

BUILDING A GREAT WEB API

NOVEMBER 17, 2011, QCON

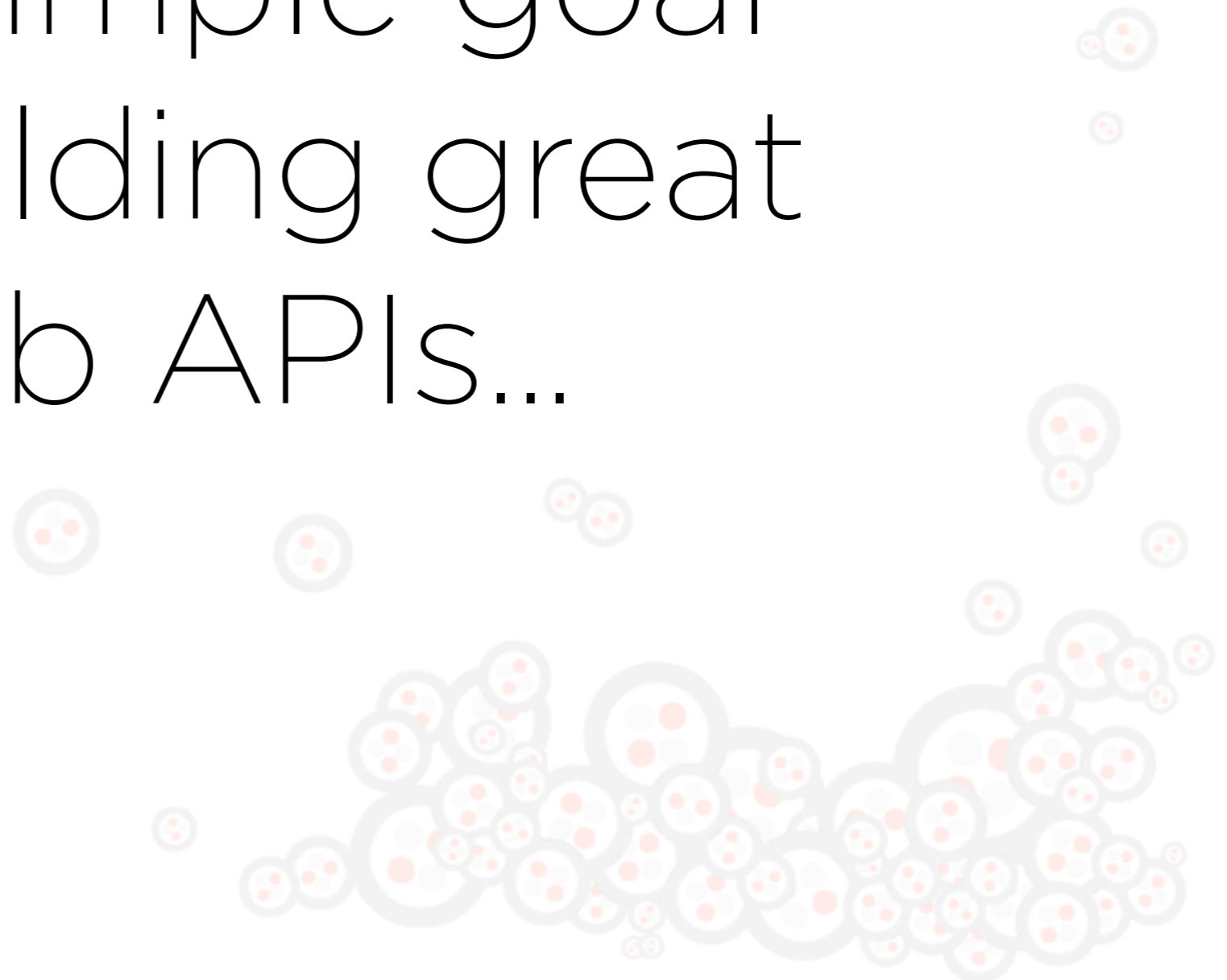
EVAN COOKE @emcooke
CO-FOUNDER & CTO



twilio
CLOUD COMMUNICATIONS



One simple goal
for building great
Web APIs...





5

Minutes



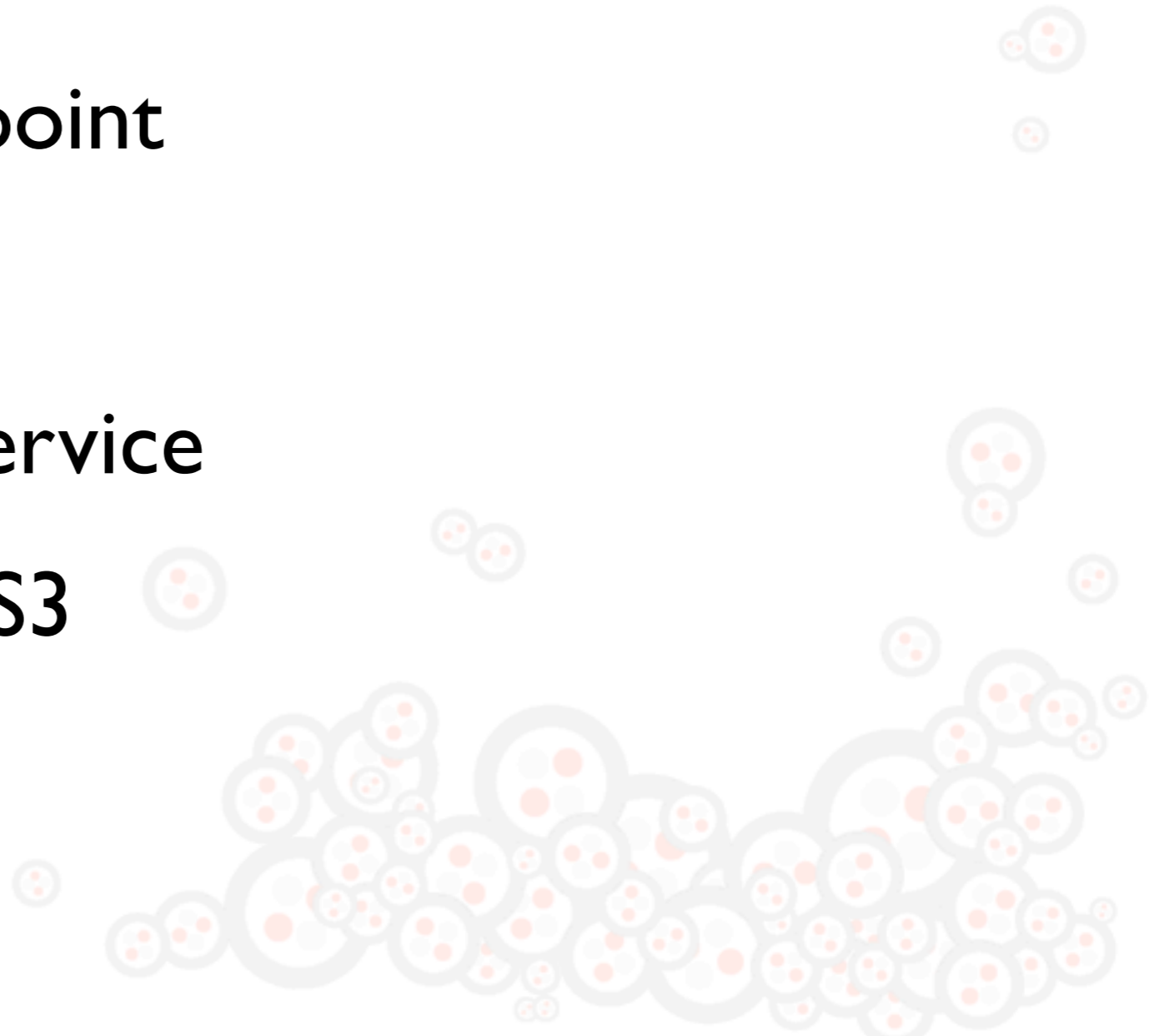
It should take no more than 5 minutes for a developer to perform a *useful* task using your API for the first time



What is a Web API?

Definition for today:

- HTTP/HTTPS endpoint
- JSON/XML
- Hosted API/Web service
- Example: Amazon S3





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Web Services Directory

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Viewing 1 to 3000 of 4258 APIs

API	Description	Category	Mashups
Google Maps	Mapping services	Mapping	2298
Twitter	Microblogging service	Social	641
Flickr	Photo sharing service	Photos	589
YouTube	Video sharing and search	Video	587
Amazon eCommerce	Online retailer	Shopping	401
Twilio	Telephony service	Telephony	317
Facebook	Social networking service	Social	312
eBay	eBay Search service	Search	213
Last.fm	Online radio service	Music	202
Google Search	Search services	Search	176
Microsoft Bing Maps	Mapping services	Mapping	175
del.icio.us	Social bookmarking	Bookmarks	157
Twilio SMS	SMS messaging service	Messaging	156
Yahoo Search	Search services	Search	141
Yahoo Maps	Mapping services	Mapping	134
Google Ajax Search	Web search components	Search	130

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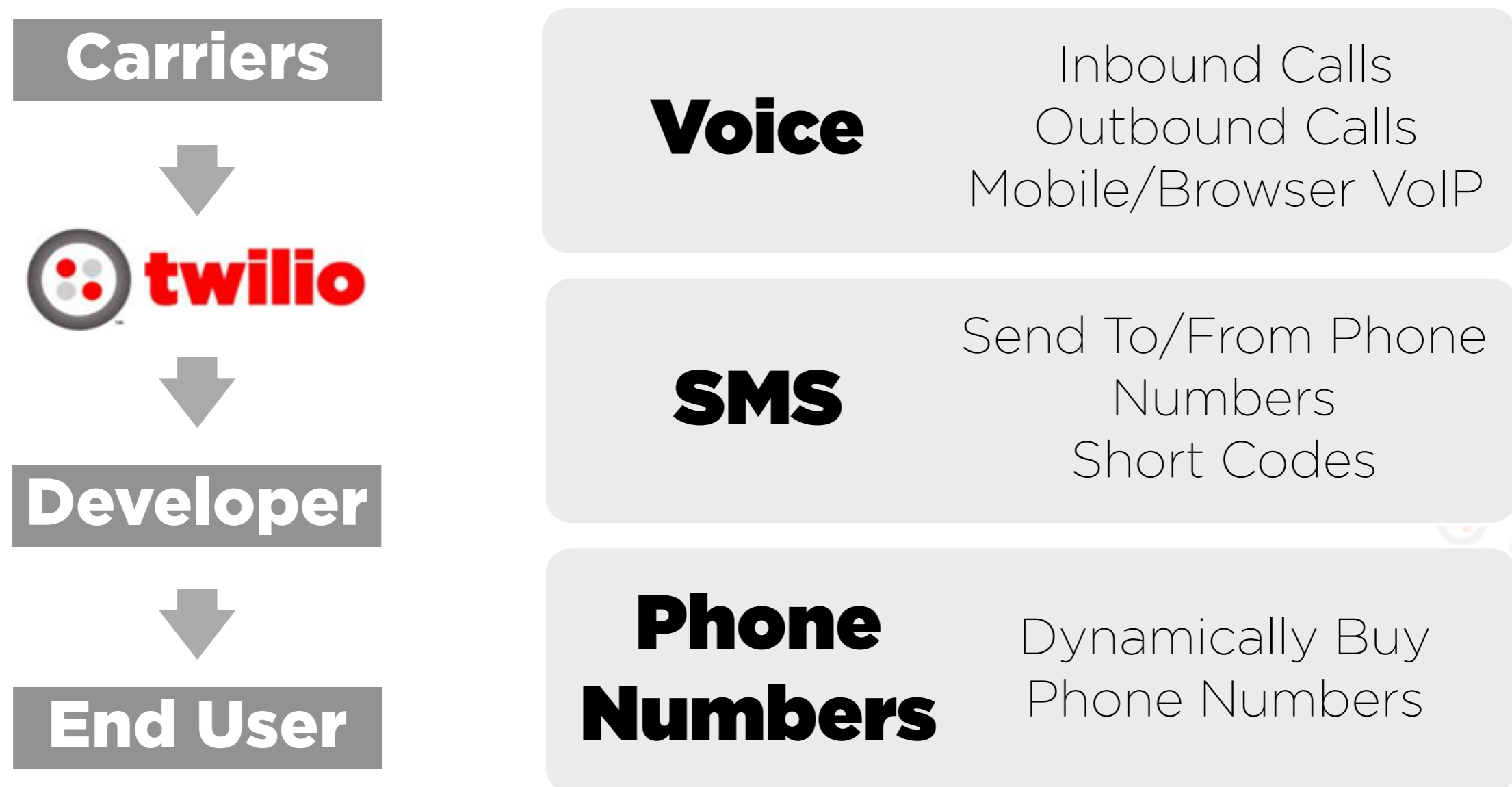


Adam DuVander Executive Editor, ProgrammableWeb. Author, Map Scripting 101. Lover, APIs.

Popular Recent

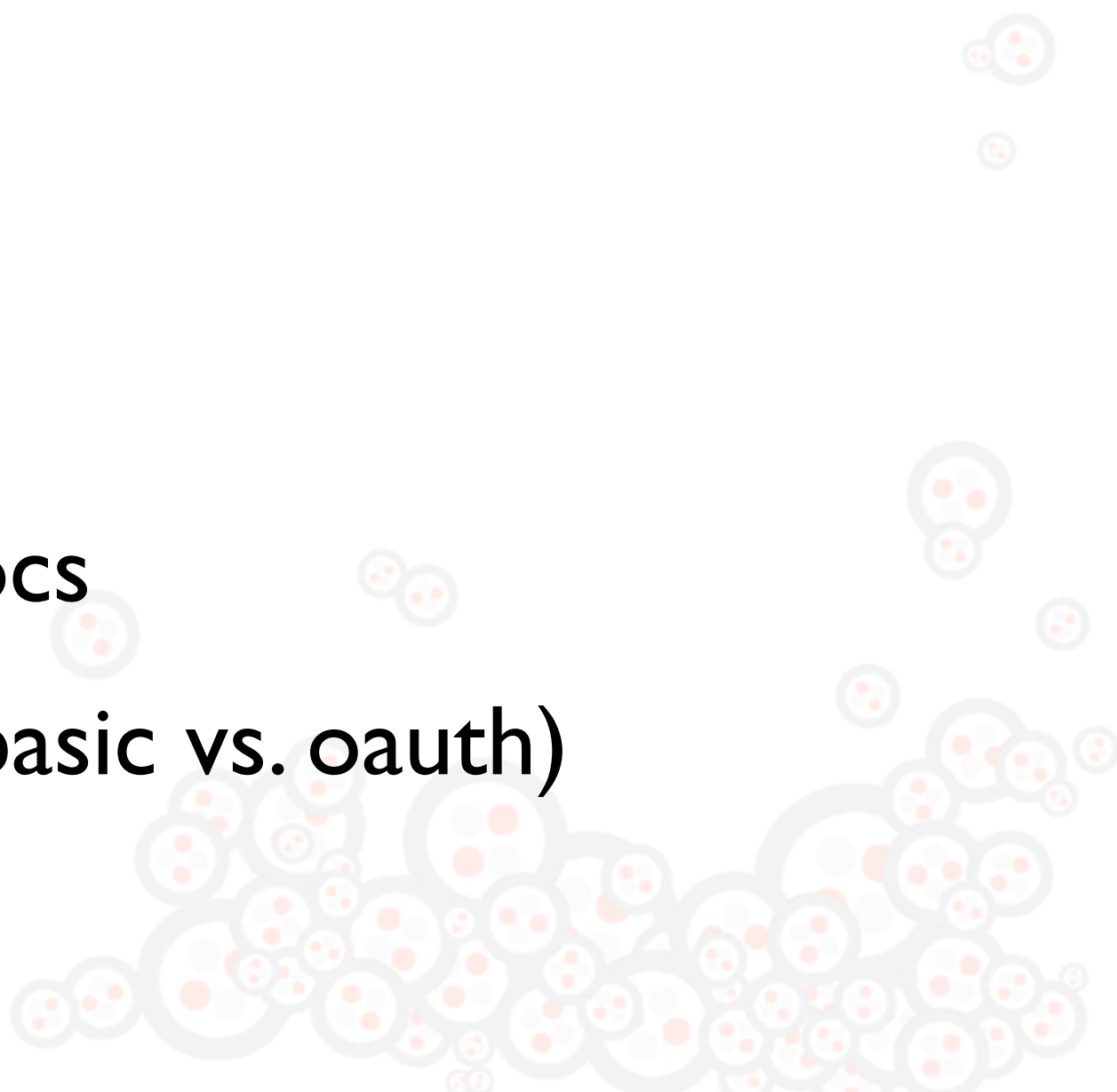
Twilio

Web service APIs to automate Voice and SMS phone communications





Why 5 Minutes?

- Clear value proposition
 - Fast signup
 - Simple API
 - Efficient quickstarts
 - Concise accessible docs
 - Easy authentication (basic vs. oauth)
 - Debuggable
- 

API Adoption Funnel

Hear about API

Try it

Build it

Production Use

Buy it

Traction

**Good APIs
Promote
Adoption**
(tell friends)



API Adoption Funnel

Hear about API

Try it

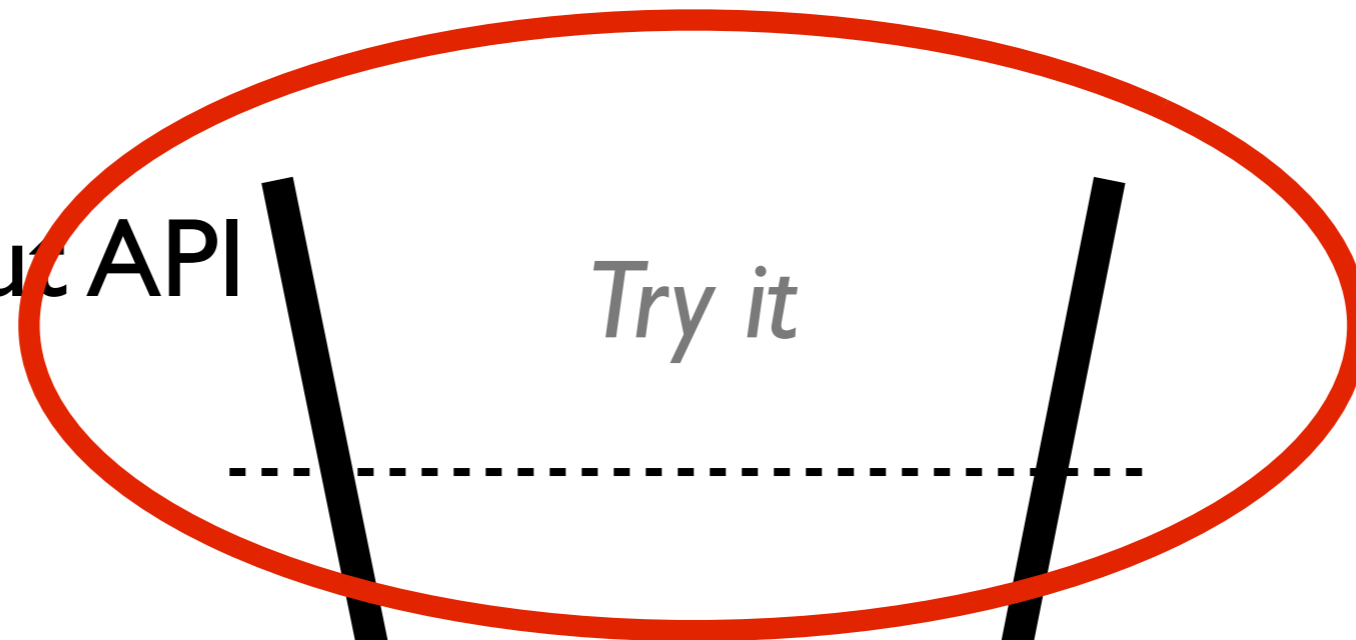
**5-Minute
Goal**

Build it

Production Use

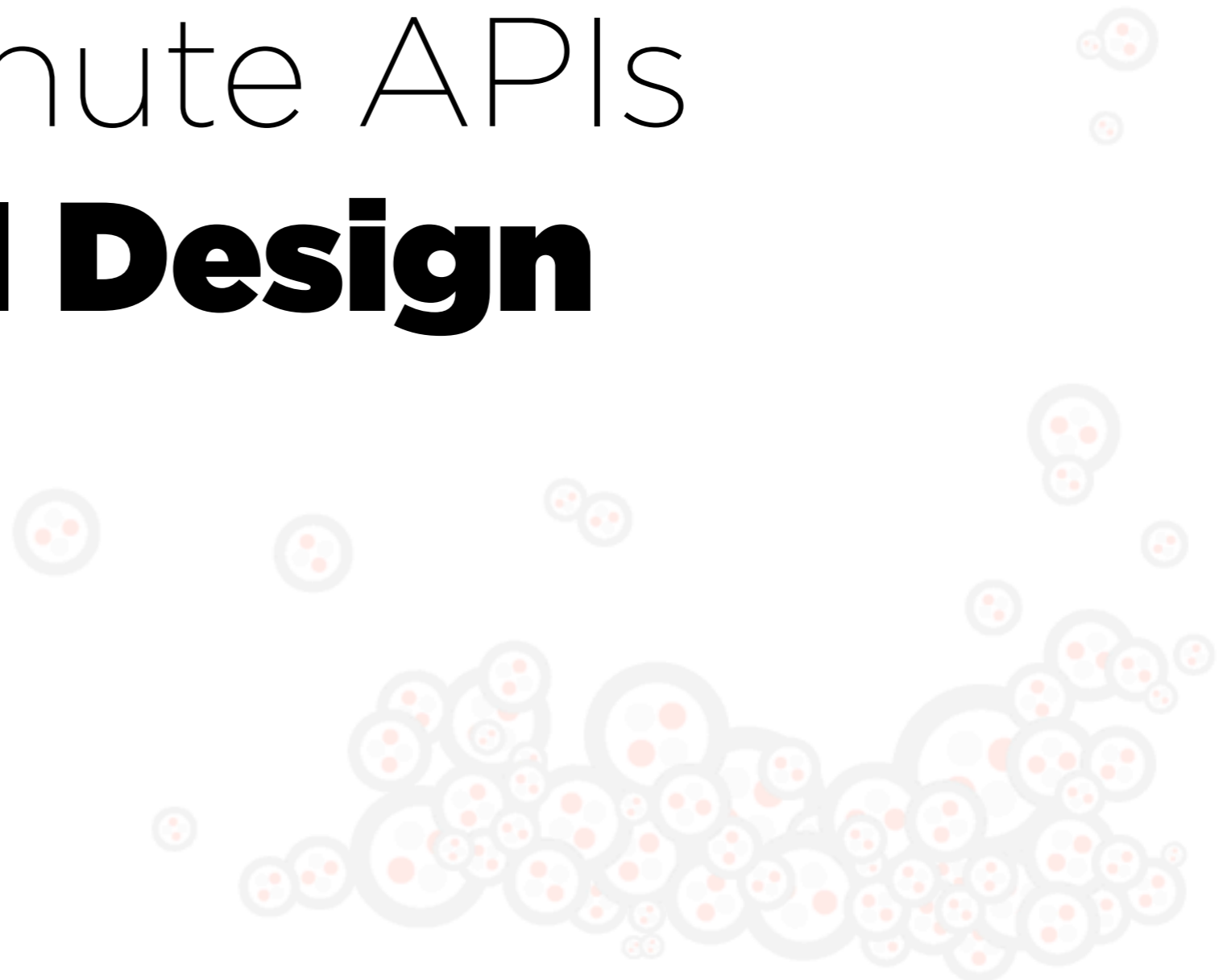
Buy it

Traction



5-minute APIs

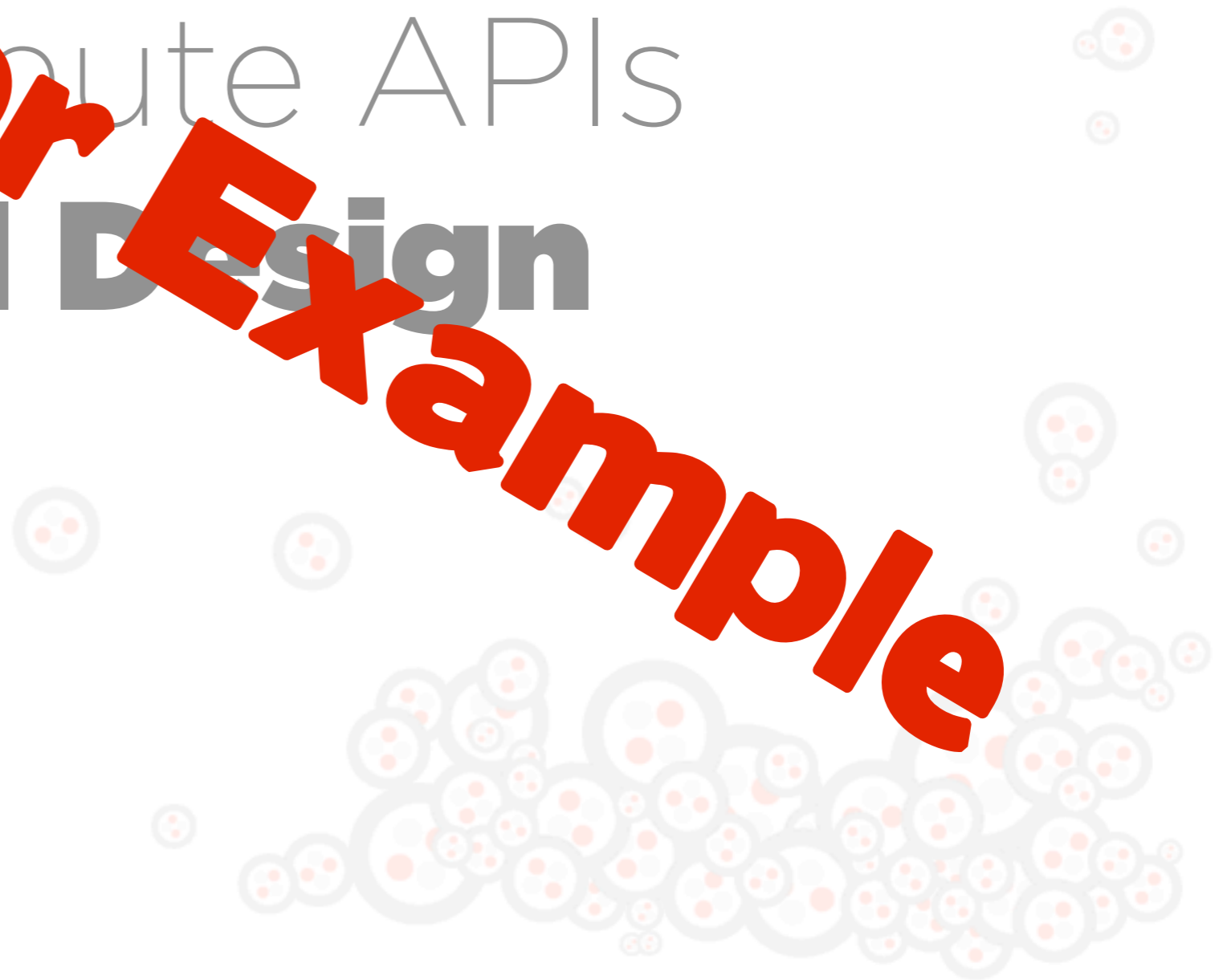
API Design



Counter Example

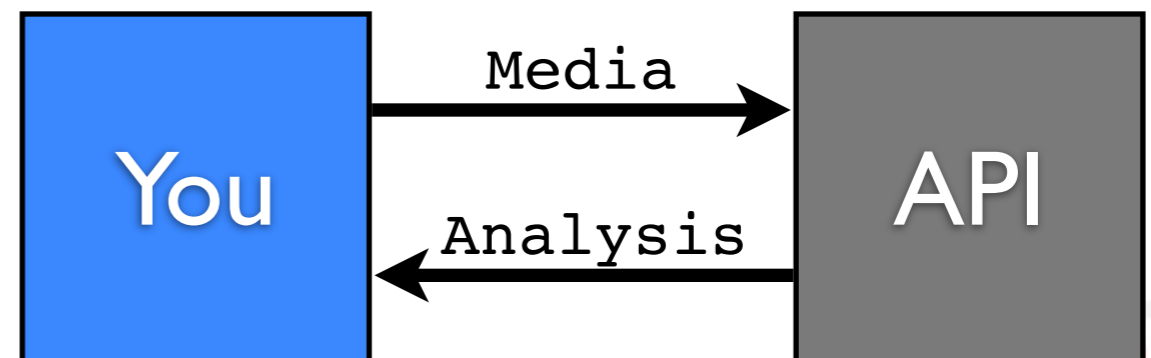
5-minute APIs

API Design



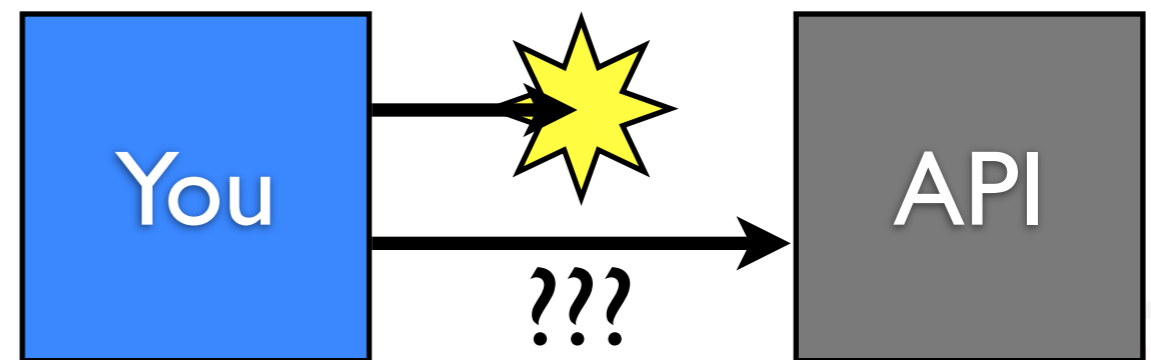
Media processing API

- HTTP API to analyze large (MBs) media files
- High tps ~100,000/day
- POST data to the API
- API synchronously returns analysis of media (could be minutes/hours later)



Media processing API

- Control and data in the same request (100 MB every request)
- Unclear error conditions. Can you resend request?
- Synchronously wait for response
- No request history/billing information



Media processing API

I Original Request

```
POST http://api.vendor.com/API/Process?  
key=2hkh&mode=bob&filter=yeah
```

Body is 100MB of binary data

Problem

Can we safely retry the request on
a transient failure?

Media processing API

2 Add a token allowing us to safely retry

POST `http://api.vendor.com/API/Process?
key=2hkh&mode=bob&filter=yeah&token=TK123`

Body is 100MB of binary data

Problem

Exposed to transient failures if the processing takes minutes/hours?

Media processing API

3 Add webhook url to asynchronously respond

```
POST http://api.vendor.com/API/Process?  
key=2hkh&mode=bob&filter=yeah&token=TK123&c  
bUrl=http%3A%2F%2Fmyserver.com%2Fresponse
```

Body is 100MB of binary data

Problem

Request is huge and fragile when data is included with control cmd?

Media processing API

4 Async fetch media & move POST params to body

POST <http://api.vendor.com/API/Process>

Body

key=2hkh

mode=bob

filter=yeah

token=TK123

cbUrl=<http://myserver.com/response>

mediaUrl=<http://s3.com/media.mov>

Media processing API

5 Version API and make URL more RESTful

POST <http://api.vendor.com/v1/Media>

Body

key=2hkh

mode=bob

filter=yeah

token=TK123

cbUrl=<http://myserver.com/response>

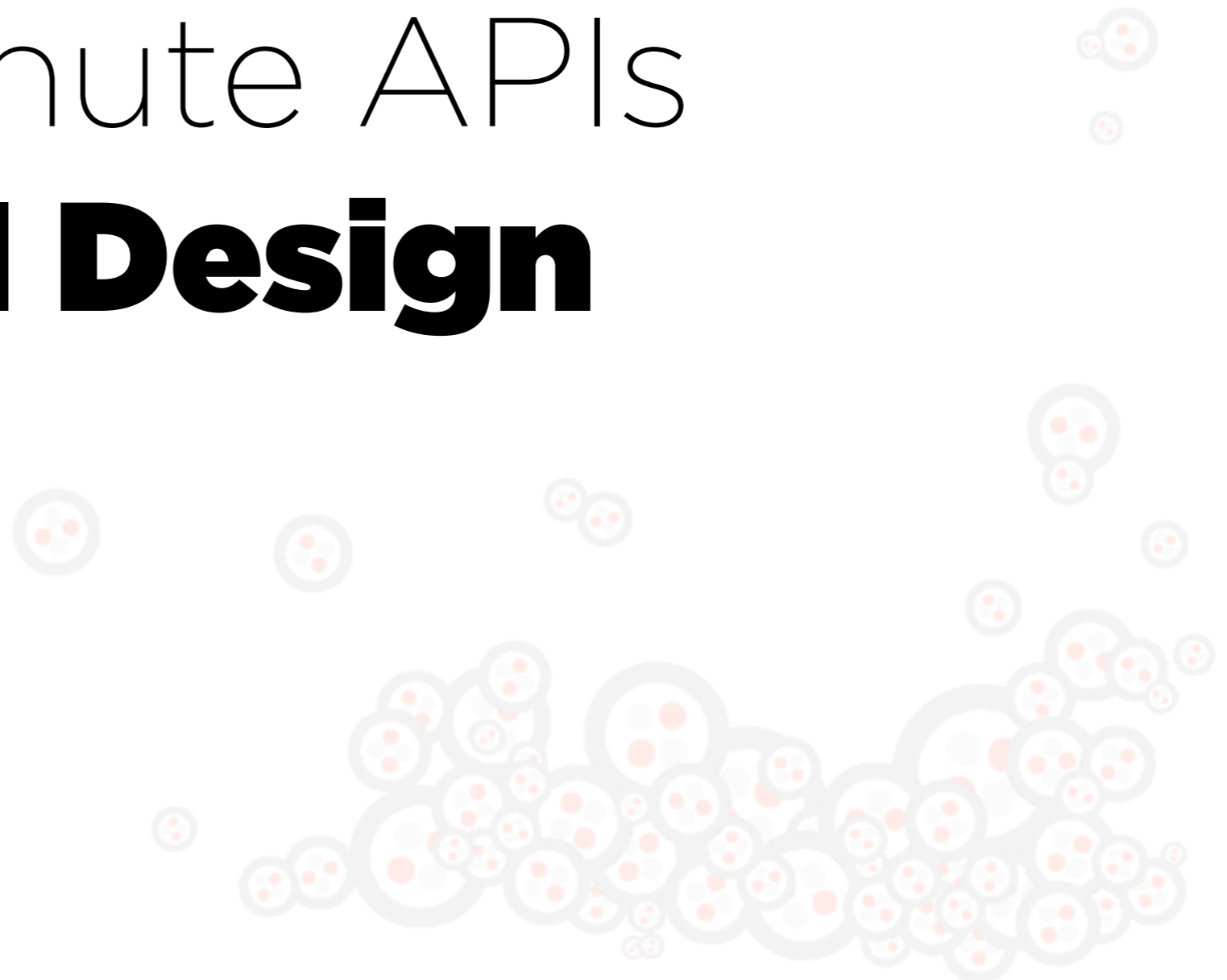
mediaUrl=<http://s3.com/media.mov>

Response

URI <http://api.vendor.com/v1/Media/MD123>

5-minute APIs

API Design



Idempotency

- **Idempotence** is the property of certain operations that they can be applied multiple times without changing the result.
- Request failures happen. Provide users a safe way to retry requests
- Example:

```
POST /BankAccount/Funds
```

```
{ 'value' : 1000, 'token' : 'TX123' }
```



Amazon Elastic Compute Cloud

API Reference (API Version 2010-08-31)

Click here for the latest version of this document



DisassociateAddress	<i>PrivateIpAddress</i>	If you're using Amazon Virtual Private Cloud, you can optionally use this parameter to assign the instance a specific available IP address from the subnet (e.g., 10.0.0.25).	No
GetConsoleOutput			
GetPasswordData			
ImportKeyPair		Type: String	
ModifyImageAttribute		Default: Amazon VPC selects an IP address from the subnet for the instance	
ModifyInstanceAttribute			
ModifySnapshotAttribute	<i>ClientToken</i>	Unique, case-sensitive identifier you provide to ensure idempotency of the request. For more information, go to How to Ensure Idempotency in the Amazon Elastic Compute Cloud User Guide .	No
MonitorInstances			
PurchaseReservedInstancesC			
RebootInstances		Type: String	
RegisterImage		Default: None	
ReleaseAddress		Constraints: Maximum 64 ASCII characters	
RequestSpotInstances			
ResetImageAttribute			
ResetInstanceAttribute			
ResetSnapshotAttribute			
RevokeSecurityGroupIngress			
RunInstances			
StartInstances			
StopInstances			
TerminateInstances			
UnmonitorInstances			

Response Elements

The elements in the following table come wrapped in a `RunInstancesResponse` structure.

Name	Description
<code>requestId</code>	The ID of the request. Type: <code>xsd:string</code>
<code>reservationId</code>	Unique ID of the reservation. Type: <code>xsd:string</code>
<code>ownerId</code>	ID of the AWS account that owns the reservation. Type: <code>xsd:string</code>
<code>groupSet</code>	List of security groups the instance belongs to. Each group's information is wrapped in an <code>item</code> element. Type: <code>GroupItemType</code>
<code>instancesSet</code>	A list of instances. Each instance's information is wrapped in an <code>item</code> element. Type: <code>RunningInstancesItemType</code>

Data Types

- Error Codes
- Amazon EC2 Resources
- Document History
- Document Conventions

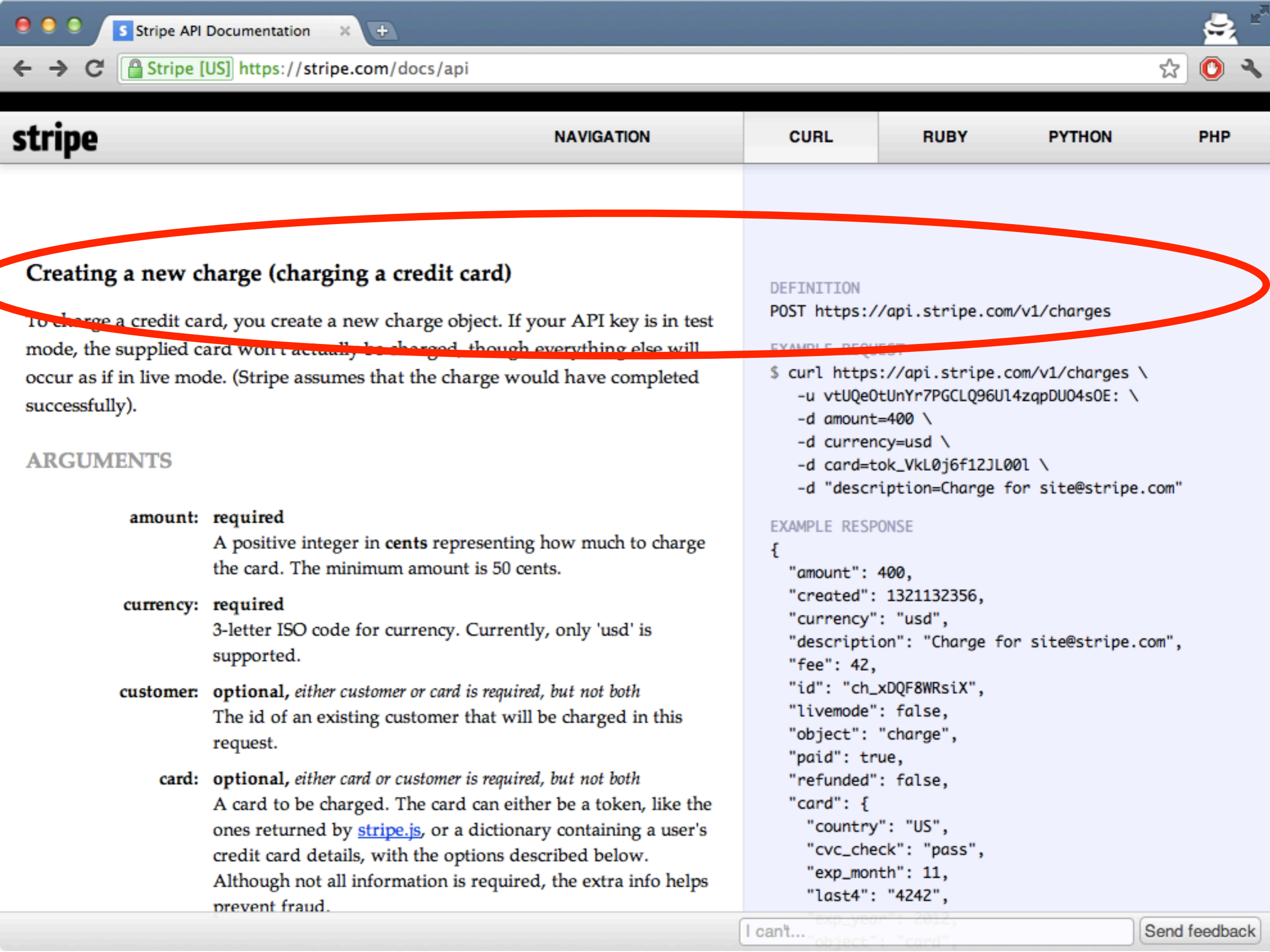
Self-documentation

- Sweat what and how you name. Naming is the best documentation.
- Example:

```
GET /Users/ID123
```

```
GET /Users/ID123/Friends
```

```
GET /Users/ID123/Photos
```

Creating a new charge (charging a credit card)

To charge a credit card, you create a new charge object. If your API key is in test mode, the supplied card won't actually be charged, though everything else will occur as if in live mode. (Stripe assumes that the charge would have completed successfully).

ARGUMENTS

amount: required

A positive integer in **cents** representing how much to charge the card. The minimum amount is 50 cents.

currency: required

3-letter ISO code for currency. Currently, only 'usd' is supported.

customer: optional, either customer or card is required, but not both

The id of an existing customer that will be charged in this request.

card: optional, either card or customer is required, but not both

A card to be charged. The card can either be a token, like the ones returned by [stripe.js](#), or a dictionary containing a user's credit card details, with the options described below. Although not all information is required, the extra info helps prevent fraud.

DEFINITION

POST https://api.stripe.com/v1/charges

EXAMPLE REQUEST

```
$ curl https://api.stripe.com/v1/charges \
-u vtUQe0tUnYr7PGCLQ96U14zqpDU04s0E: \
-d amount=400 \
-d currency=usd \
-d card=tok_VkL0j6f12JL001 \
-d "description=Charge for site@stripe.com"
```

EXAMPLE RESPONSE

```
{
  "amount": 400,
  "created": 1321132356,
  "currency": "usd",
  "description": "Charge for site@stripe.com",
  "fee": 42,
  "id": "ch_xDQF8WRsiX",
  "livemode": false,
  "object": "charge",
  "paid": true,
  "refunded": false,
  "card": {
    "country": "US",
    "cvc_check": "pass",
    "exp_month": 11,
    "last4": "4242",
```

RESTfulness

- Adherence to REST object model and verbs provides a clean way to expose business logic
- Create POST /Users
- Fetch GET /Users/ID123
- Modify PUT/POST /Users/ID123
- Remove DELETE /Users/ID123


Google™ Custom Search

Help

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- [The Forums](#)
- [Ask Support](#)

General Info

- [FAQs](#)
- [Video Tour](#)
- [Terminology](#)

Accounts

- [Login](#)
- [Account Manager](#)
- [User Management](#)
- [Activity Log](#)

Forms

- [Form Manager](#)
- [Form Builder](#)
- [Entry Manager](#)
- [Code Manager](#)
- [Notifications](#)
- [Rule Builder](#)
- [Payment Settings](#)
- [Integrations](#)

Wufoo Rest API V3

On this Page

- [1. Introduction](#)
- [2. Finding Your Key](#)
- [3. Wufoo REST Structure](#)
- [4. URL Prefix](#)
- [5. The Extension](#)
- [6. Convenience Parameters](#)
- [7. Authentication](#)
- [8. Hashed URL Vs Friendly URL](#)

FAQs

- [1. Are there any API restrictions?](#)
- [2. Can sub-users use the API?](#)
- [3. Where are the old APIs?](#)

Introduction

Other APIs

- [1. API Introduction](#)
- [2. Forms GET](#)
- [3. Fields GET](#)
- [4. Entries GET / POST](#)
- [5. Users GET](#)
- [6. Reports GET](#)
- [7. Widgets GET](#)
- [8. Comments GET](#)
- [9. Web Hooks PUT / DELETE](#)
- [10. Login POST](#)
- [11. Examples](#)
- [12. The Wufoo REST Principles](#)

API Wrappers

- [1. Learn about and get API Wrappers](#)

Versioning

- Do it. Remember you will be stuck supporting old API versions (indefinitely?)

- Examples

```
GET /api/1/blag
```

```
GET /api/v1/blag
```

```
GET /api/20101206/blag
```



POST statuses/update

Updated on Thu, 2011-11-03 21:00

Updates the authenticating user's status, also known as tweeting. To upload an image to accompany the tweet, use [POST statuses/update_with_media](#).

For each update attempt, the update text is compared with the authenticating user's recent tweets. Any attempt that would result in duplication will be blocked, resulting in a 403 error. Therefore, a user cannot submit the same status twice in a row.

While not rate limited by the API a user is limited in the number of tweets they can create at a time. If the number of updates posted by the user reaches the current allowed limit this method will return an HTTP 403 error.

Resource URL

<http://api.twitter.com/1/statuses/update.format>

Parameters

status
required The text of your status update, typically up to 140 characters. URL encode as necessary. [t.co link wrapping](#) may effect character counts.

in_reply_to_status_id
optional The ID of an existing status that the update is in reply to.
Note: This parameter will be ignored unless the author of the tweet this parameter references is mentioned within the status text. Therefore, you must include @username, where username is the author of the referenced tweet, within the update.

Jump to

Related open issues

[Sending a DM using statuses/update results in a 404, but the message is still sent.](#)

Resource Information

Rate Limited?	No
Requires Authentication?	Yes
Response Formats	json xml
HTTP Methods	POST

OAuth tool

Please [Sign in](#) with your Twitter account

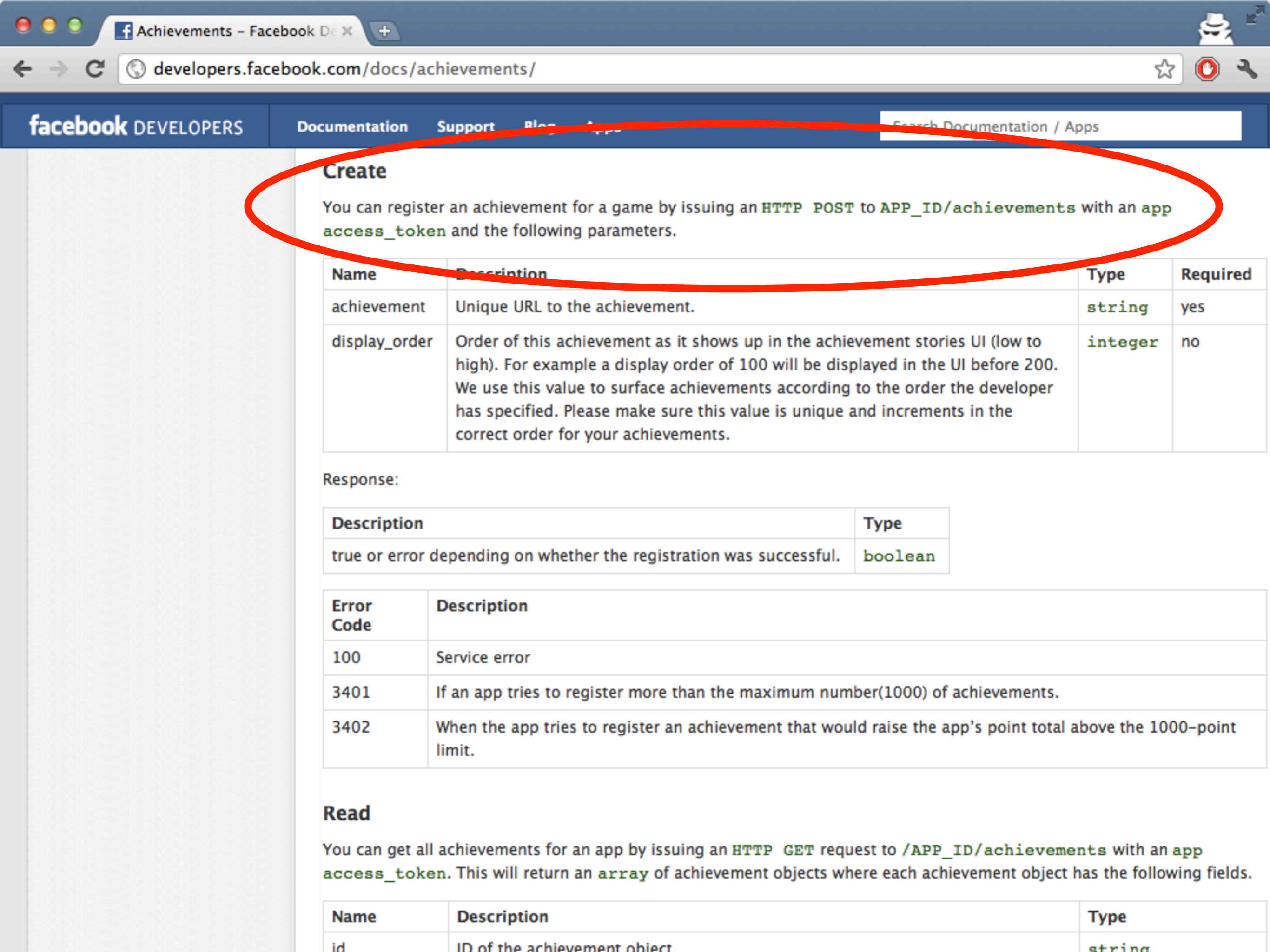
Statefulness

- When possible, offload the work of keeping state/history because it's hard!
- Examples

POST /Calls

GET /Calls/CA123

GET /Calls/CA123/Recordings/RE123



Create

You can register an achievement for a game by issuing an `HTTP POST` to `APP_ID/achievements` with an `app access_token` and the following parameters.

Name	Description	Type	Required
achievement	Unique URL to the achievement.	string	yes
display_order	Order of this achievement as it shows up in the achievement stories UI (low to high). For example a display order of 100 will be displayed in the UI before 200. We use this value to surface achievements according to the order the developer has specified. Please make sure this value is unique and increments in the correct order for your achievements.	integer	no

Response:

Description	Type
true or error depending on whether the registration was successful.	boolean

Error Code	Description
100	Service error
3401	If an app tries to register more than the maximum number(1000) of achievements.
3402	When the app tries to register an achievement that would raise the app's point total above the 1000-point limit.

Read

You can get all achievements for an app by issuing an `HTTP GET` request to `/APP_ID/achievements` with an `app access_token`. This will return an `array` of achievement objects where each achievement object has the following fields.

Name	Description	Type
id	ID of the achievement object.	string

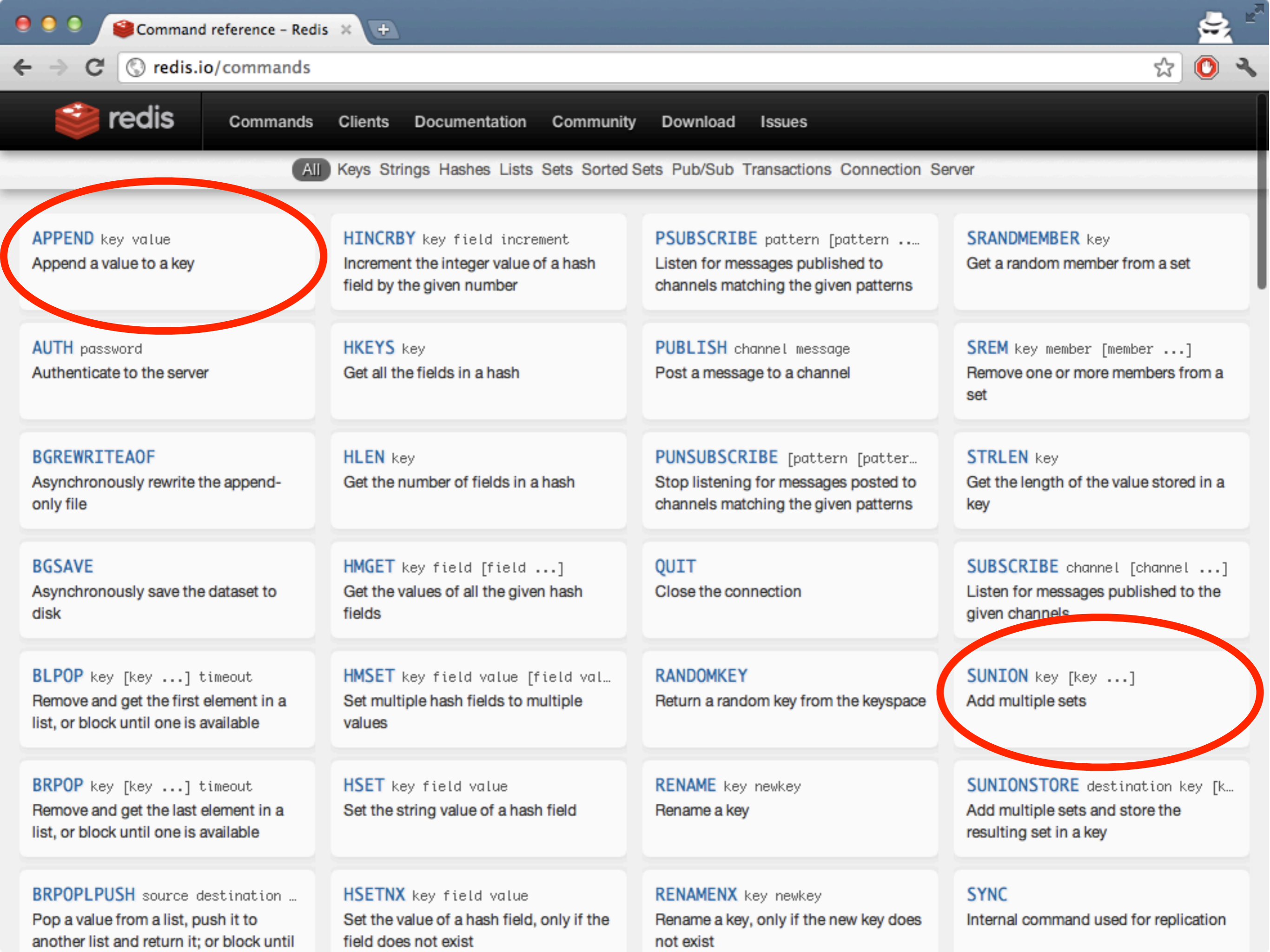
Predictability

- The API should do what users expect
- Examples

```
<Play>music.mp3</Play>
```

```
<Play>music.aiff</Play>
```





APPEND key value
Append a value to a key

AUTH password
Authenticate to the server

BGREWRITEAOF
Asynchronously rewrite the append-only file

BGSAVE
Asynchronously save the dataset to disk

BLPOP key [key ...] timeout
Remove and get the first element in a list, or block until one is available

BRPOP key [key ...] timeout
Remove and get the last element in a list, or block until one is available

BRPOPLPUSH source destination ...
Pop a value from a list, push it to another list and return it; or block until

HINCRBY key field increment
Increment the integer value of a hash field by the given number

HKEYS key
Get all the fields in a hash

HLEN key
Get the number of fields in a hash

HMGET key field [field ...]
Get the values of all the given hash fields

HMSET key field value [field val...]
Set multiple hash fields to multiple values

HSET key field value
Set the string value of a hash field

HSETNX key field value
Set the value of a hash field, only if the field does not exist

PSUBSCRIBE pattern [pattern ...]
Listen for messages published to channels matching the given patterns

PUBLISH channel message
Post a message to a channel

PUNSUBSCRIBE [pattern [patter...]
Stop listening for messages posted to channels matching the given patterns

QUIT
Close the connection

RANDOMKEY
Return a random key from the keyspace

RENAME key newkey
Rename a key

RENAMENX key newkey
Rename a key, only if the new key does not exist

SRANDMEMBER key
Get a random member from a set

SREM key member [member ...]
Remove one or more members from a set

STRLEN key
Get the length of the value stored in a key

SUBSCRIBE channel [channel ...]
Listen for messages published to the given channels

SUNION key [key ...]
Add multiple sets

SUNIONSTORE destination key [k...]
Add multiple sets and store the resulting set in a key

SYNC
Internal command used for replication

Responsiveness

- When a response is available immediately, use a synchronous response. Otherwise, consider an asynchronous *webhook* rather than polling
- Examples:

POST /Object/Transforms

Body

cbUrl=<http://b.com/response>

Twiml™ Voice: <Record>

The <Record> verb records the caller's voice and returns to you the URL of a file containing the audio recording. You can optionally generate text transcriptions of recorded calls by setting the 'transcribe' attribute of the <Record> verb to 'true'.

Verb Attributes

The <Record> verb supports the following attributes that modify its behavior:

Attribute Name	Allowed Values	Default Value
<u>action</u>	relative or absolute URL	current document URL
<u>method</u>	GET, POST	POST
<u>timeout</u>	positive integer	5
<u>finishOnKey</u>	any digit # *	1234567890*#
<u>maxLength</u>	integer greater than 1	3600 (1 hour)
<u>transcribe</u>	true, false	false
<u>transcribeCallback</u>	relative or absolute URL	none
<u>playBeep</u>	true, false	true

action

The 'action' attribute takes an absolute or relative URL as a value. When recording is finished Twilio will make a GET or POST request to this URL including the parameters below. If no 'action' is provided, <Record> will default to requesting the current document's URL.

After making this request, Twilio will continue the current call using the Twiml received in your response. Keep in mind that by default Twilio will re-request the current document's URL, which can lead to unwanted looping behavior if you're not careful. Any

- Docs Home
- Quickstart Guides
- HowTo's and Examples
- Helper Libraries

Twiml Reference

Version 2010-04-01

- Voice
 - Overview
 - Twilio Request
 - Your Response
 - Primary Verbs
 - <Say>
 - <Play>
 - <Gather>
 - <Record>
 - <Sms>
 - <Dial>
 - <Number>
 - <Client>
 - <Conference>
 - Secondary Verbs
 - <Hangup>
 - <Redirect>

Key Ideas

- Idempotency
- Self-documentation
- RESTfulness
- Versioning
- Statefulness
- Predictability
- Responsiveness



5-minute APIs

“Good”



What makes a good API?

- Easy to Learn
- Easy to use (even without documentation)
- Hard to Misuse
- Easy to read and maintain code that uses it
- Sufficiently powerful to satisfy requirements
- Easy to extend
- Appropriate to audience

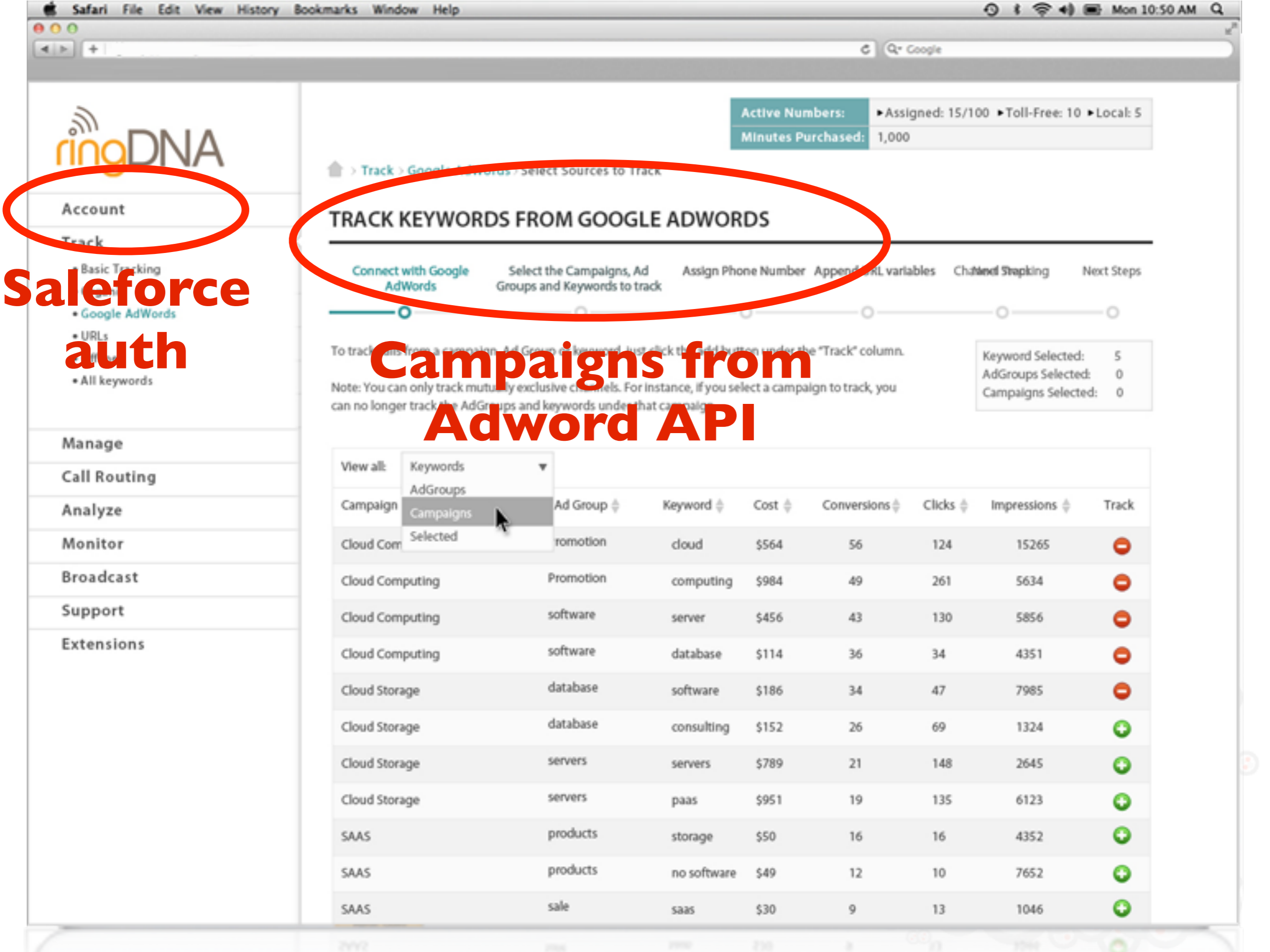
How to Design a Good API and Why it Matters
Joshua Bloch, Google



Human-centric



ringDNA



**Salesforce
auth**

**Campaigns from
Adword API**

Active Numbers: ▶ Assigned: 15/100 ▶ Toll-Free: 10 ▶ Local: 5
Minutes Purchased: 1,000

Track > Google AdWords > Select Sources to Track

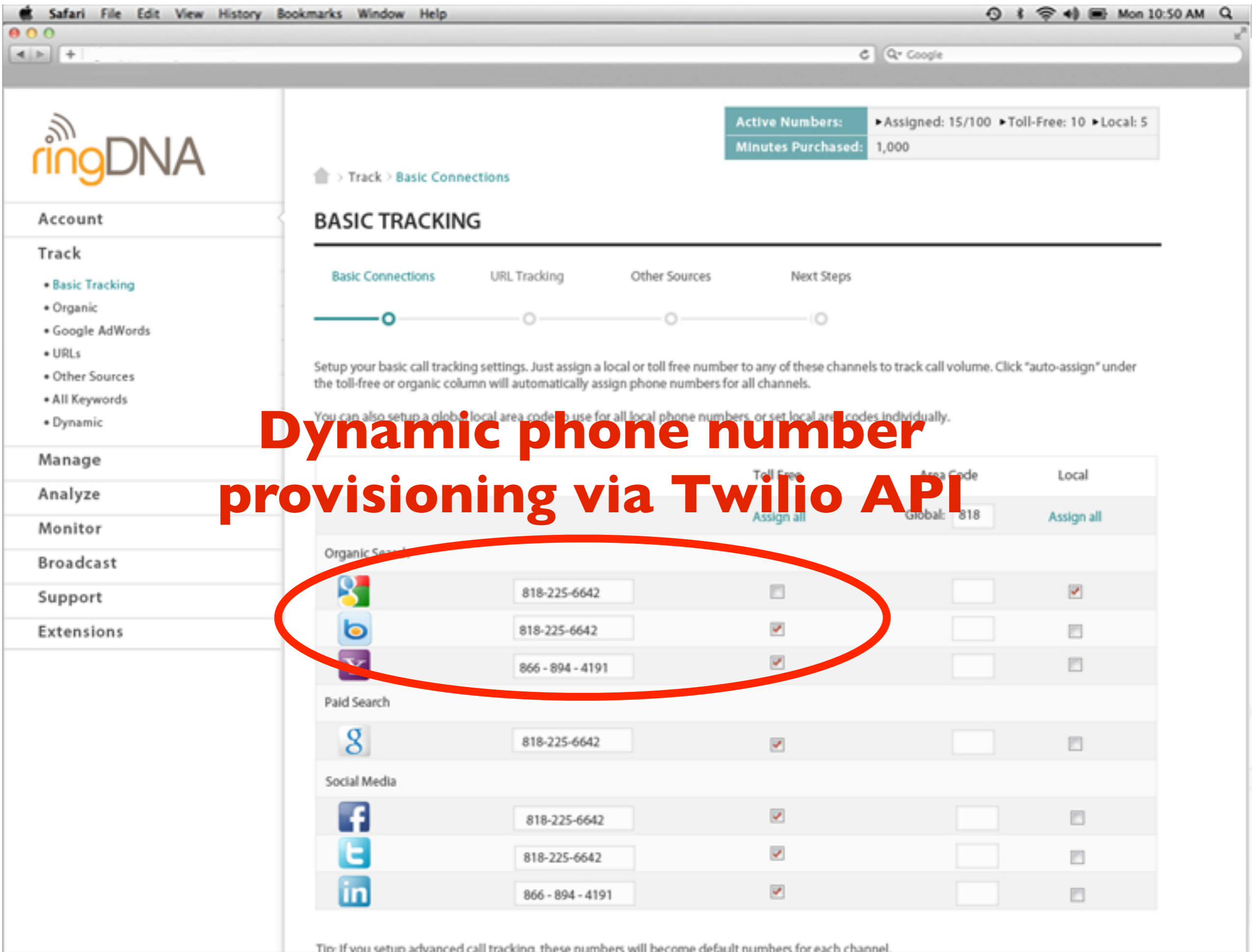
TRACK KEYWORDS FROM GOOGLE ADWORDS

Connect with Google AdWords | Select the Campaigns, Ad Groups and Keywords to track | Assign Phone Number | Append URL variables | Channel Striping | Next Steps

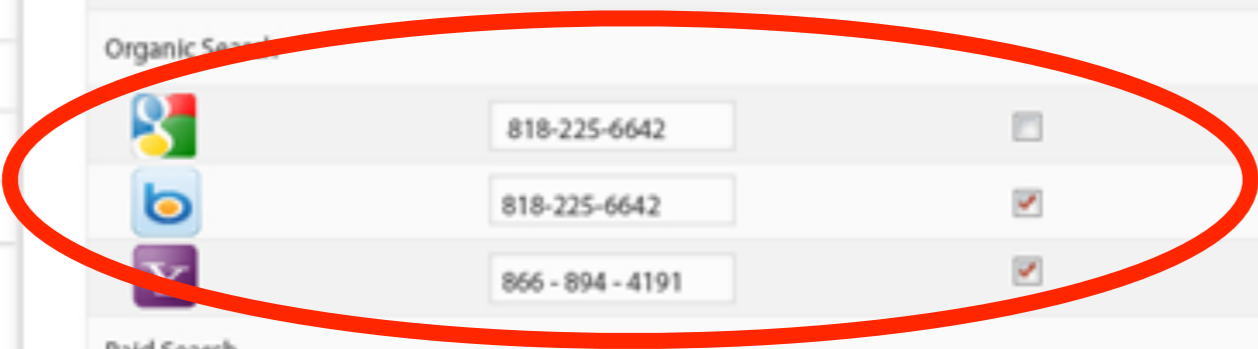
To track keywords from a campaign, Ad Group or keyword, just click the Add button under the "Track" column.
Note: You can only track mutually exclusive channels. For instance, if you select a campaign to track, you can no longer track the AdGroups and keywords under that campaign.

Keyword Selected: 5
AdGroups Selected: 0
Campaigns Selected: 0

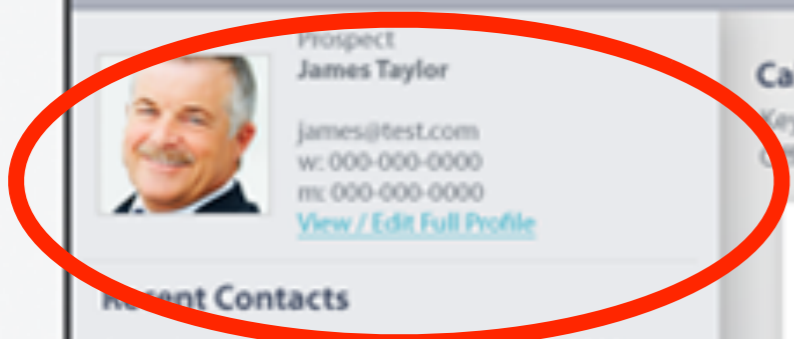
View all:	Keywords		Ad Group	Keyword	Cost	Conversions	Clicks	Impressions	Track
Campaign	Campaigns		Promotion	cloud	\$564	56	124	15265	-
Cloud Com	Selected		Promotion	cloud	\$564	56	124	15265	-
Cloud Computing			Promotion	computing	\$984	49	261	5634	-
Cloud Computing			software	server	\$456	43	130	5856	-
Cloud Computing			software	database	\$114	36	34	4351	-
Cloud Storage			database	software	\$186	34	47	7985	-
Cloud Storage			database	consulting	\$152	26	69	1324	+
Cloud Storage			servers	servers	\$789	21	148	2645	+
Cloud Storage			servers	paas	\$951	19	135	6123	+
SAAS			products	storage	\$50	16	16	4352	+
SAAS			products	no software	\$49	12	10	7652	+
SAAS			sale	saas	\$30	9	13	1046	+



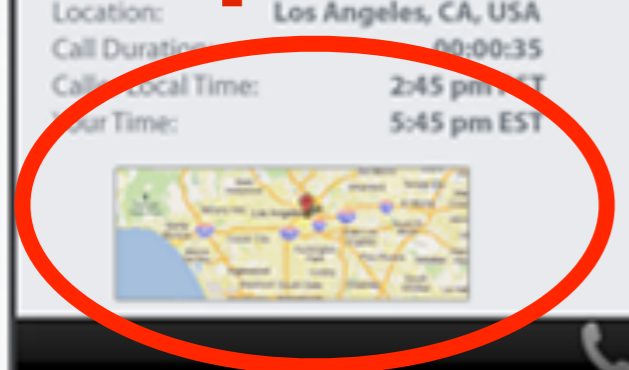
Dynamic phone number provisioning via Twilio API



**Salesforce
CRM data**

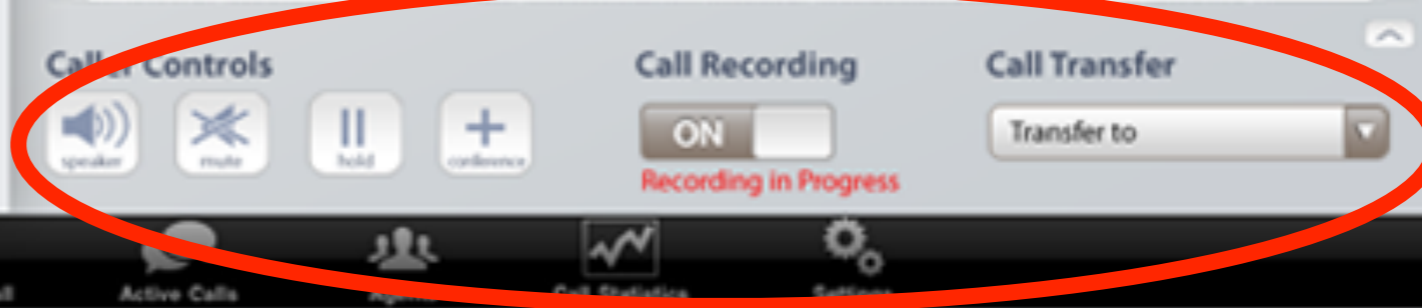
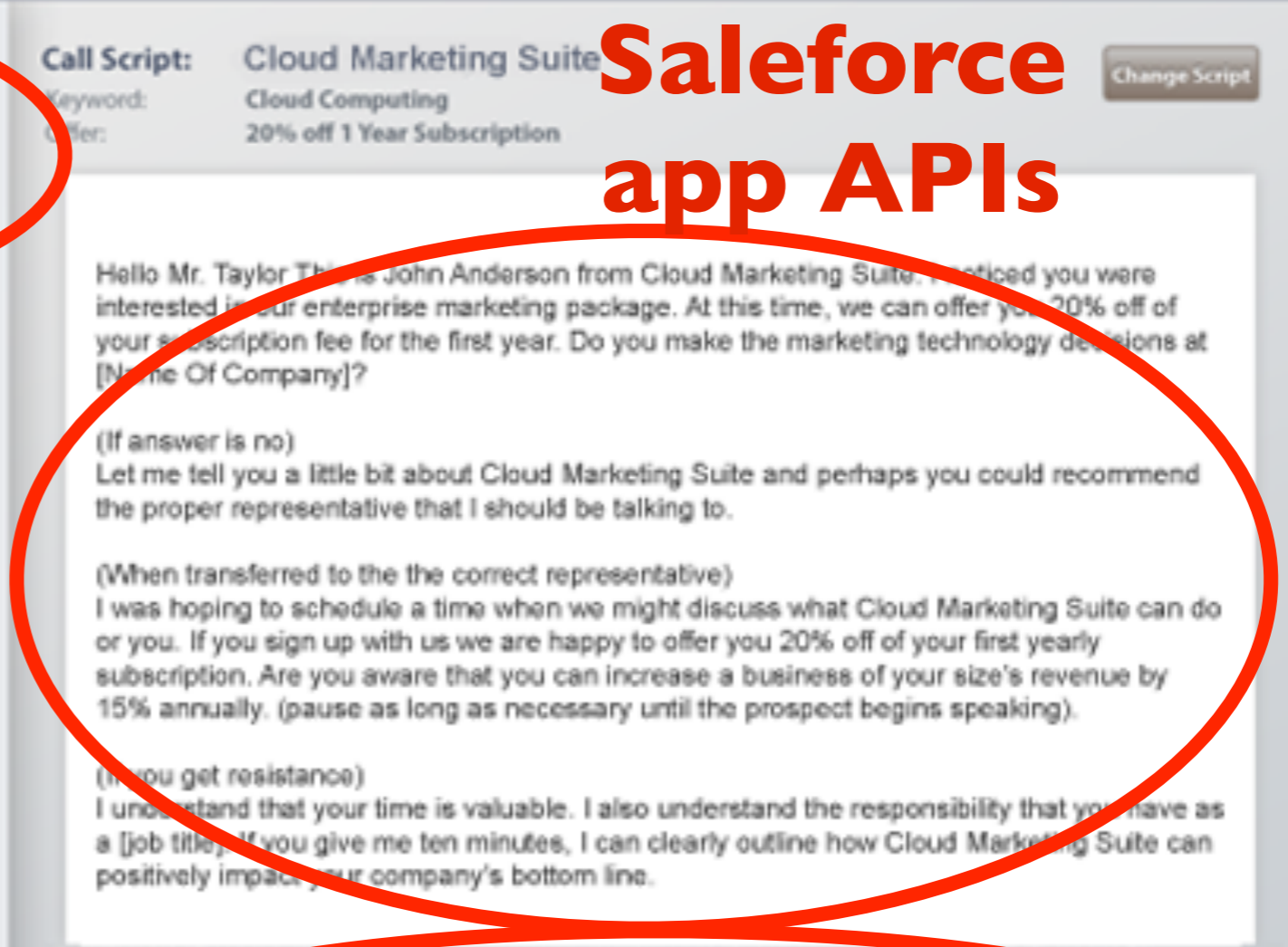


**Google
Maps API**



Incoming Call - Advanced Caller ID

**Salesforce
app APIs**



Twilio Client API

Back

Active Calls



See Alerts ³

Listen to Call

Join Call

Cloud Marketing Suite

Agent Group: [Agent Group]

Status: [Status]

Call Information

Call Duration: [Duration]

Caller Information


Name: [Name]

Company: [Company]

Call Source: [Call Source]

Keyword: [Keyword]

In Salesforce: [In Salesforce]



Agent: Elise Baumhaus
Group: Tech Support (PST)
Status: **Call In Progress**

Call Information

Call Duration: **00:18:32** +32% vs. Avg

Caller Information

Name: Joe Smith
Company: Big Company Inc.
Call Source: Google (Organic)
Keyword: CRM
In Salesforce: Yes

Agent Group: [Agent Group]

Status: [Status]

Call Information

Call Duration: [Duration] +32% vs. Avg

Caller Information

Name: [Name]

Company: [Company]

Call Source: [Call Source]

Keyword: [Keyword]

In Salesforce: [In Salesforce]

Make A Call

Active Calls ⁸

Agents

Call Statistics

Settings

Simplicity



DEPLOYING YOUR WEB API



twilio
CLOUD COMMUNICATIONS



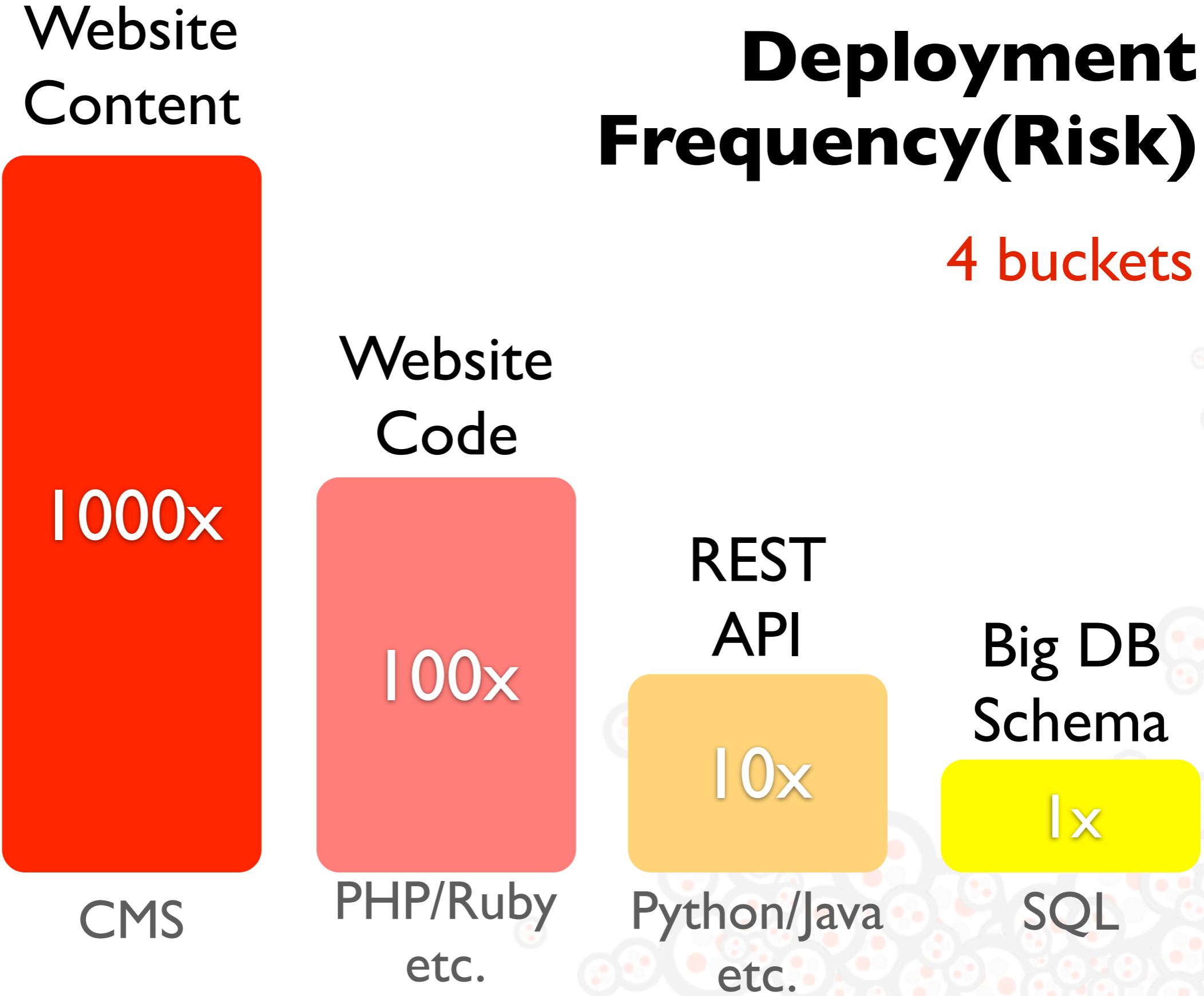
Infrastructure

- 100's of prod hosts in continuous operation
- 80+ service types running in prod
 - Python(Twisted/GEvent), PHP, Java
- 50+ prod database servers
 - MySQL, Redis
- Prod deployments **several times/day** across 7 engineering teams

Deployment Frequency(Risk)

4 buckets

Log Scale



Website Content



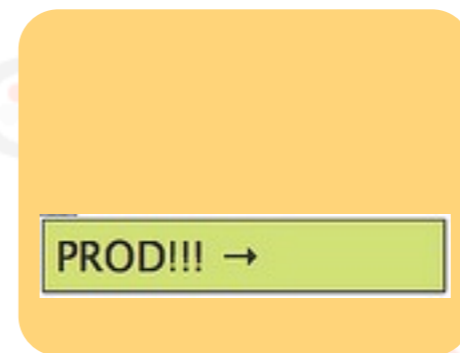
One Click

Website Code



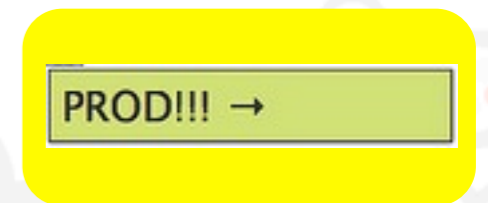
CI Tests
One Click

REST API



CI Tests
Human Sign-off
One Click

Big DB Schema



CI Tests
Human Sign-off
Human Assisted Click

Deployment Processes

Cluster automation via **boxconfig**

The screenshot shows the Boxconfig web interface in a browser window. The browser tab is titled "Boxconfig - dev" and the address bar shows "localhost:8888/#/hosts". The interface has a dark navigation bar with the "Boxconfig" logo, a search filter, and several menu items: "Hosts", "Roles", "Hostnames", "Instances", "Externals", and "Build Status". An "Actions" dropdown is on the right, and a green "dev" badge is in the top right corner.

Below the navigation bar is a "Hosts" section with a table listing various hosts. The table has columns for "Id", "SSH", "Description", "Status", "Svn", "Price", and "Roles". The "Status" column is color-coded: "Finished" is purple, and "Running" is green.

<input type="checkbox"/>	Id	SSH	Description	Status	Svn	Price	Roles
<input type="checkbox"/>	[redacted]	ssh	dev	Finished	21906	\$0.00	[redacted]
<input type="checkbox"/>	[redacted]	ssh	SAVE - min new	Running	22078	\$0.09	matrix
<input type="checkbox"/>	[redacted]	ssh	min	Running	22078	\$0.09	stream
<input type="checkbox"/>	[redacted]	ssh	Curious George new	Running	22077	\$0.09	monkey
<input type="checkbox"/>	[redacted]	ssh	Charlotte new	Running	22060	\$0.09	api web
<input type="checkbox"/>	[redacted]	ssh	Curious George	Running	21906	\$0.09	monkey
<input type="checkbox"/>	[redacted]	ssh	Charlotte	Running	21963	\$0.09	api web
<input type="checkbox"/>	[redacted]	ssh	[redacted]	Running	22044	\$0.09	
<input type="checkbox"/>	[redacted]	ssh	[redacted]	Running	22042	\$0.09	[redacted]
<input type="checkbox"/>	[redacted]	ssh	dev new	Running	22035	\$0.09	hurl-sp
<input type="checkbox"/>	[redacted]	ssh	dev	Running	21906	\$0.09	hurl-sp
<input type="checkbox"/>	[redacted]	ssh	dev new	Running	22022	\$0.09	hurl
<input type="checkbox"/>	[redacted]	ssh	Cache Money	Running	21993	\$0.09	memcache-api

Please give me feedback on UI

Cluster automation via **boxconfig**

Boxconfig - dev
localhost:8888/#/hosts

Boxconfig filter... Hosts Roles Hostnames Instances Externals Build Status Actions dev

Hosts

- Build and deployment system - boot entire Twilio stack with one key press
- Host configuration - versioned code & config
- Host orchestration - load balancing
- Monitoring and alerting - nagios
- Multi-datacenter deployment & analytics

Please give me feedback on UI

Cluster automation via **boxconfig**

The image shows a screenshot of the Boxconfig web interface. The browser address bar displays 'localhost:8888/#/hosts'. The interface includes a navigation menu with 'Hosts', 'Roles', 'Hostnames', 'Instances', 'Externals', and 'Build Status'. A 'filter...' input field is present. The main content area shows a table of hosts with columns for 'Id', 'SSH', and 'De'. A diagram is overlaid on the interface, illustrating the automation workflow:

- S3** (red circle) is connected to the host table via a red arrow labeled **Fetch**.
- A central box contains three layers: **role** (grey), **SVN/git** (red), and **Base (AMI)** (blue).
- A **Vanilla Linux Host (cloud/colo)** is indicated below the central box.
- A **Boxconfig** (black circle) is connected to the host table via a black arrow labeled **Provision**.
- A black arrow labeled **Start Roles** points from the **Boxconfig** circle to the **role** layer of the central box.

The background table shows several host entries, including one with 'Cache Money' in the 'De' column and 'Running' status.



twilio

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