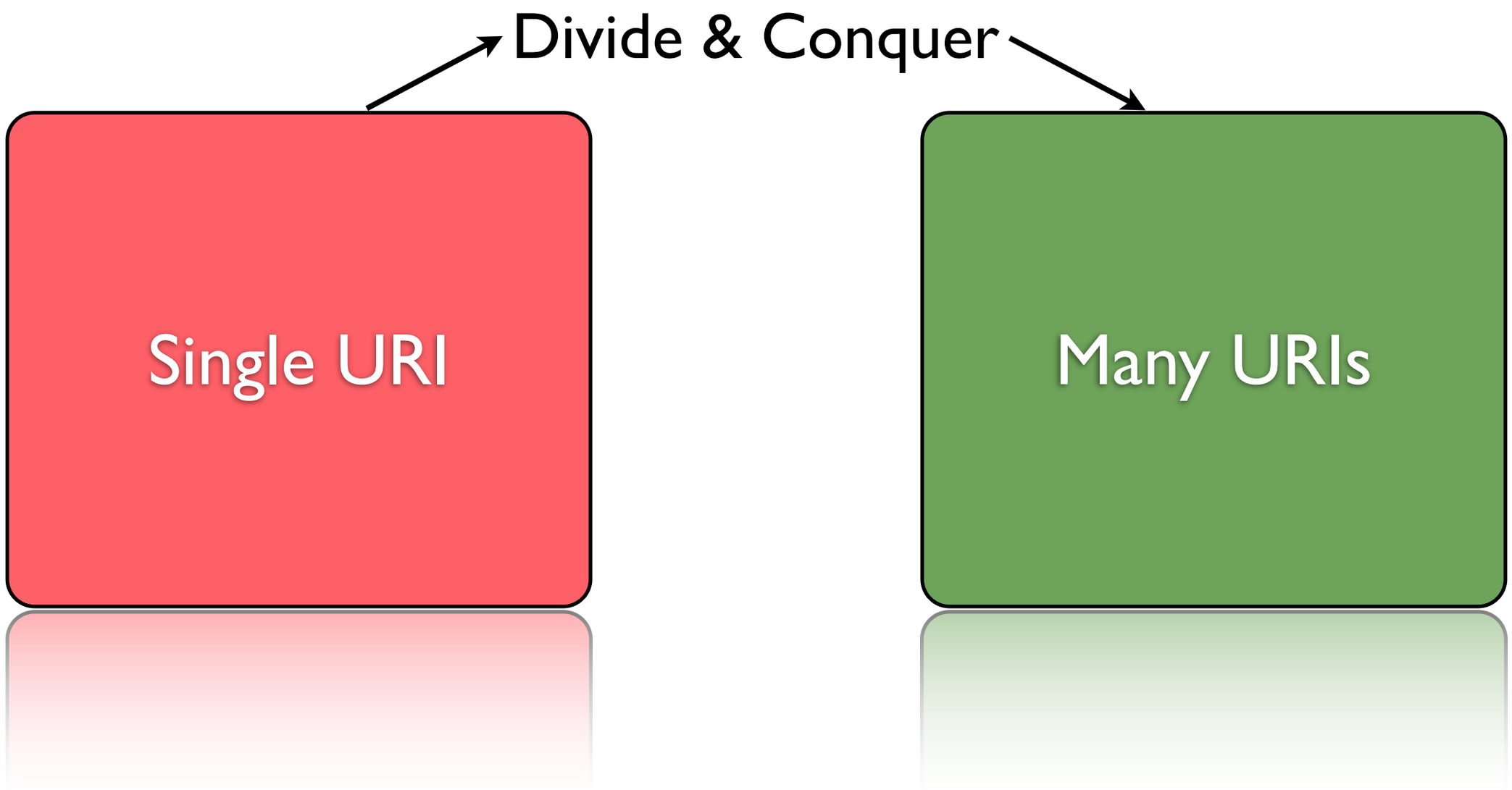
Improving API v1.0



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Lets build v2.0

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API v2.0

- GET **/create_order**?products=p1,p2,p3
- GET **/list_orders**
- GET **/view_order**?order_id=o1
- GET **/cancel_order**?order_id=o1

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API v2.0 - core

```
(defroutes application-routes

  (GET "/create_order" [params] (web/json-response (api/create-order params)))

  (GET "/list_orders" [params] (web/json-response (api/list-orders)))

  (GET "/view_order/:order-id" [order-id] (web/json-response (api/view-order order-id)))

  (GET "/cancel_order/:order-id" [order-id] (web/json-response (api/cancel-order order-id)))

  (route/not-found "Page not found"))
```

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API v2.0 - api

```
(defn create-order [params]
  (order/create-order params))

(defn list-orders []
  (order/find-all))

(defn view-order [id]
  (order/find-order id))

(defn cancel-order [id]
  (order/delete id))
```

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API v2.0
Use Cases

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Find Existing Order

```
(clj-http.client/get "http://localhost:4000/view_order/1" {:as :json})
```

```
{:body {:status "PAID", :products ["p1" "p2" "p3"], :id "1"},
 :status 200}
```

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Cancel Order

```
(clj-http.client/get "http://localhost:4000/cancel_order/1" {:as :json})
```

```
{:body {}, :status 200}
```

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Find Cancelled Order

```
(clj-http.client/get "http://localhost:4000/view_order/1" {:as :json})
```

```
{:body {:error "Order is not present with given ID"}, :status 200}
```

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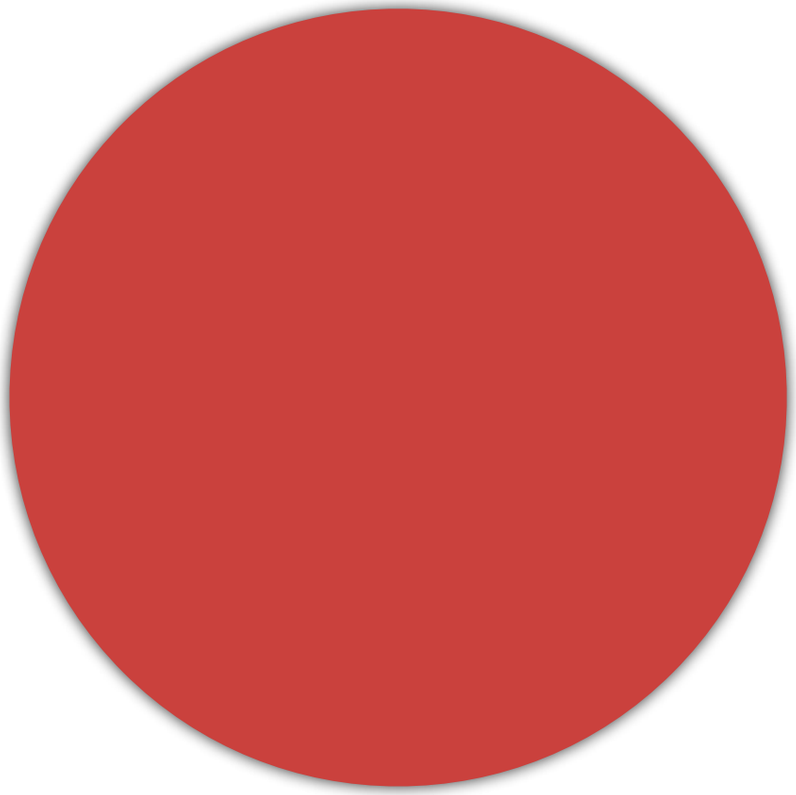
API v2.0
Goals Reached?

- Maintainable
- Scalable
- Recoverable
- Loosely Coupled



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API v2.0
Goals Reached?

- Maintainable
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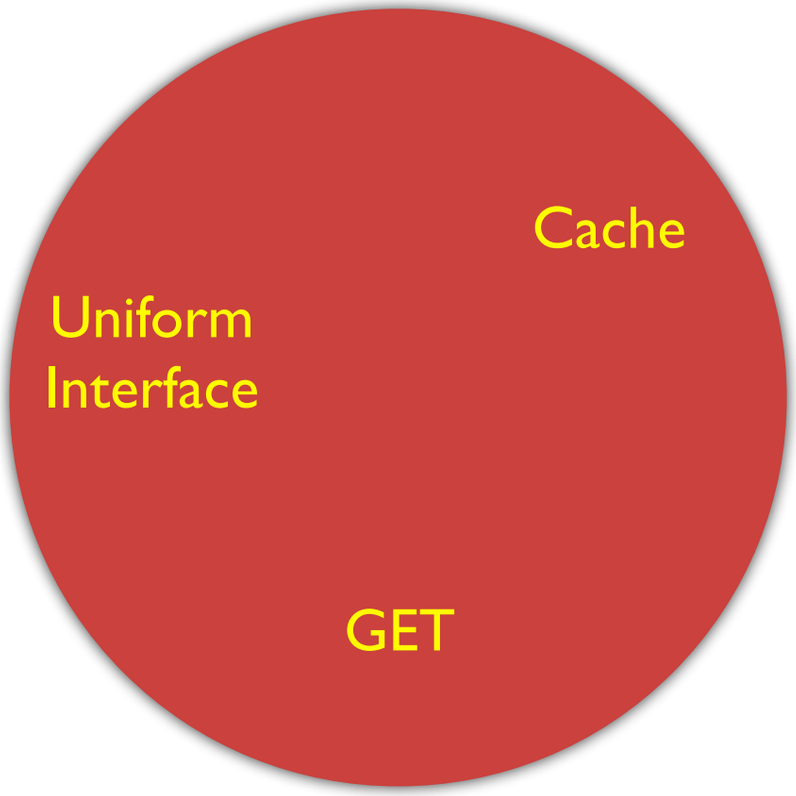

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Find Cancelled Order

```
(clj-http.client/get "http://localhost:4000/view_order/1" {:as :json})
```

```
{:body {:error "Order is not present with given ID"}, :status 200}
```

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Cancel Order

```
(clj-http.client/get "http://localhost:4000/cancel_order/1" {:as :json})
```

```
{:body {}, :status 200}
```

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Improving API v2.0

URI encode
Operations

No uniform interface

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Improving API v2.0

Do the same things
the same way

URI encode
Operations

No uniform interface

URIs

HTTP Status code

HTTP verbs

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Lets build v3.0

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API v3.0

- POST **/orders**
- GET **/orders**
- GET **/orders**/{order_id}
- DELETE **/orders**/{order_id}

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HTTP Status Codes

1xx - Metadata

2xx – Success

3xx – Redirection

4xx – Client error

5xx – Server error

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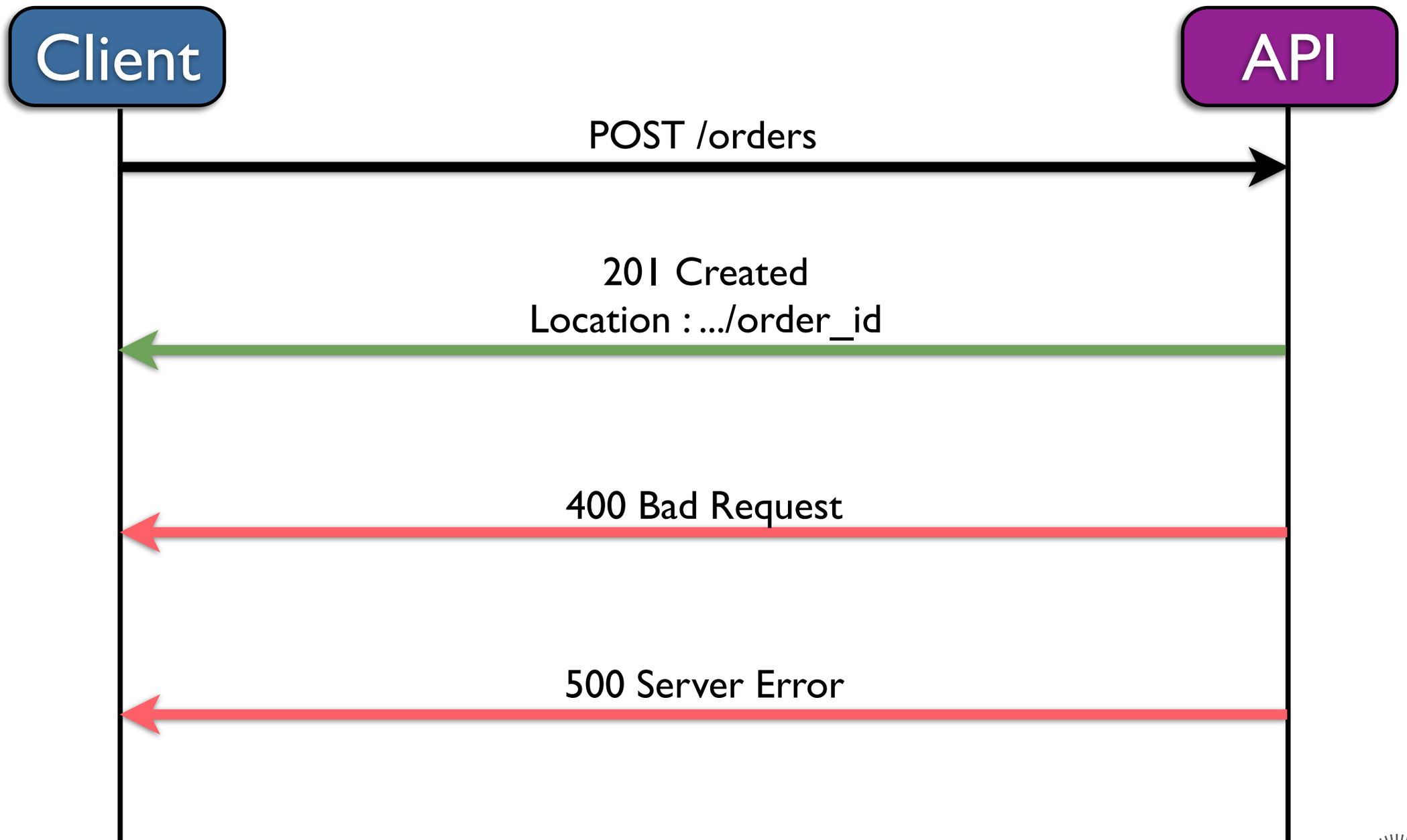
HTTP verbs
Create with POST



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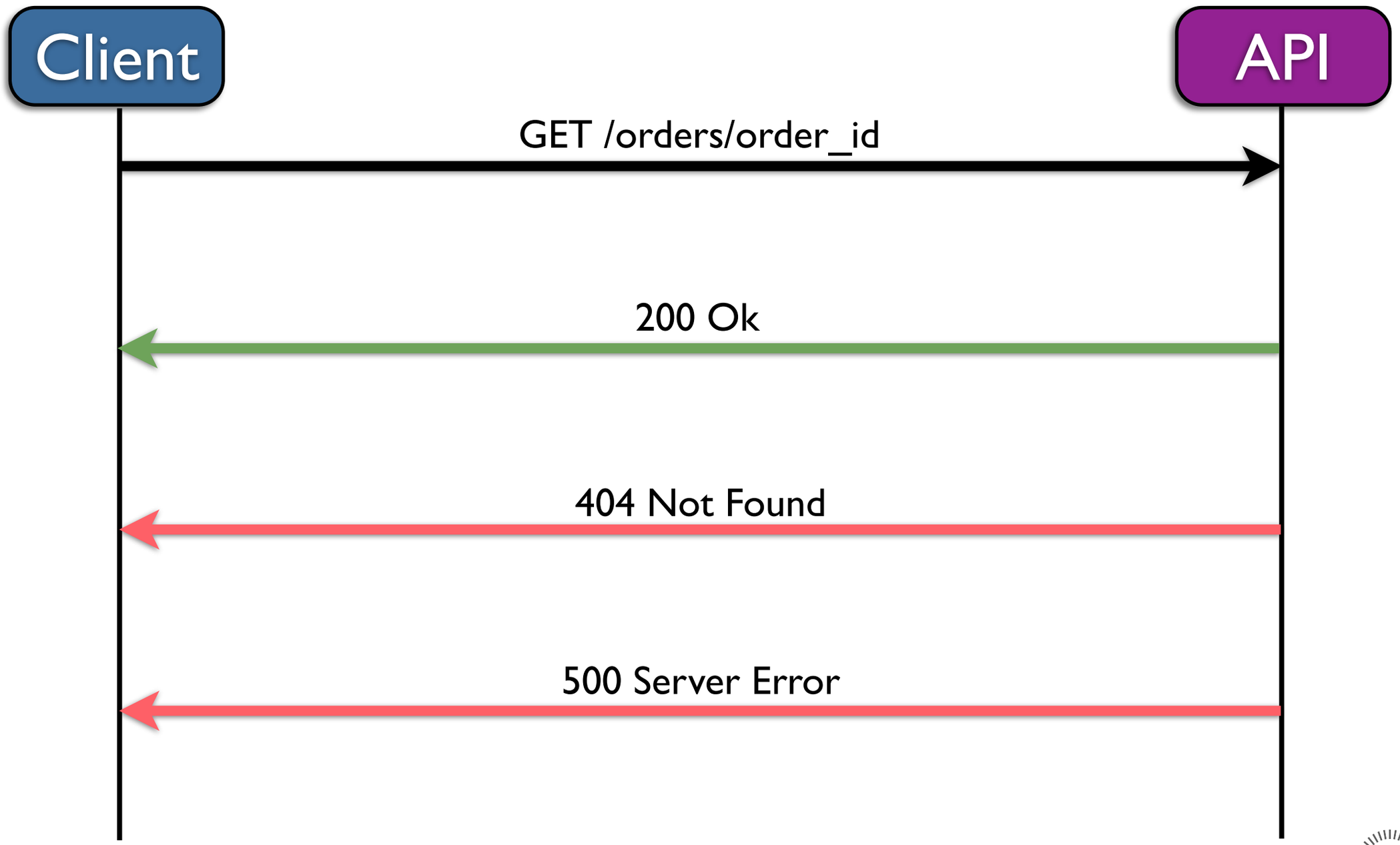
HTTP verbs
Read with GET



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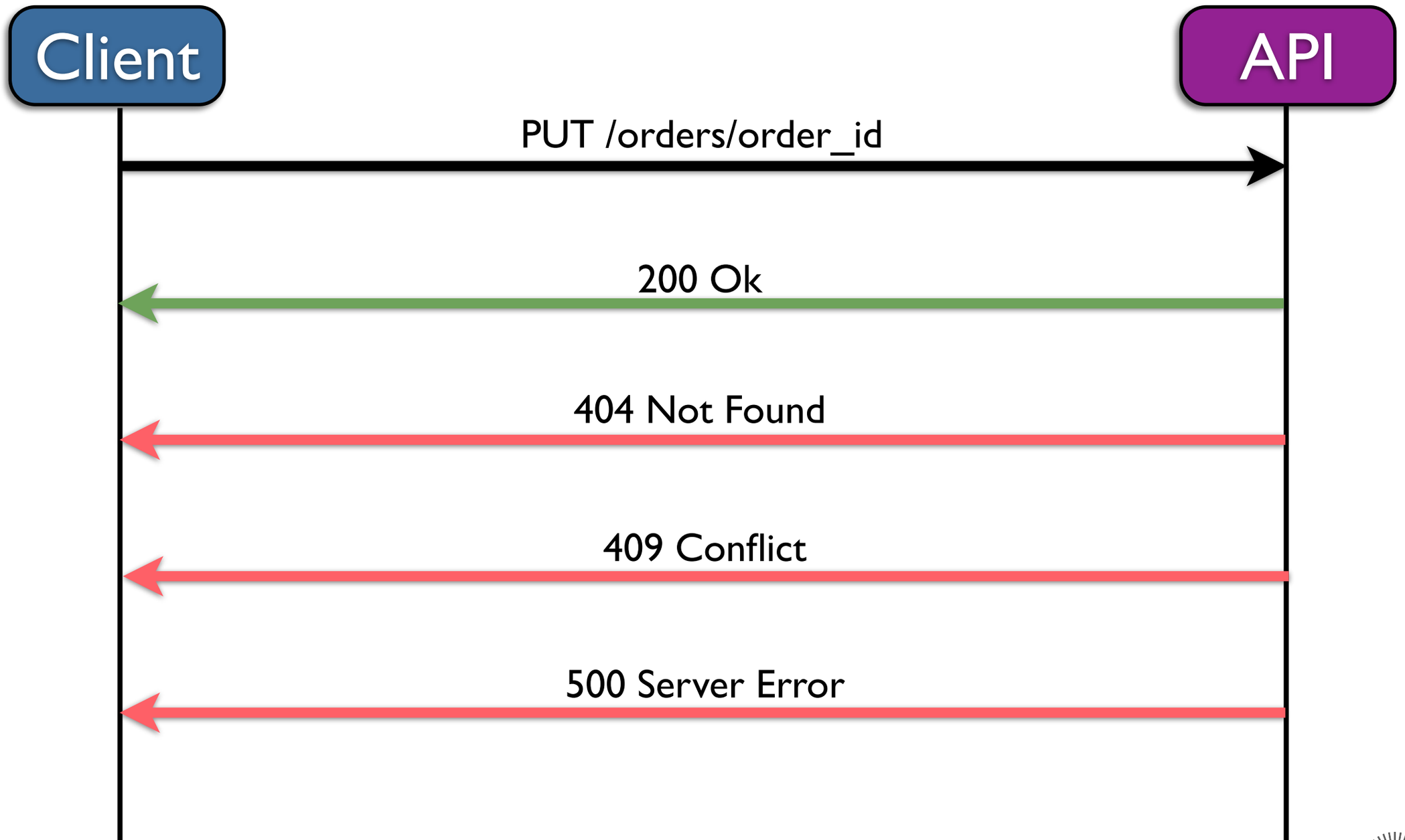
HTTP verbs
Update with PUT



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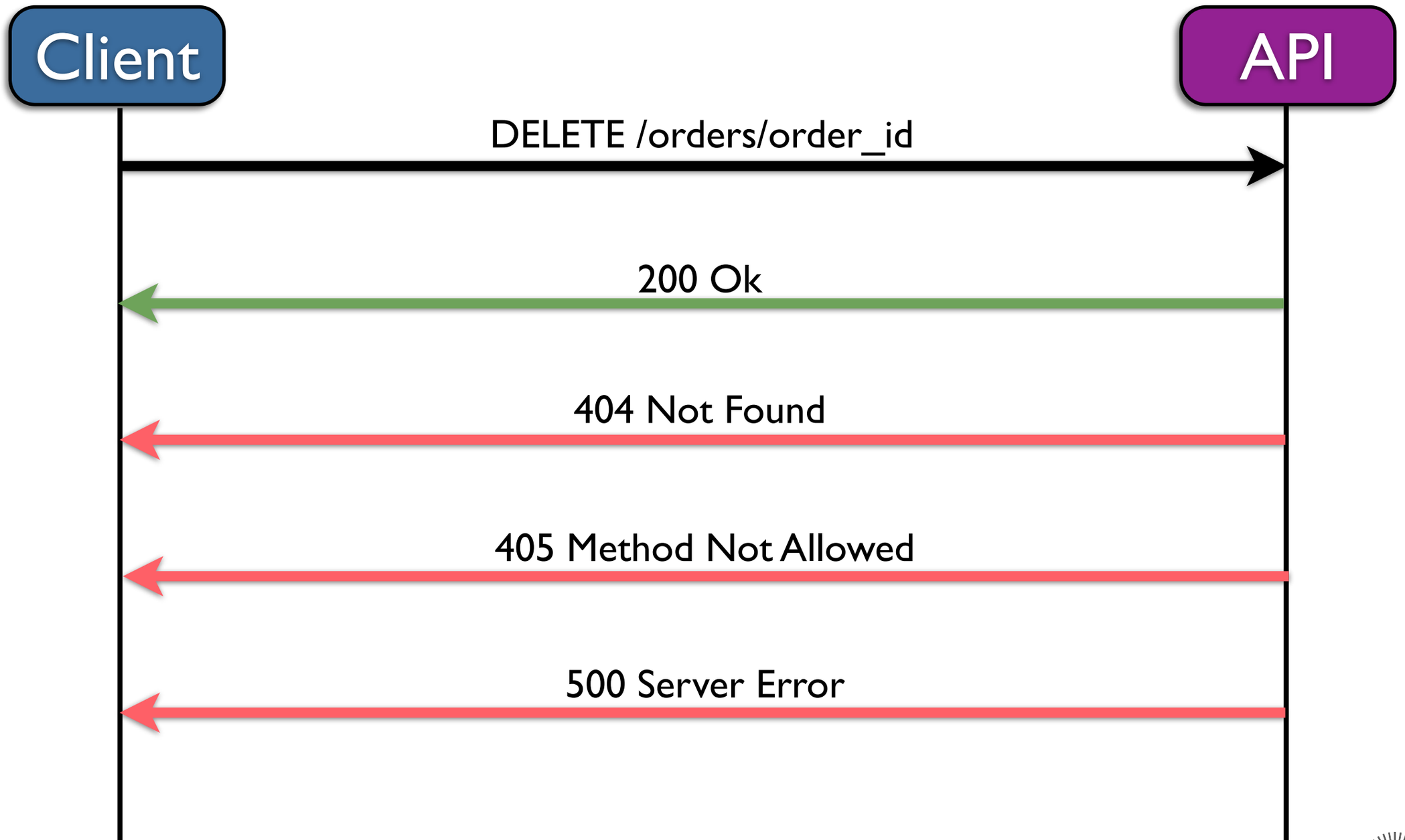
HTTP verbs
Remove with DELETE



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API v3.0 - core

```
(defroutes application-routes
  (POST "/orders" [params] (api/create-order params))
  (GET "/orders" [params] (web/json-response (api/list-orders)))
  (GET "/orders/:order-id" [order-id] (web/json-response (api/view-order order-id)))
  (DELETE "/orders/:order-id" [order-id] (web/json-response (api/cancel-order order-id)))
  (route/not-found "Page not found"))
```

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API v3.0 - middleware

```
(defn wrap-error-handling [handler]
  (f [request]
    (try+
     (handler request)
     (catch [:type :not-found] e
       (error-response e 404))
     (catch [:type :bad-request] e
       (error-response e 400))
     (catch [:type :method-not-allowed] e
       (error-response e 405))
     (catch Exception e
       (json-response {:error (.getMessage e)} 500))))))
```

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API v3.0 - api

```
(defn create-order [params]
  (let [o (order/create-order params)]
    {:status 201
     :headers {"Content-Type" "application/json; charset=utf-8"
               "Location " (order-url o)}
     :body {}}))

(defn list-orders []
  (order/find-all))

(defn view-order [id]
  (order/find-order id))

(defn cancel-order [id]
  (order/delete id))
```

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Clojure Libraries

- liberator
- bishop
- https://github.com/zololabs/

API v3.0
Use Cases

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Find Existing Order

```
(clj-http.client/get "http://localhost:4000/orders/1" {:as :json})
```

```
{:body {:status "PAID", :products ["p1" "p2" "p3"], :id "1"},
 :status 200}
```

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Cancel Order

```
(clj-http.client/delete "http://localhost:4000/orders/1" {:as :json})
```

```
{:body {}, :status 200}
```

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Find Cancelled Order

```
(clj-http.client/get "http://localhost:4000/orders/1" {:as :json})
```

```
{:body "{\"error\":\"Order is not present with given ID\"}",
 :status 404}
```

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Cancel Shipped Order

```
(clj-http.client/delete "http://localhost:4000/orders/2" {:as :json})
```

```
{:body "{\"error\":\"Order is already SHIPPED\"}", :status 405}
```

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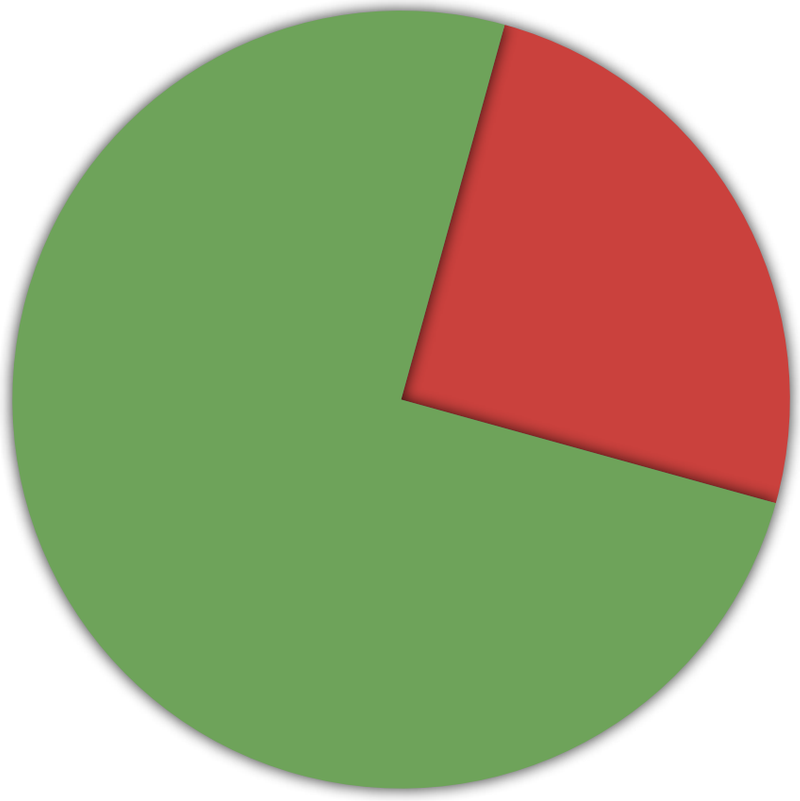
API v3.0
Goals Reached?

- Maintainable
- Scalable
- Recoverable
- Loosely Coupled



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API v3.0

Is this RESTful?

- POST /orders
- GET /orders
- GET /orders/{order_id}
- DELETE /orders/{order_id}

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API v3.0

Is this RESTful?

- POST /orders
- GET /or
- GET /or
- DELETE /orders/{order_id}

NO!

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I don't care about buzzwords

API v3 is a good design

I am here to provide business value

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The Other Side

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TimeLine

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TimeLine

API v1.0

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TimeLine

API v1.0

Client v1

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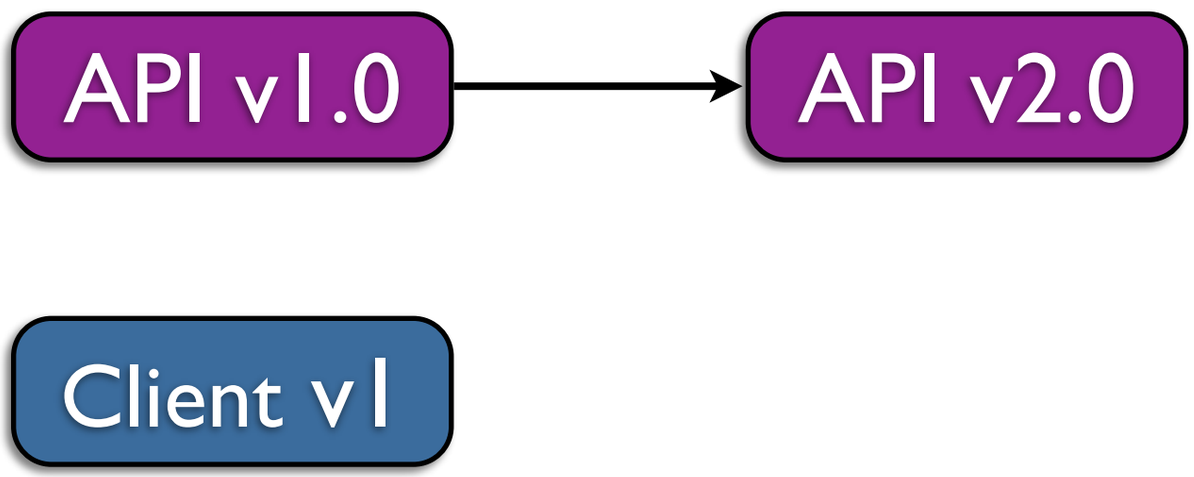
TimeLine



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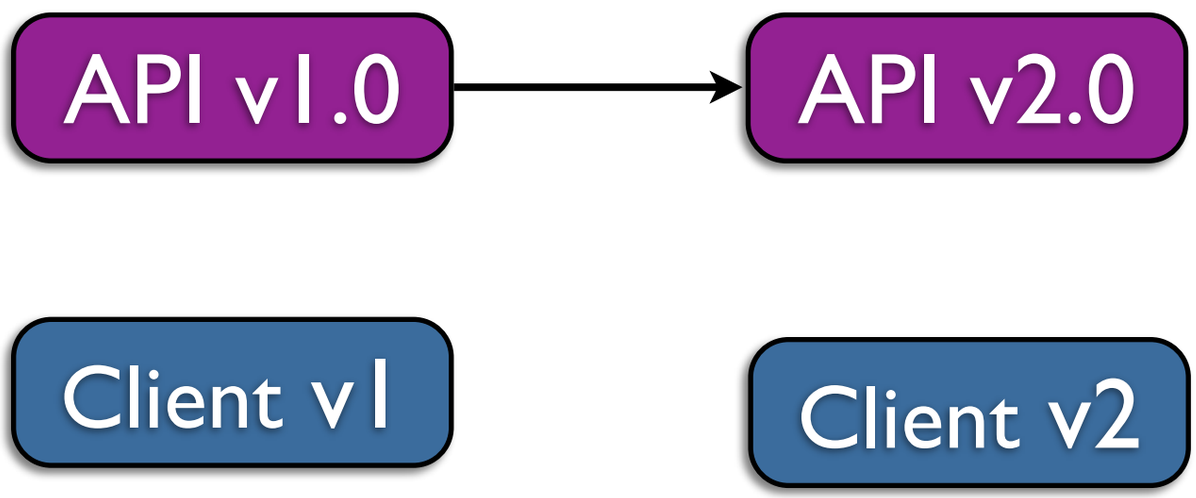
TimeLine



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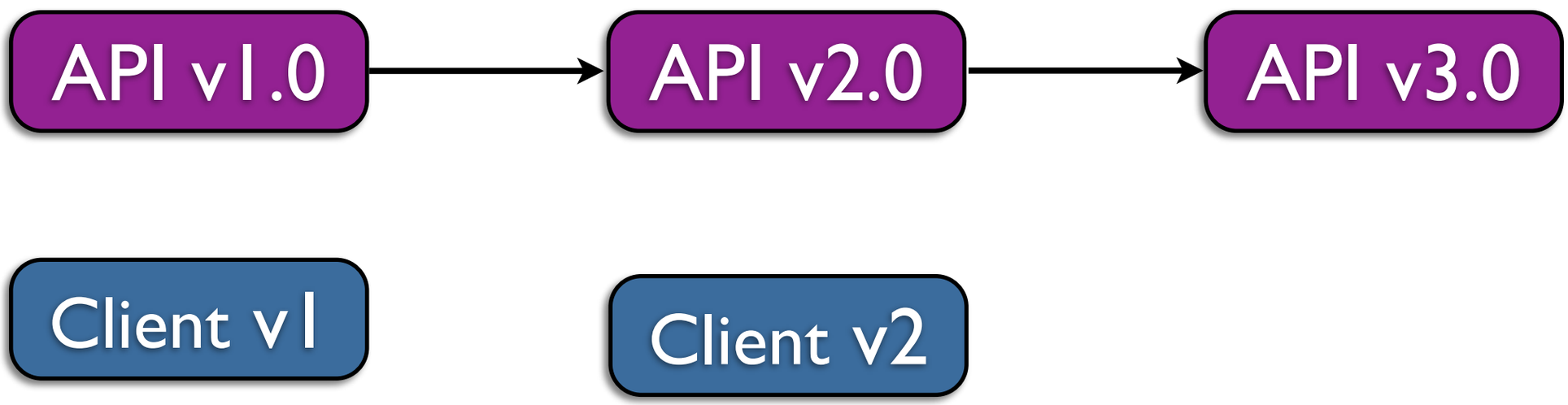
TimeLine



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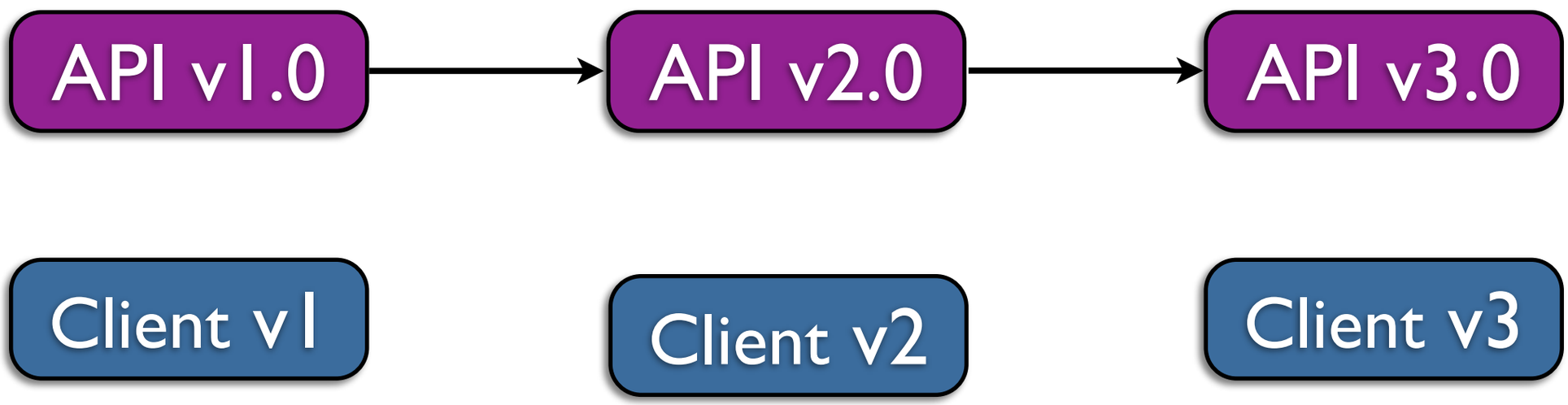
TimeLine



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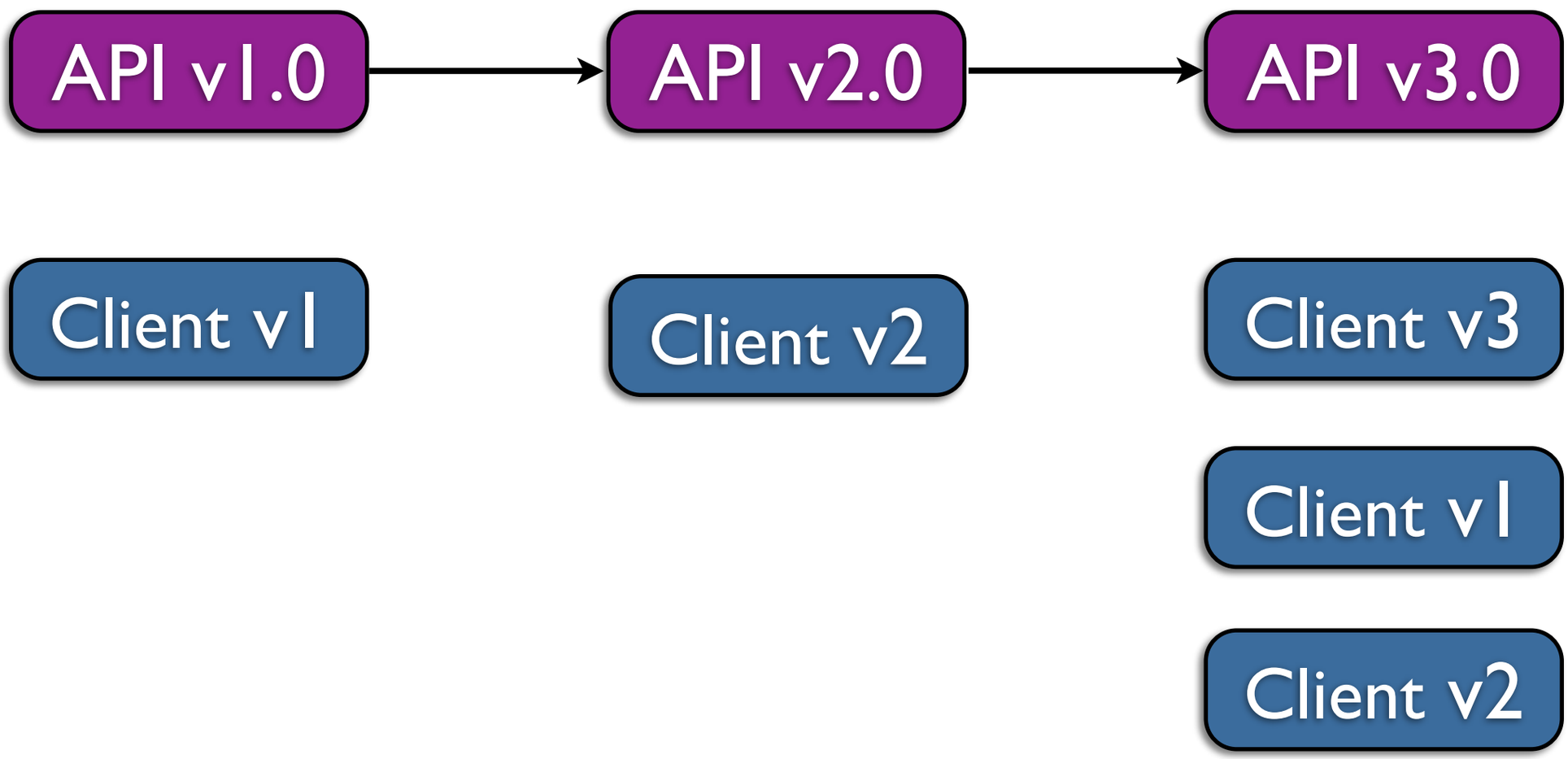
TimeLine



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API v3.0

- POST **/orders**
- GET **/orders**
- GET **/orders**/{order_id}
- DELETE **/orders**/{order_id}

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API v3.0

- GET /api?action=create_order&products=p1,p2,p3
- GET /api?action=list_orders
- GET /api?action=view_order&order_id=o1
- GET /api?action=cancel_order&order_id=o1
- GET /create_order?products=p1,p2,p3
- GET /list_orders
- GET /view_order?order_id=o1
- GET /cancel_order?order_id=o1
- POST /orders
- GET /orders
- GET /orders/{order_id}
- DELETE /orders/{order_id}

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This is a dumb argument, Siva

We would have started in v3.0 ... so we won't have this problem

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This is a dumb argument, Siva

You still can't evolve this API

We would have started in v3.0 ... so we won't have this problem

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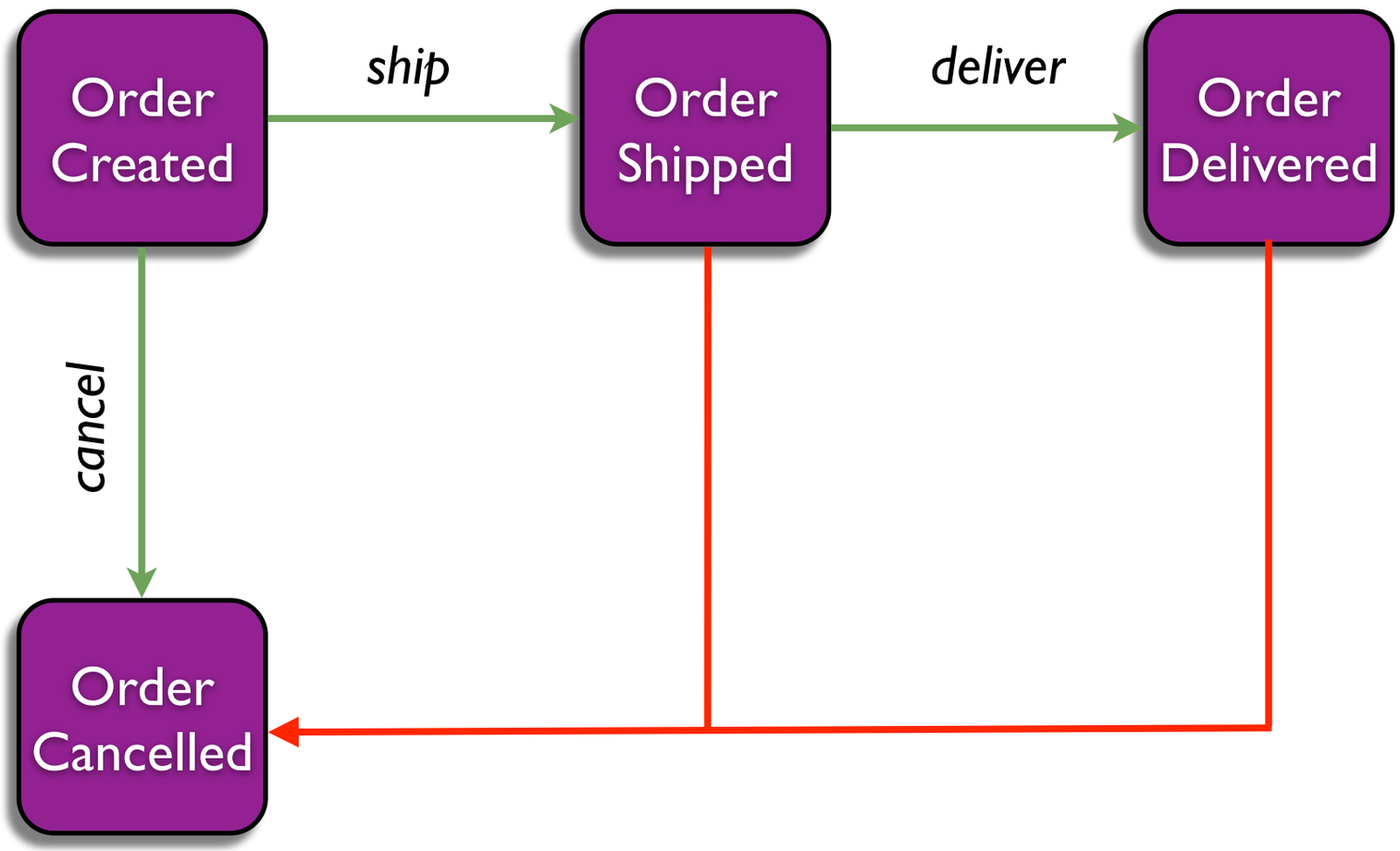
Cancel Order Logic



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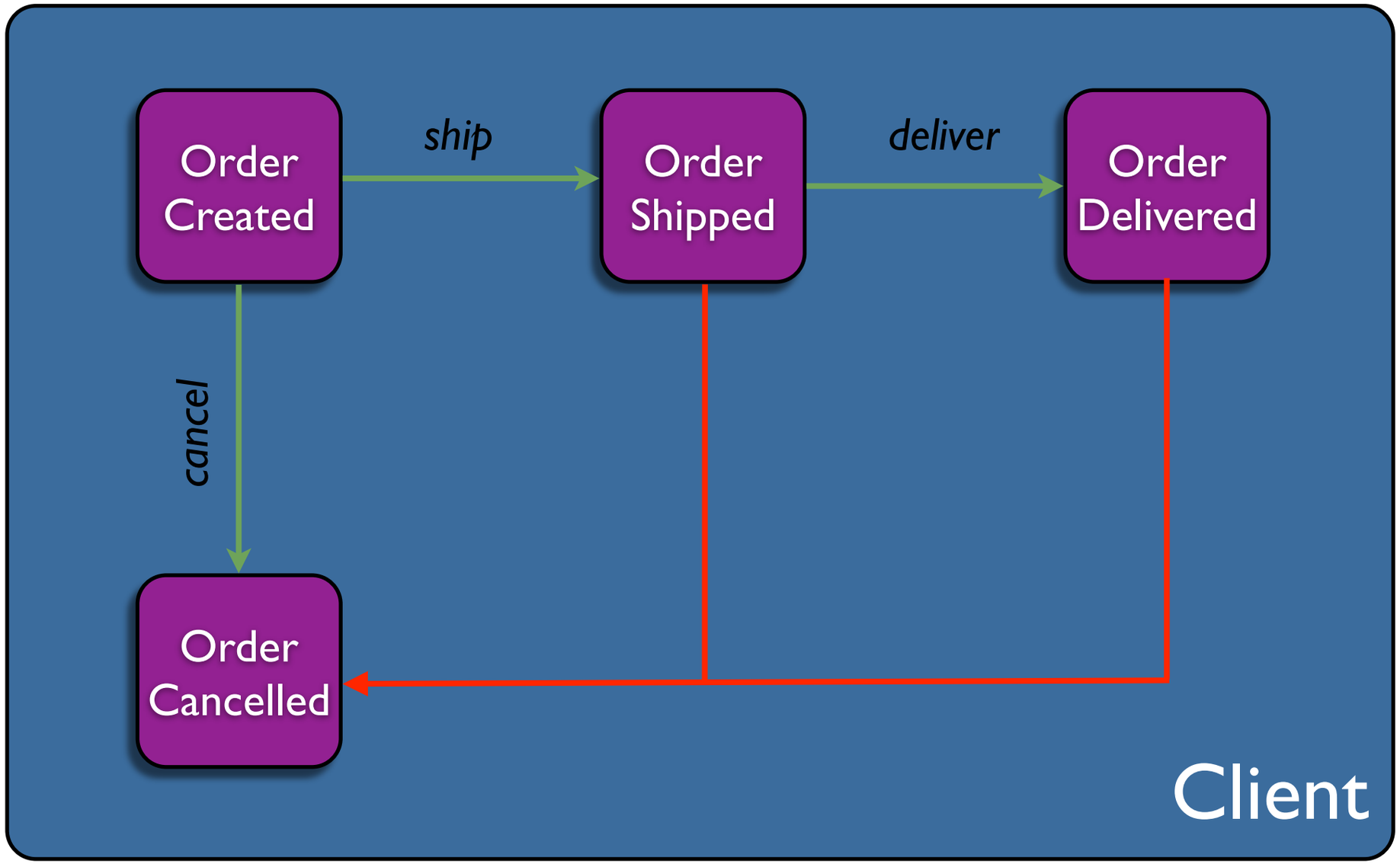
Cancel Order Logic



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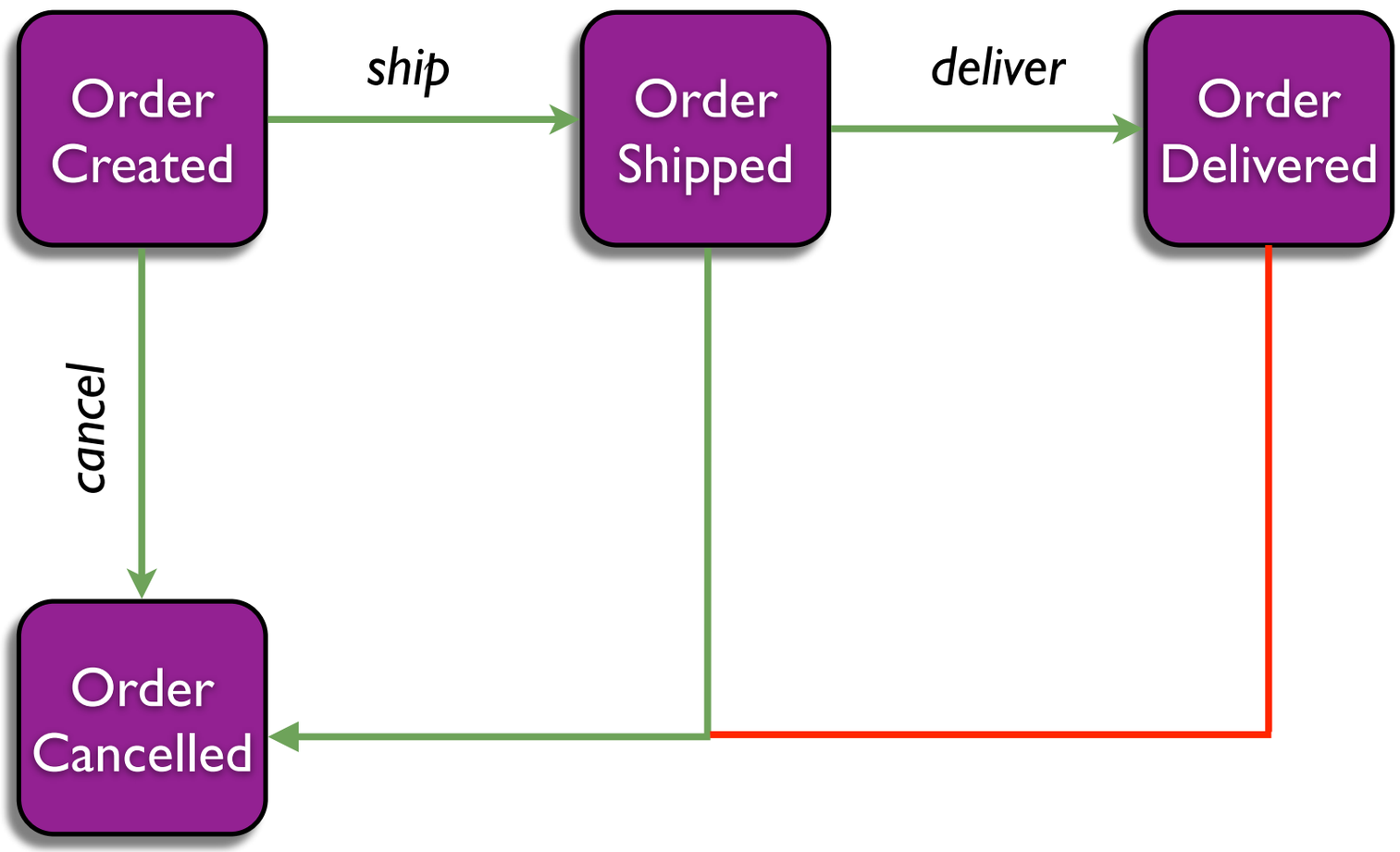
New

Cancel Order Logic



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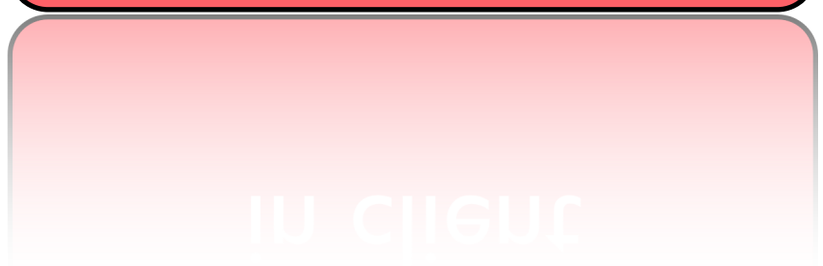
Improving API v3.0

Application state transition logic is in client



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Improving API v3.0

Describe special behavior
in a standard way

Application state transition logic is in client

Send valid transitions to clients for a current resource

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Lets Build API v4.0

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API v4.0

no change from v3.0

- POST **/orders**
- GET **/orders**
- GET **/orders**/{order_id}
- DELETE **/orders**/{order_id}

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v4.0 vs v3.0

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v4.0 vs v3.0

API v3.0

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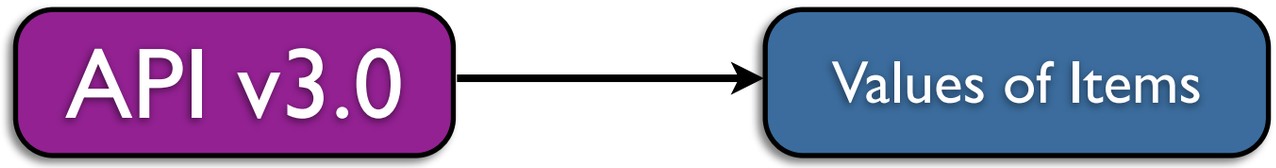
v4.0 vs v3.0



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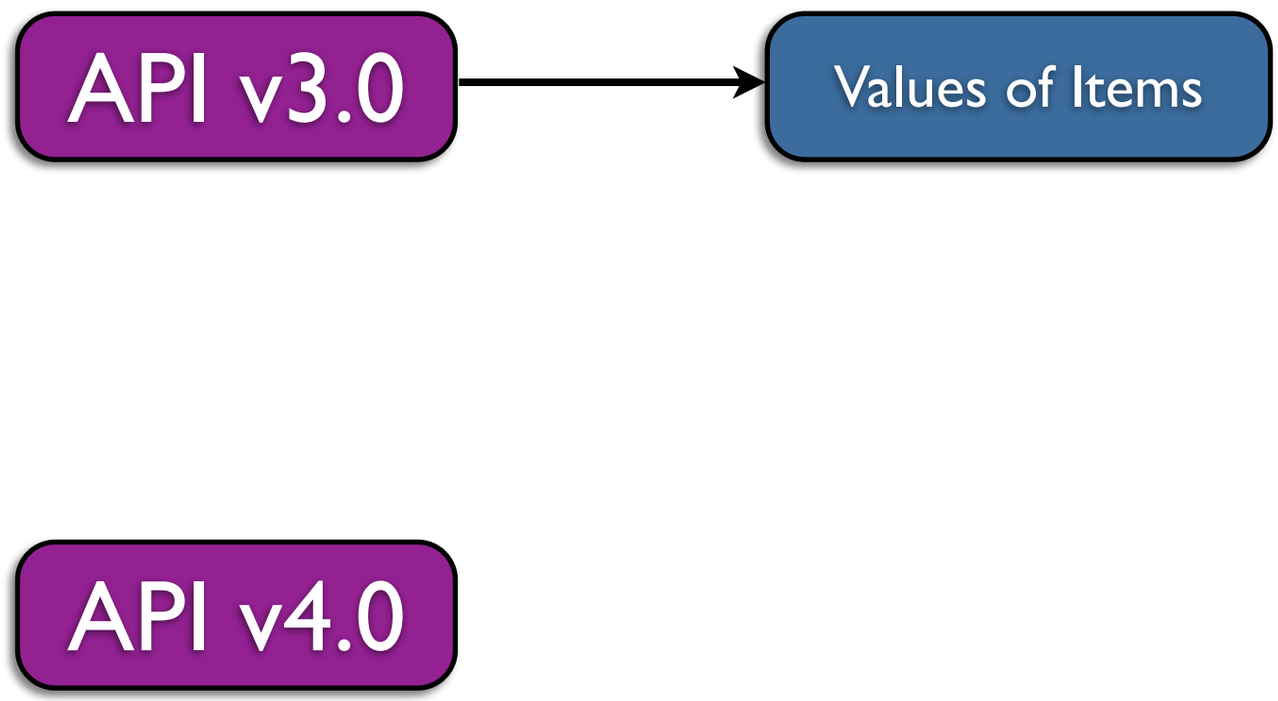
v4.0 vs v3.0



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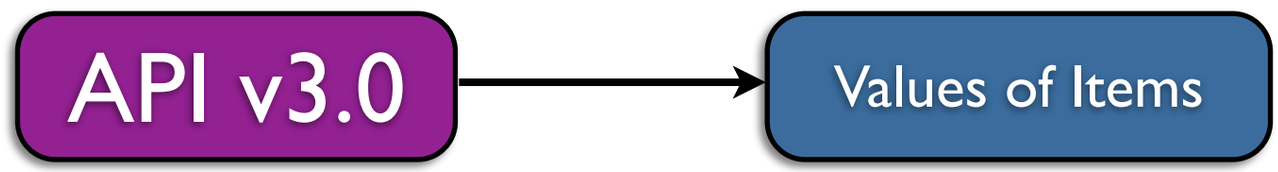
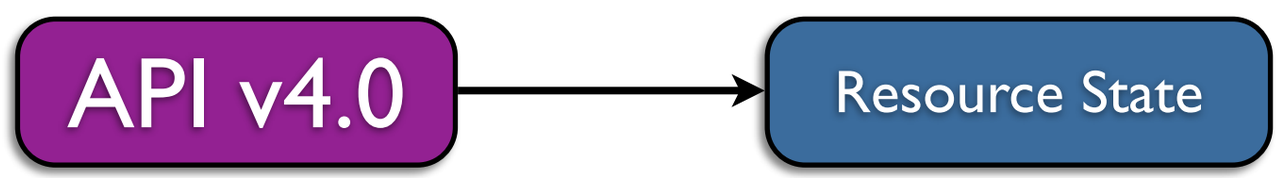
v4.0 vs v3.0





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Resource State

Values of Items

Links - Related Resources

Links - Transitions

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API v4.0
Use Cases

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Find Existing Order

```
(clj-http.client/get "http://localhost:4000/orders/1" {:as :json})
```

```
{:status 200,
 :body
 {:status "PAID",
  :products ["p1" "p2" "p3"],
  :links
  [{:href "http://localhost:4000/orders", :rel "self"}
   {:href "http://localhost:4000/orders", :rel "cancel"}]
  :id "1"}}
```

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Find Shipped Order

```
(clj-http.client/get "http://localhost:4000/orders/1" {:as :json})
```

```
{:status 200,
 :body
 {:status "SHIPPED",
  :products ["p2" "p4" "p6"],
  :links [{:href "http://localhost:4000/orders", :rel "self"}],
  :id "2"}}
```

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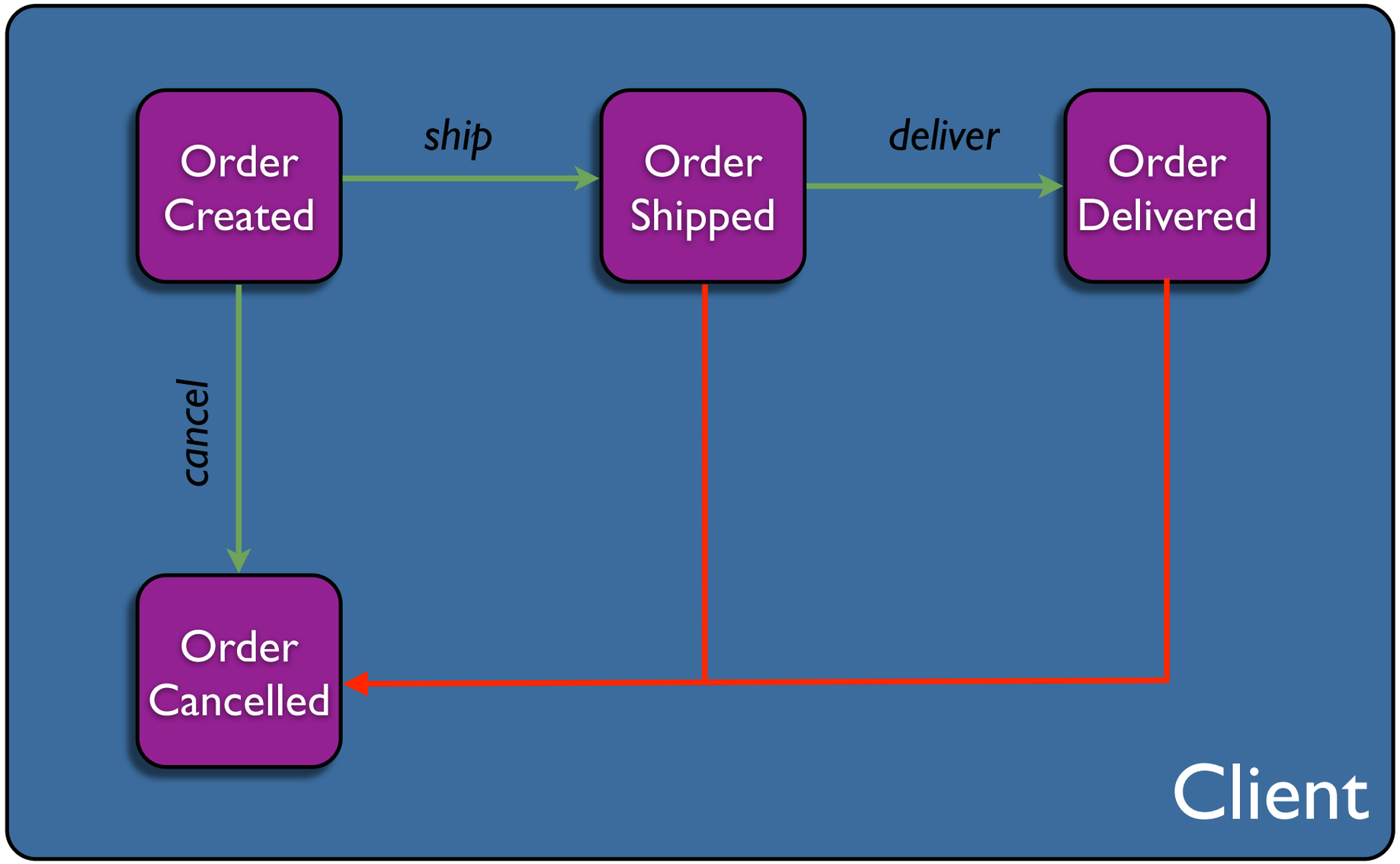
Cancel Order Logic



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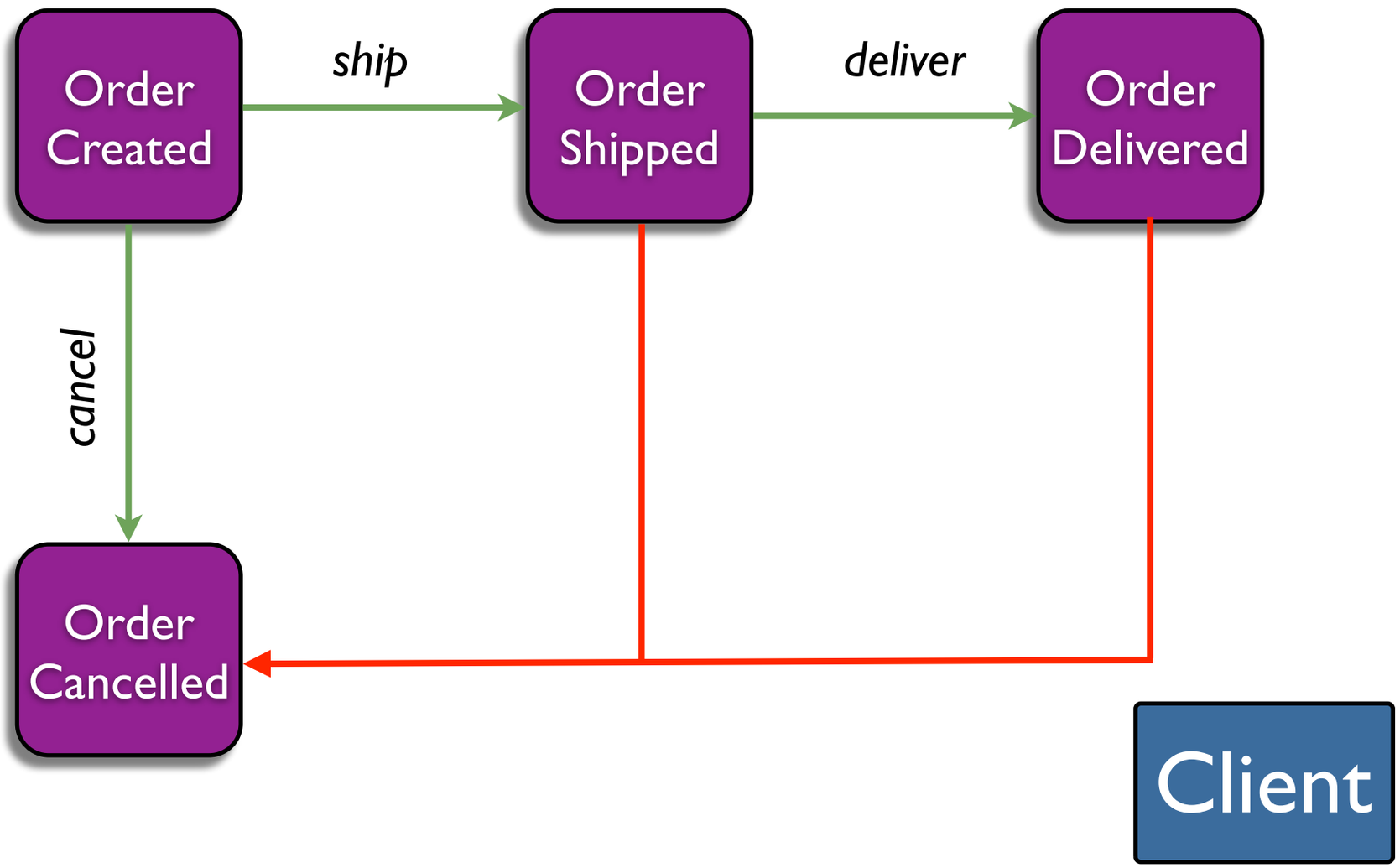
Cancel Order Logic



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API v4.0
Goals Reached?

- Maintainable
- Scalable
- Recoverable
- Loosely Coupled

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Complex System

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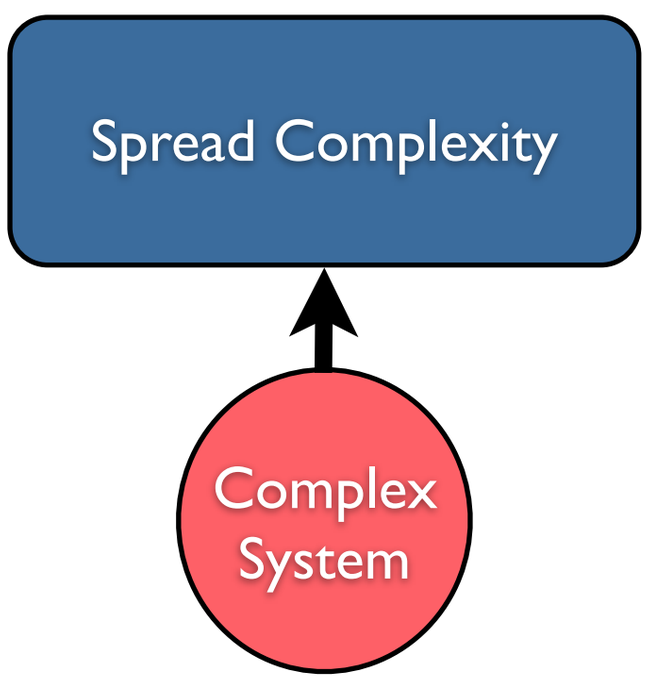

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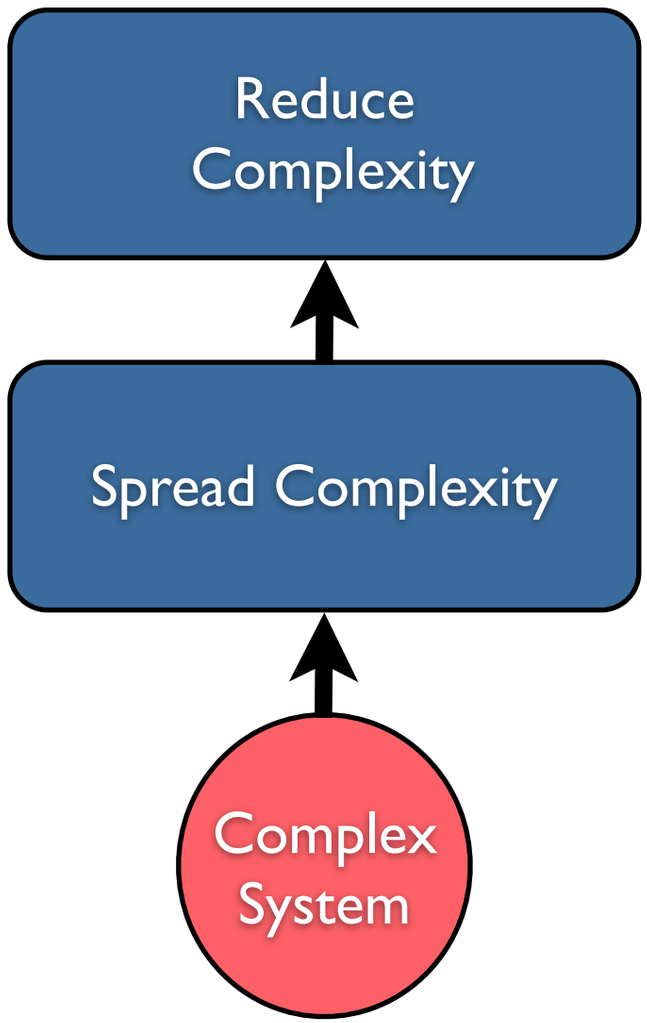
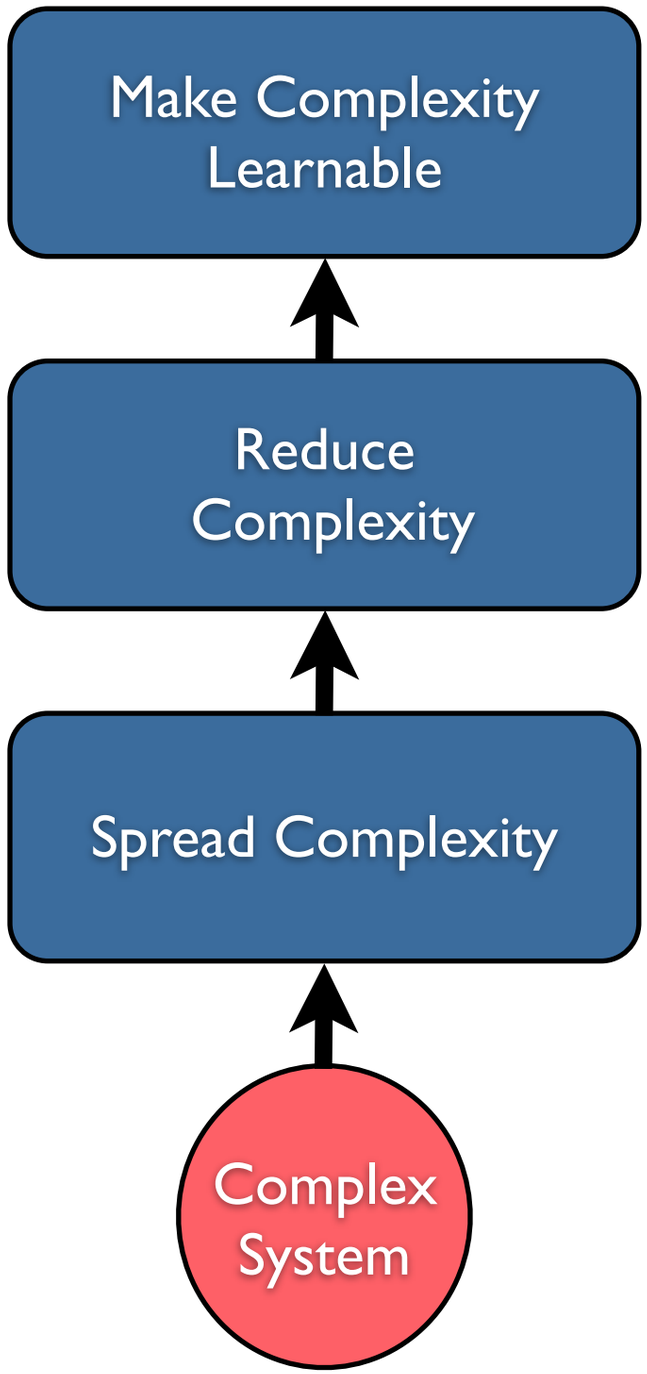
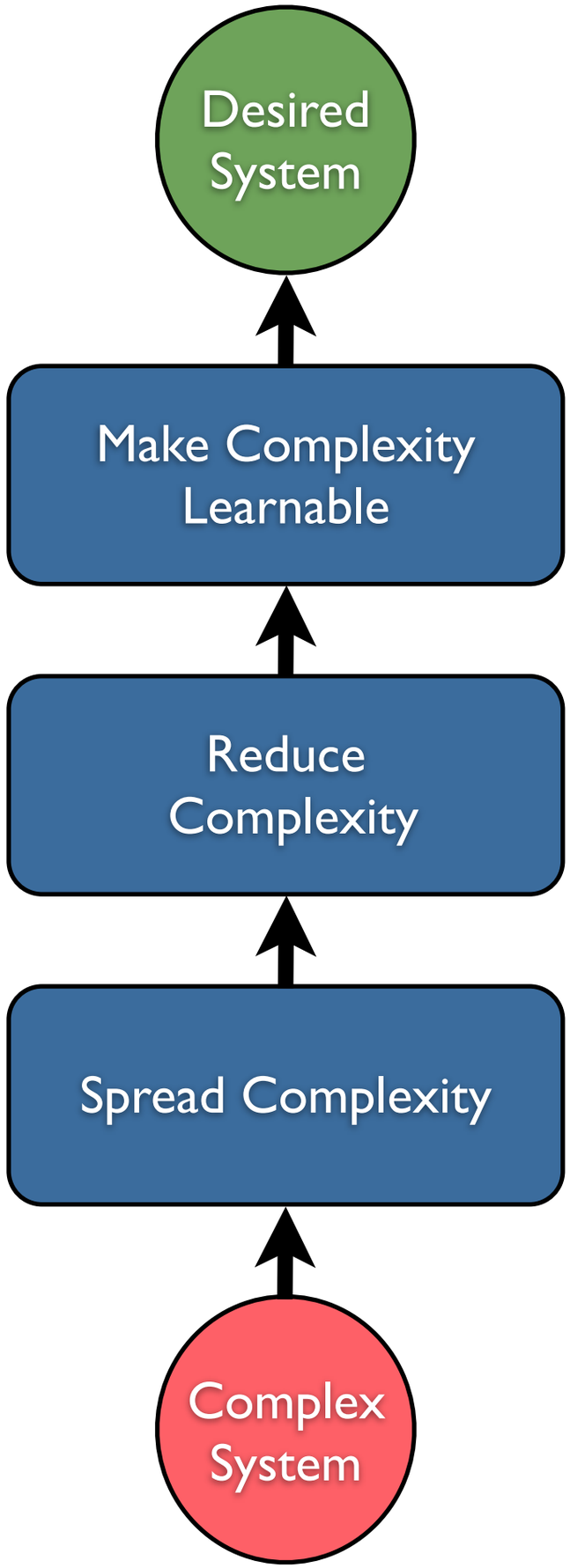


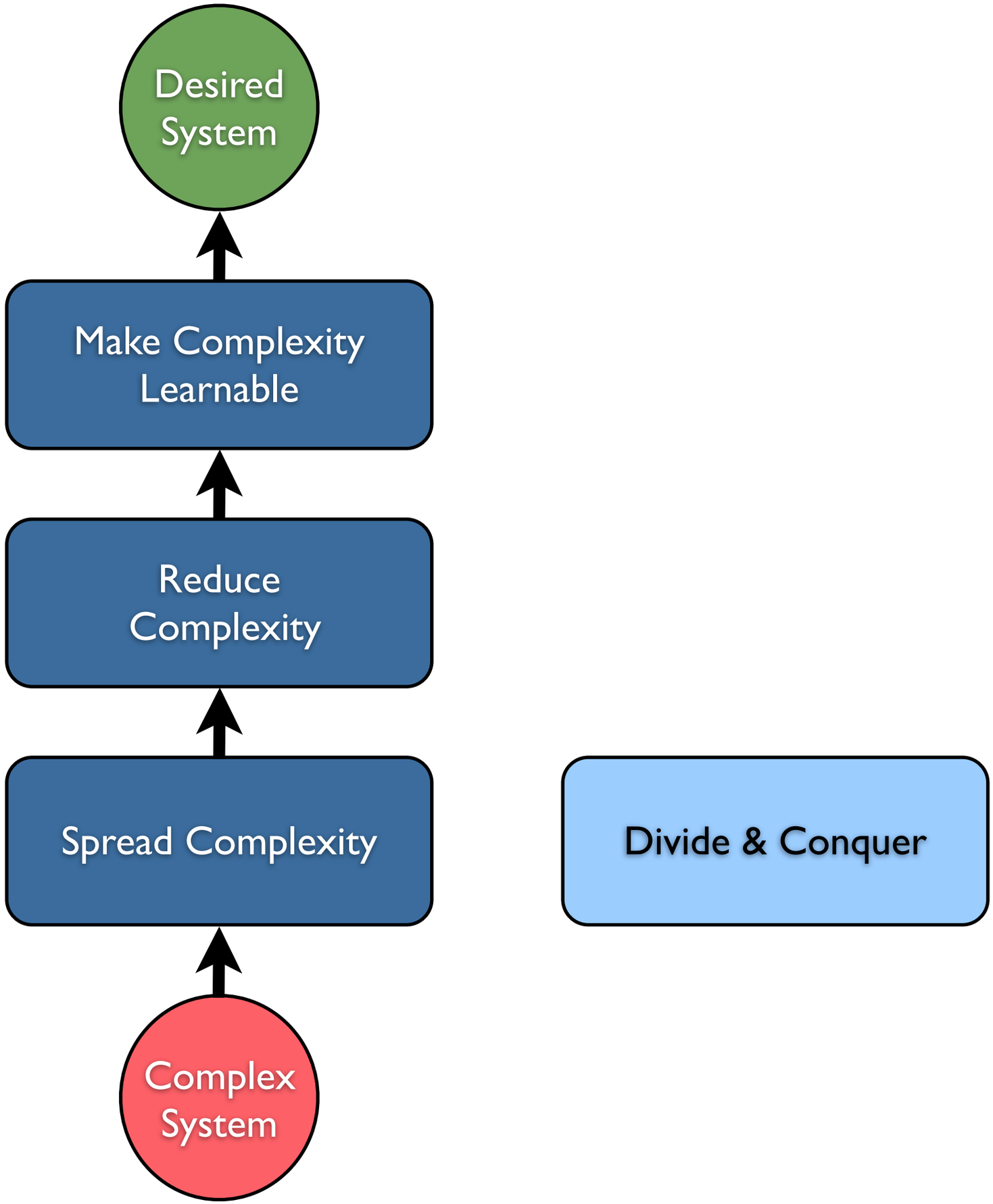
zolodeck


Make Complexity Learnable
Reduce Complexity
Spread Complexity
Complex System

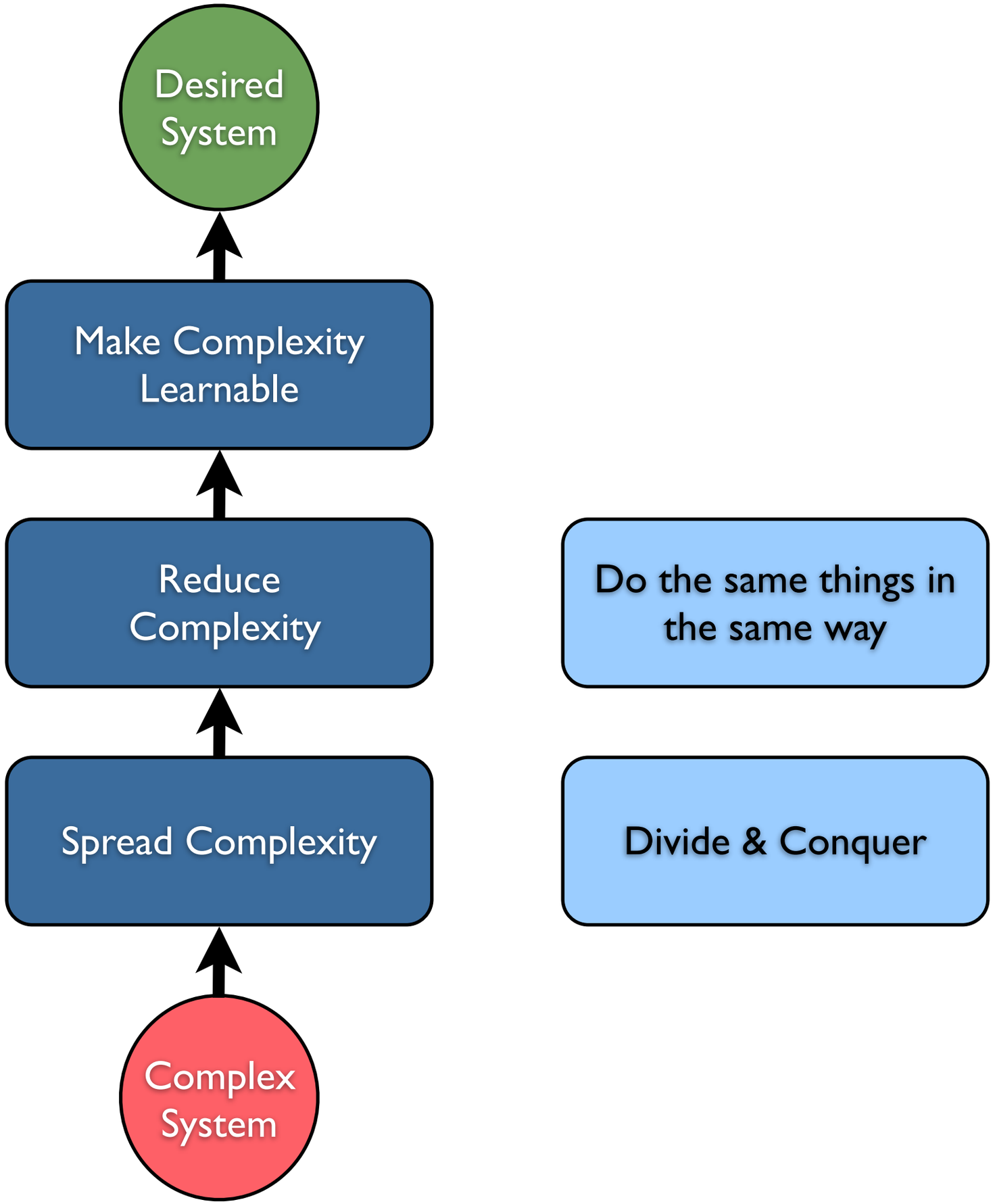
zolodeck


Desired System
Make Complexity Learnable
Reduce Complexity
Spread Complexity
Complex System

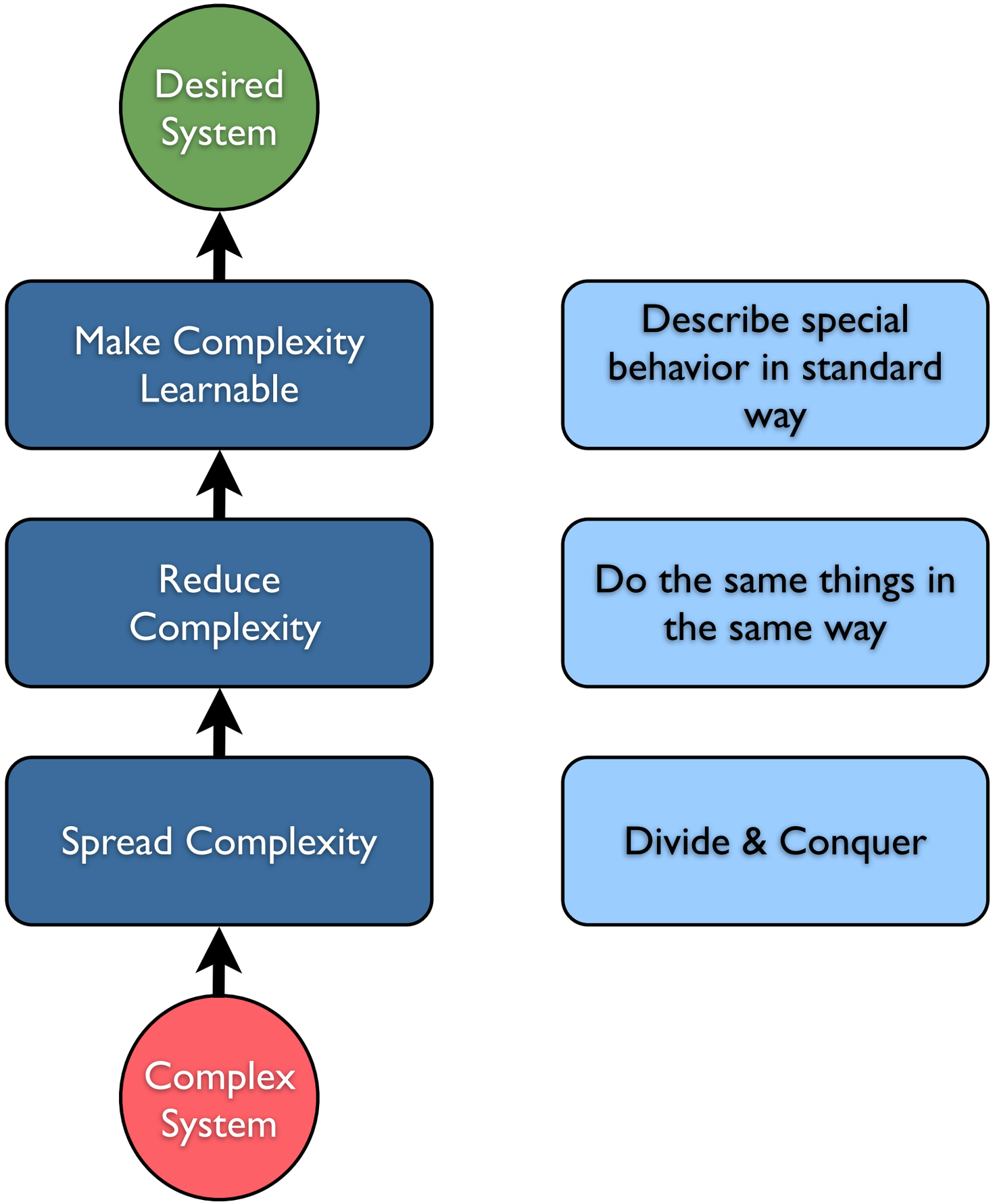
zolodeck


Desired System
Make Complexity Learnable
Reduce Complexity
Spread Complexity
Complex System
Divide & Conquer

zolodeck


Desired System
Make Complexity Learnable
Reduce Complexity
Spread Complexity
Complex System
Do the same things in the same way
Divide & Conquer

zolodeck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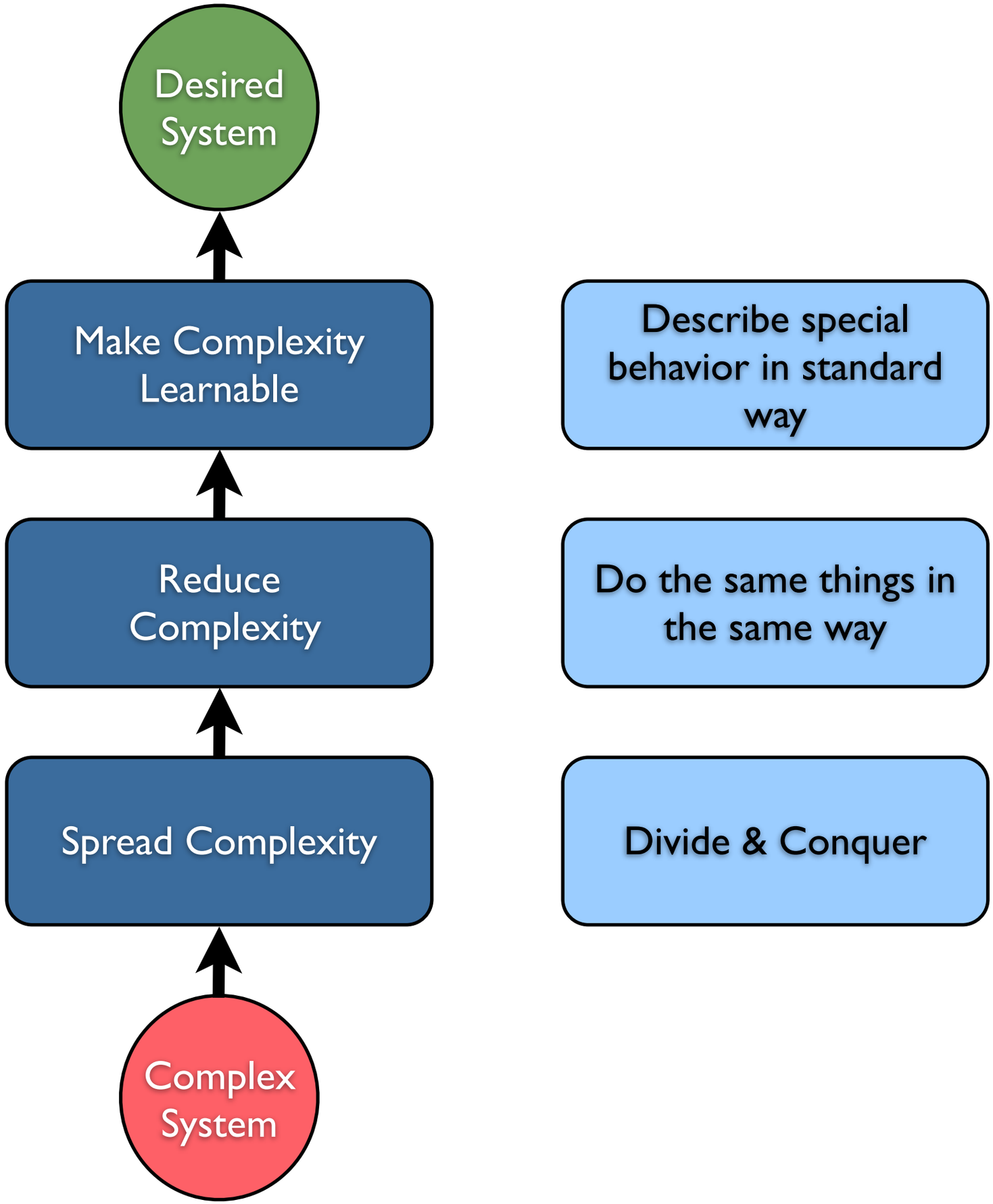
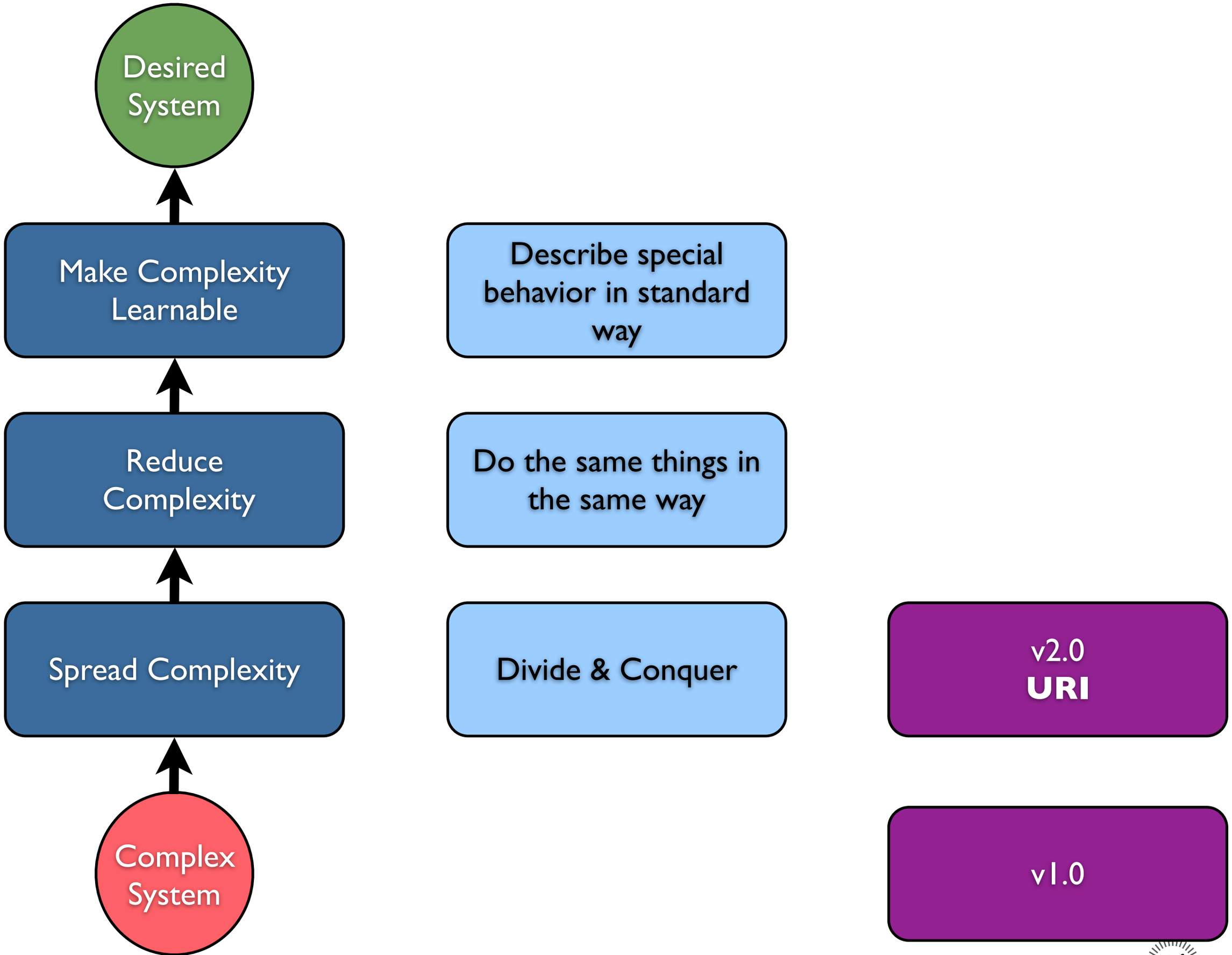
Describe special behavior in standard way
Do the same things in the same way
Divide & Conquer

zolodeck

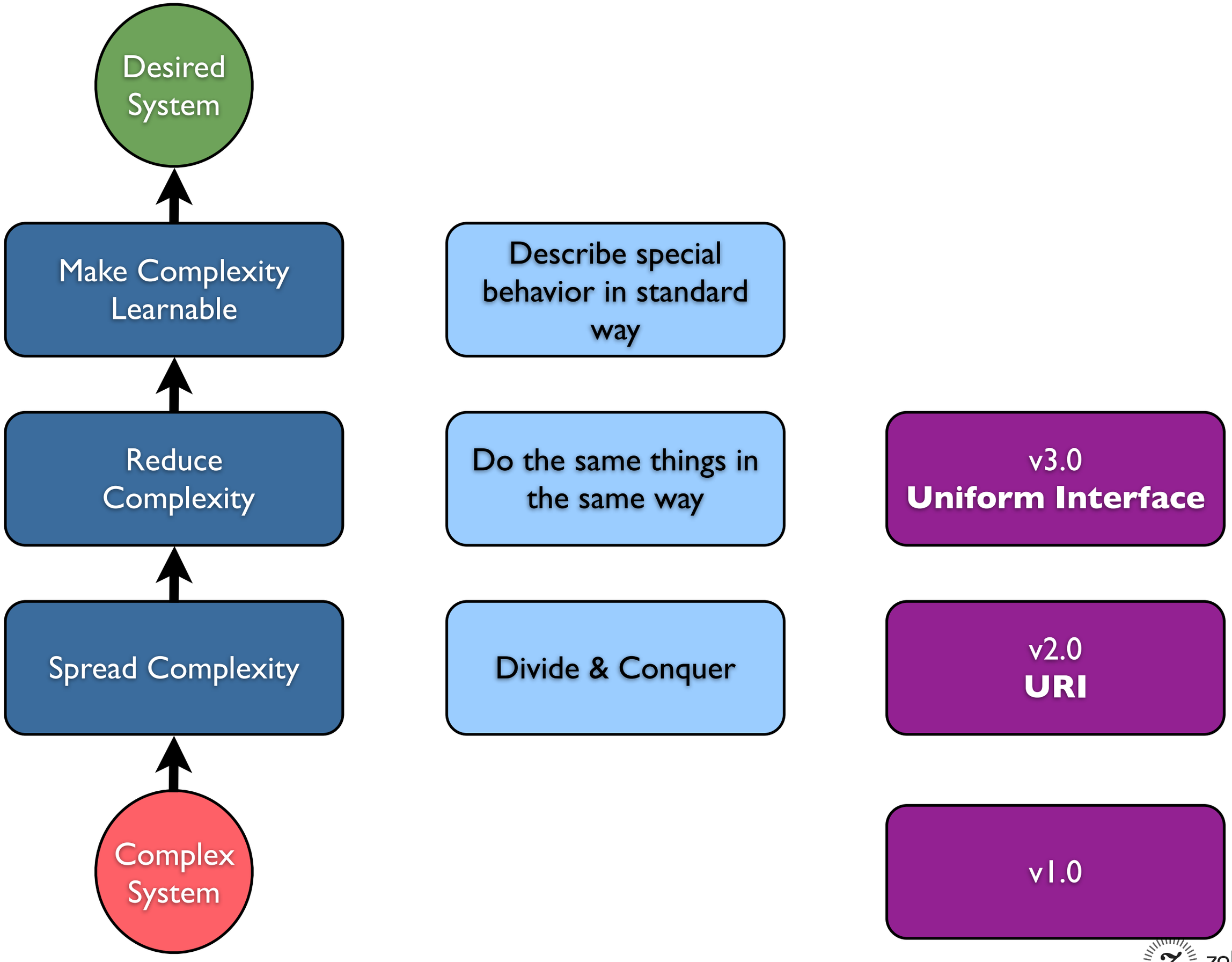


v1.0

zolodeck


Desired System
Make Complexity Learnable
Reduce Complexity
Spread Complexity
Complex System
Describe special behavior in standard way
Do the same things in the same way
Divide & Conquer
v2.0
URI
v1.0

zolodeck


Desired System
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v3.0
Uniform Interface
v2.0
URI
v1.0

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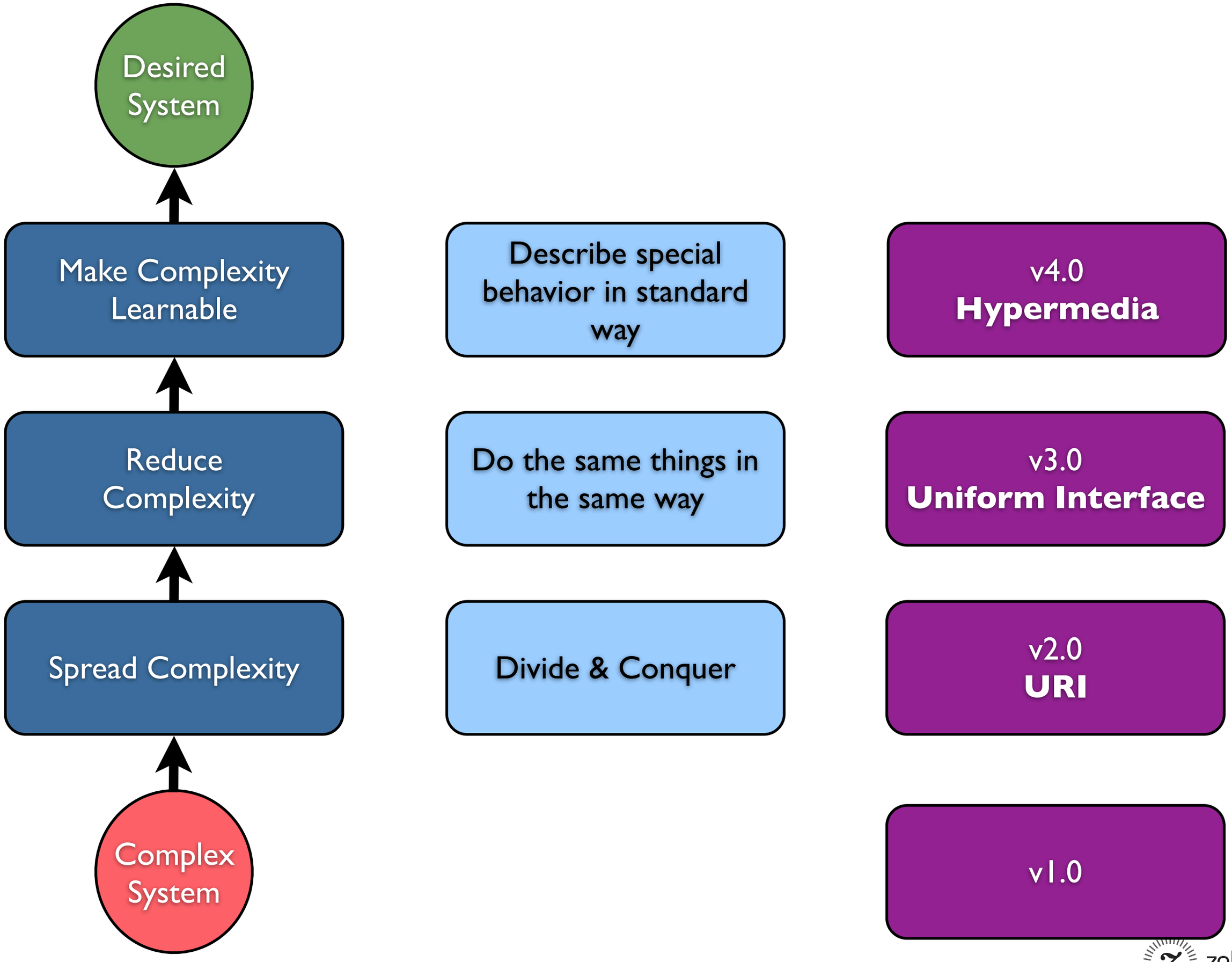
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Spread Complexity
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Divide & Conquer
v4.0
Hypermedia
v3.0
Uniform Interface
v2.0
URI
v1.0

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Richardson Maturity Model

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Richardson Maturity Model

Level 0

The swamp of POX

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Richardson Maturity Model

Level 1	URI
Level 0	The swamp of POX

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Richardson Maturity Model

Level 2	HTTP
Level 1	URI
Level 0	The swamp of POX

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Richardson Maturity Model

Level 3	Hypermedia
Level 2	HTTP
Level 1	URI
Level 0	The swamp of POX

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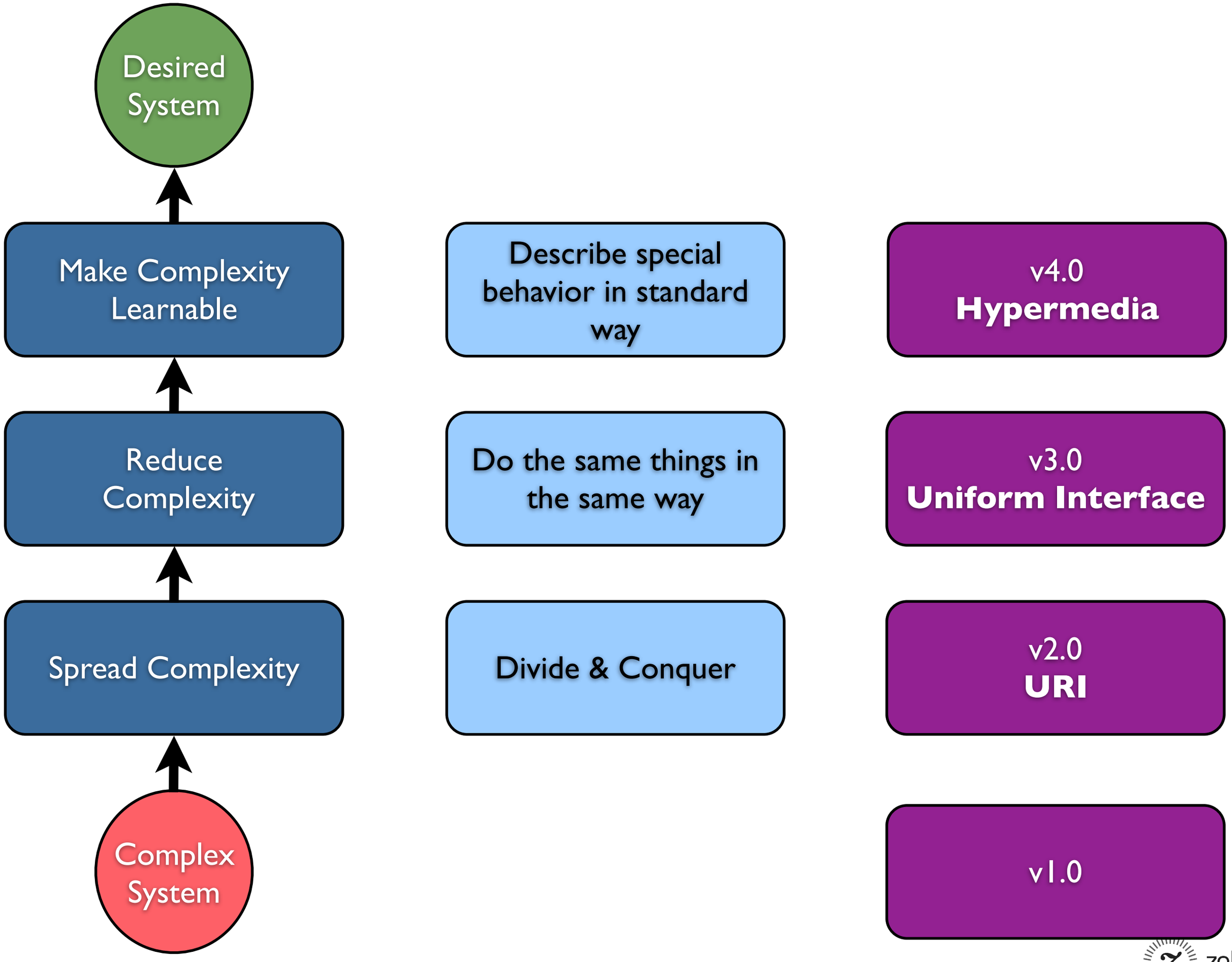
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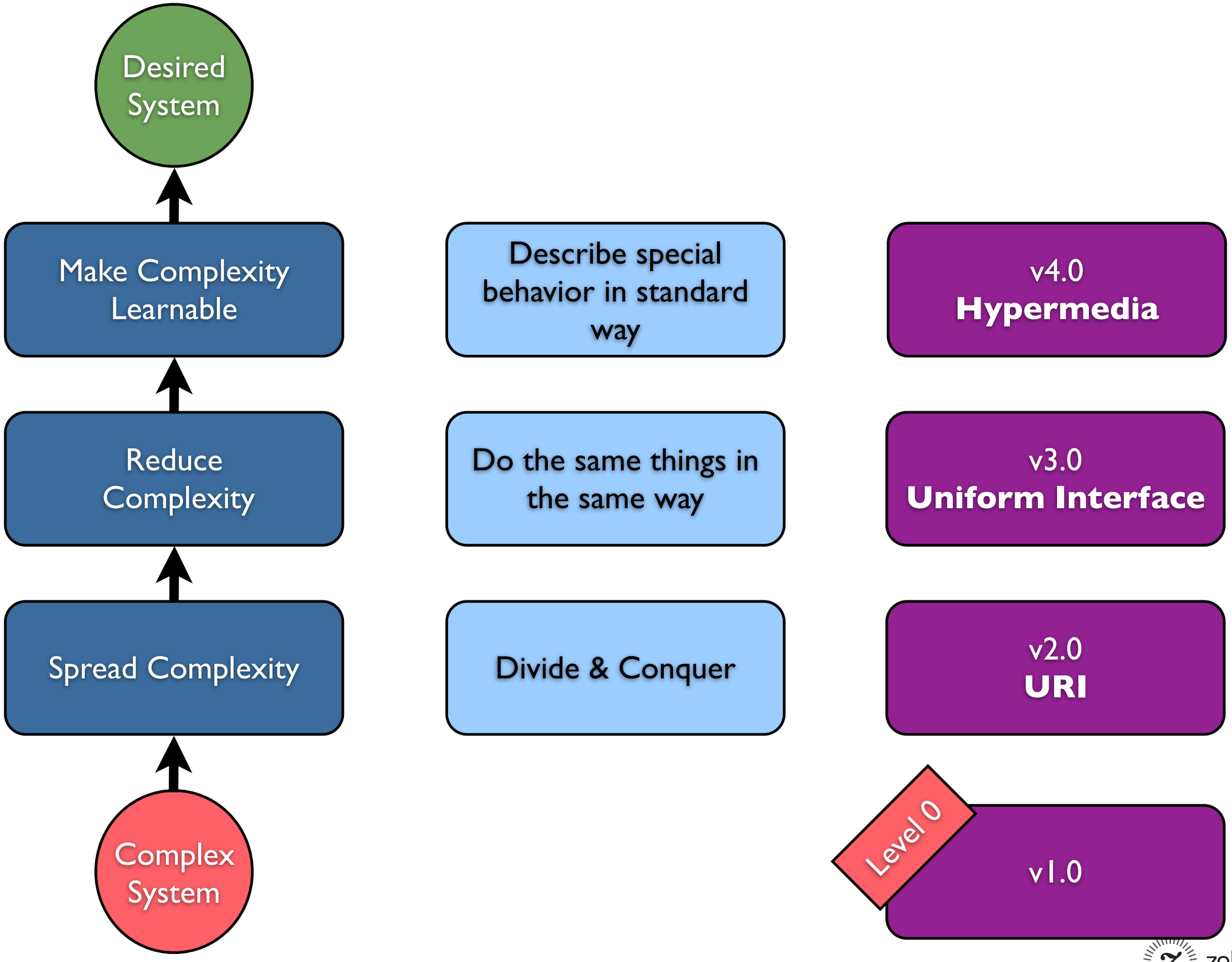
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Reduce Complexity
Do the same things in the same way
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v2.0
URI
Complex System
Level 0
v1.0

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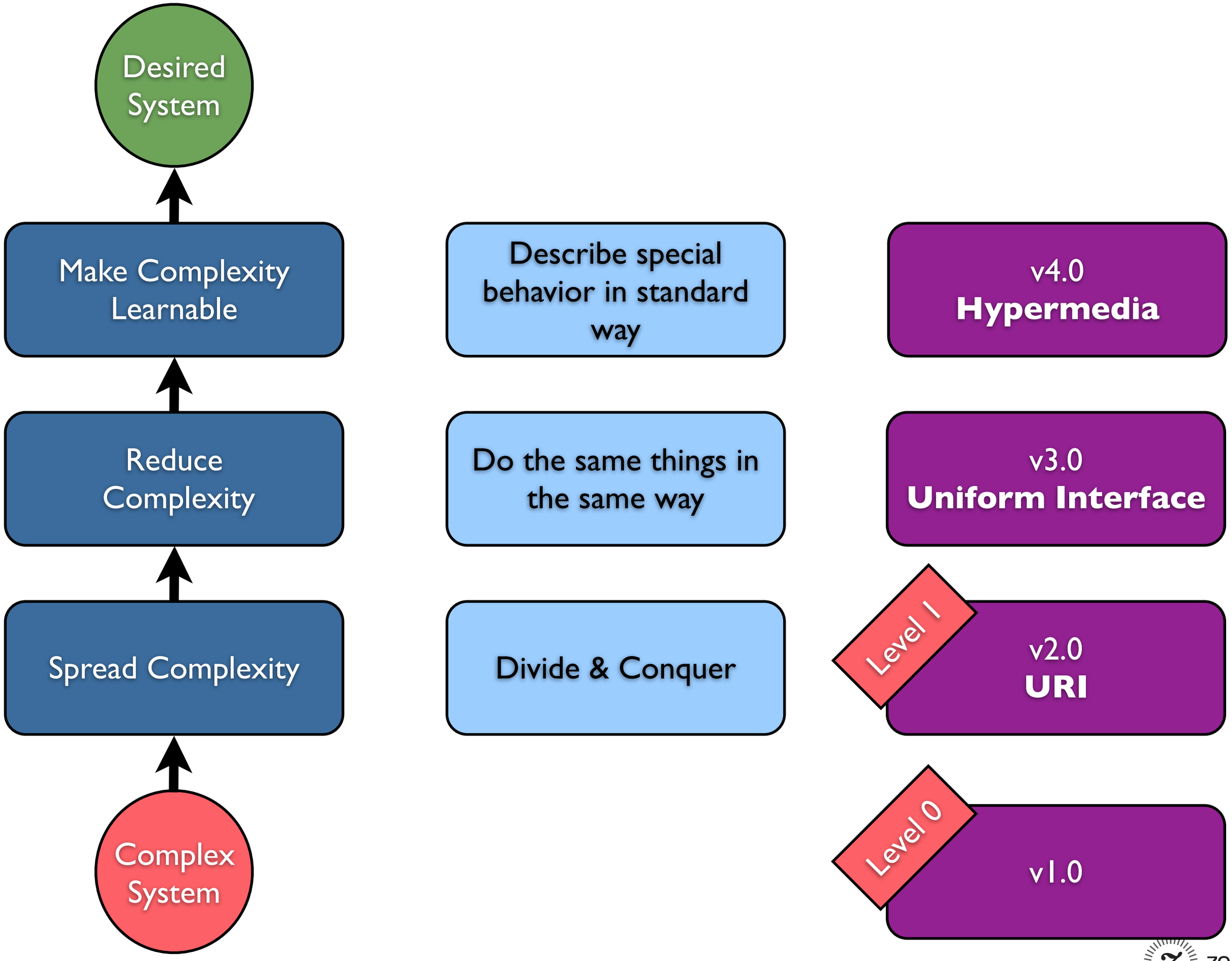
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Level 0
v1.0

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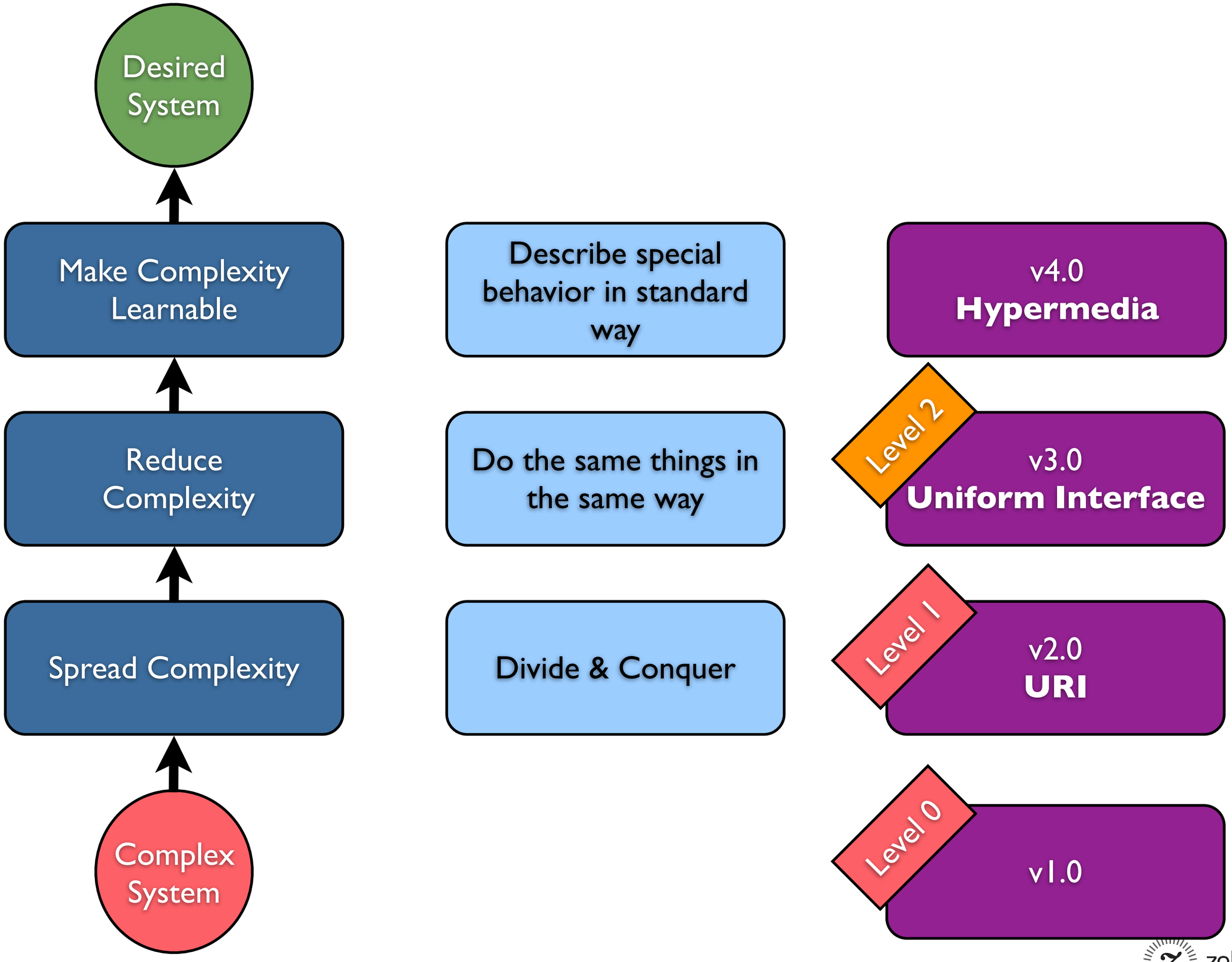
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v1.0

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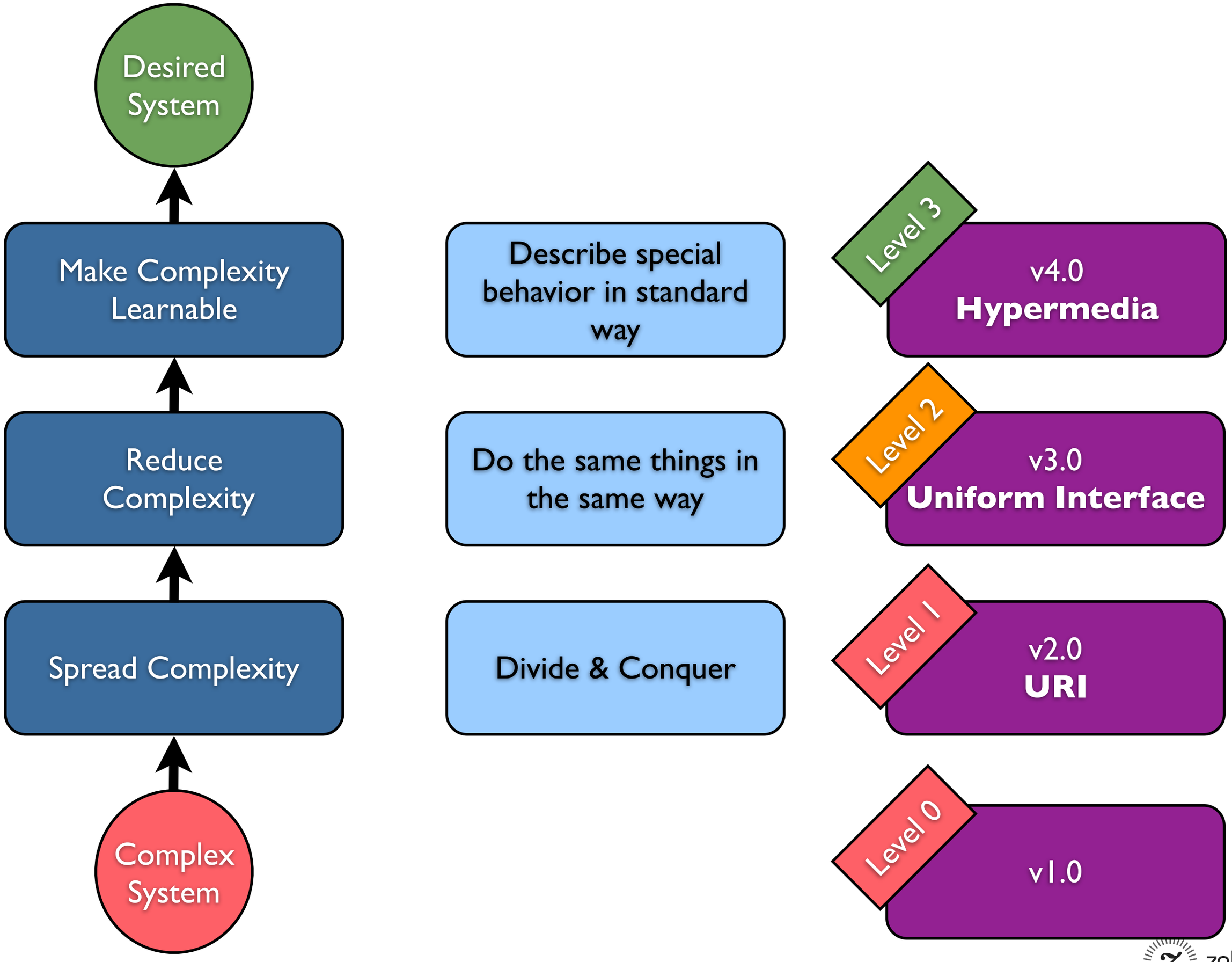
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v1.0

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“if the engine of application state (and hence the API) is not being driven by hypertext, then it cannot be RESTful and cannot be a REST API. Period. ”

Roy T. Fielding

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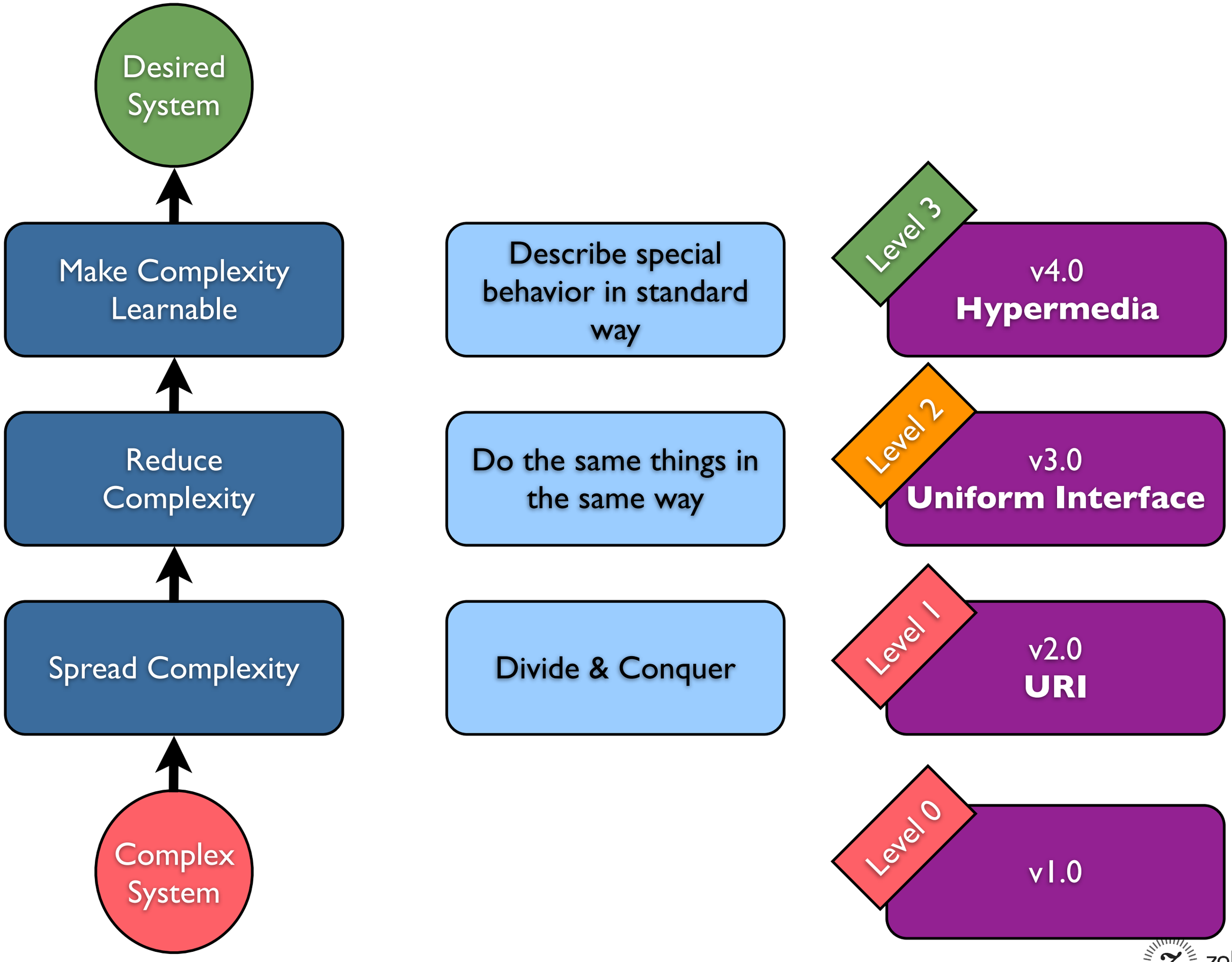
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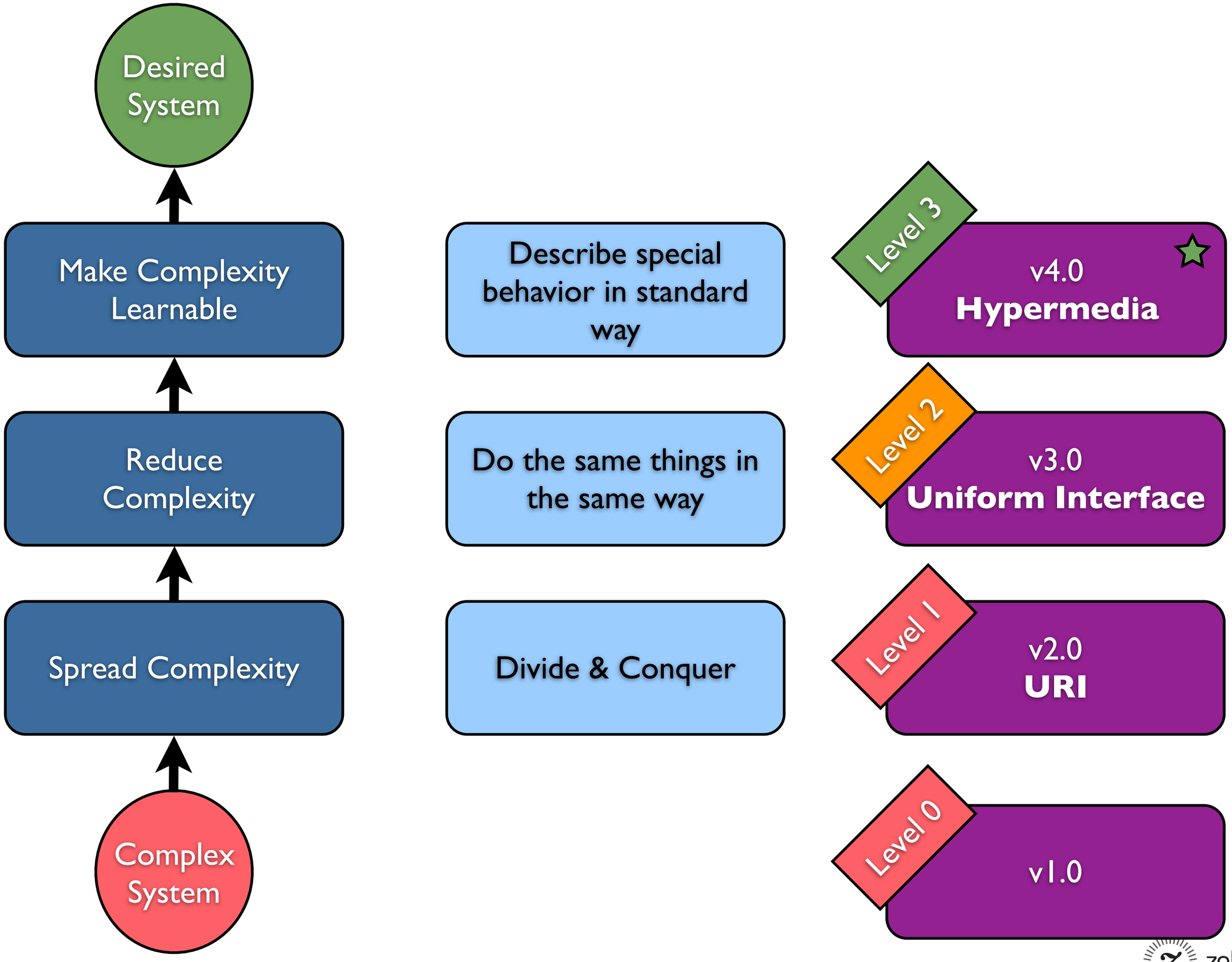
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"Like many terms in software, REST gets lots of definitions, but since Roy Fielding coined the term, his definition should carry more weight than most."

Martin Fowler

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to sum up ...

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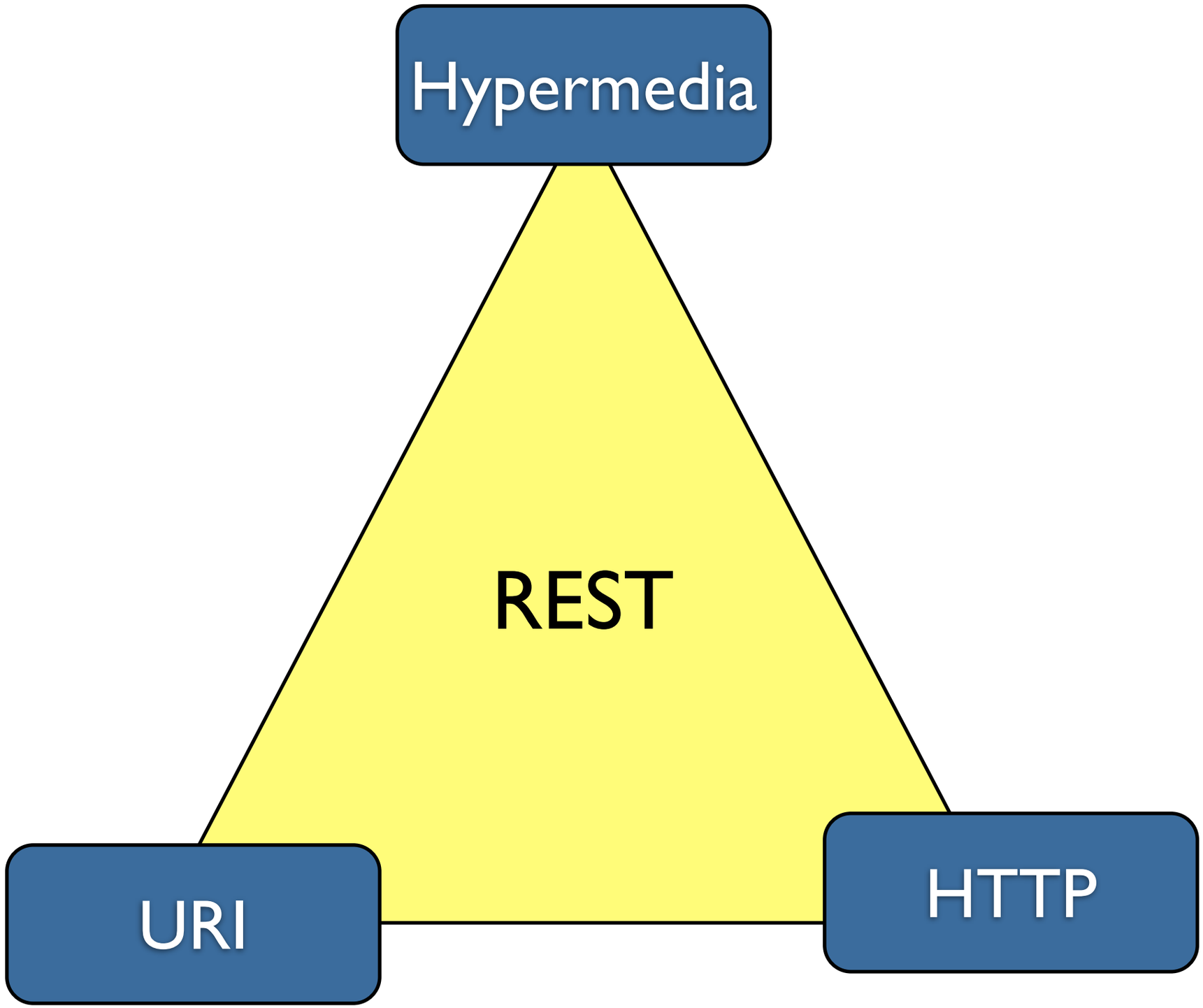
What?



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Why?

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

Roy T. Fielding

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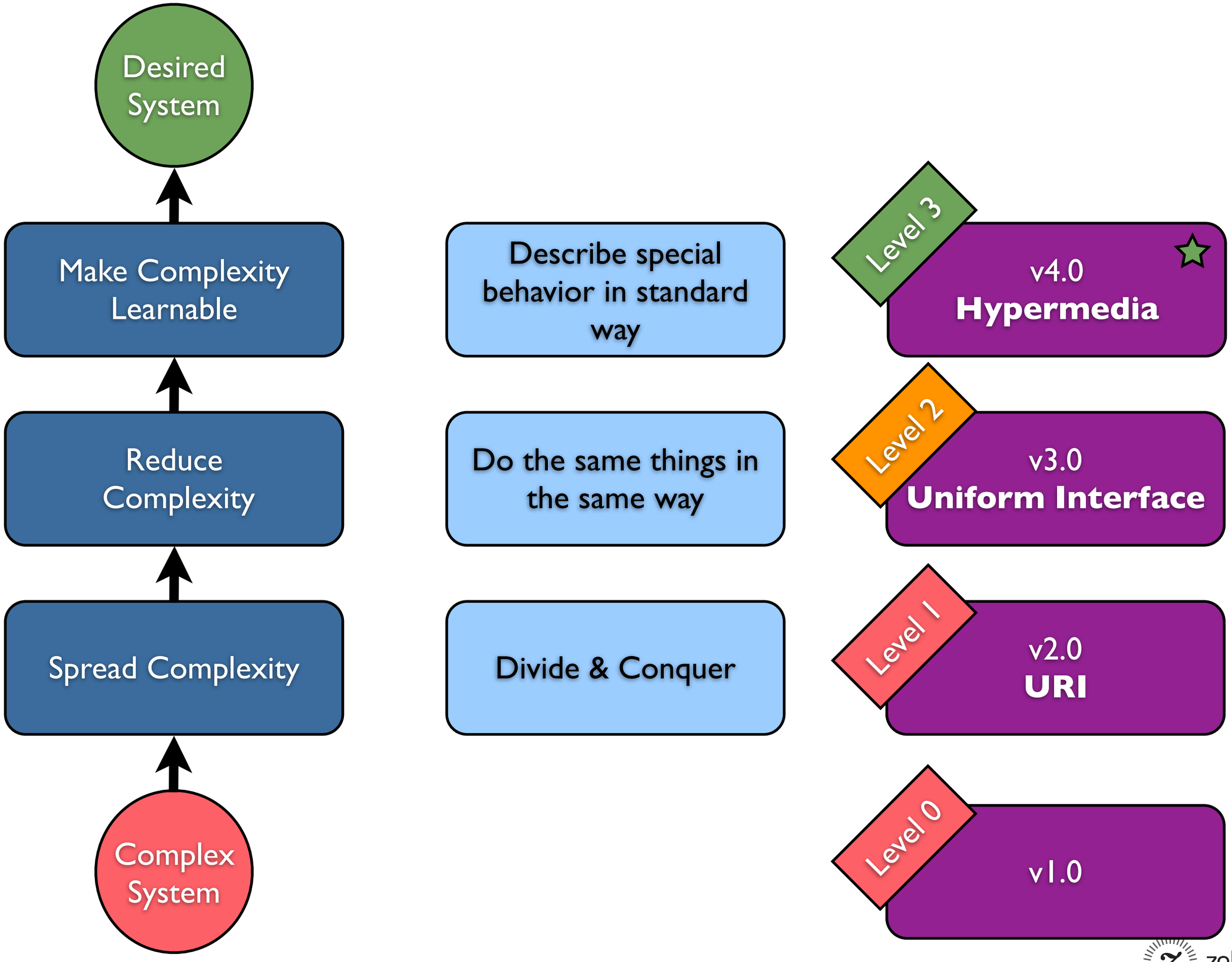
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Let us take the last step ...

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Questions?

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- http://blog.zololabs.com
- http://techbehindtech.com
- zolodeck.com

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