

The Netflix logo, consisting of the word "NETFLIX" in white, bold, sans-serif capital letters with a slight 3D effect, set against a solid red rectangular background.

NETFLIX

Techniques for Scaling the Netflix API

By Daniel Jacobson

@daniel_jacobson

djacobson@netflix.com

Techniques for Scaling the Netflix API

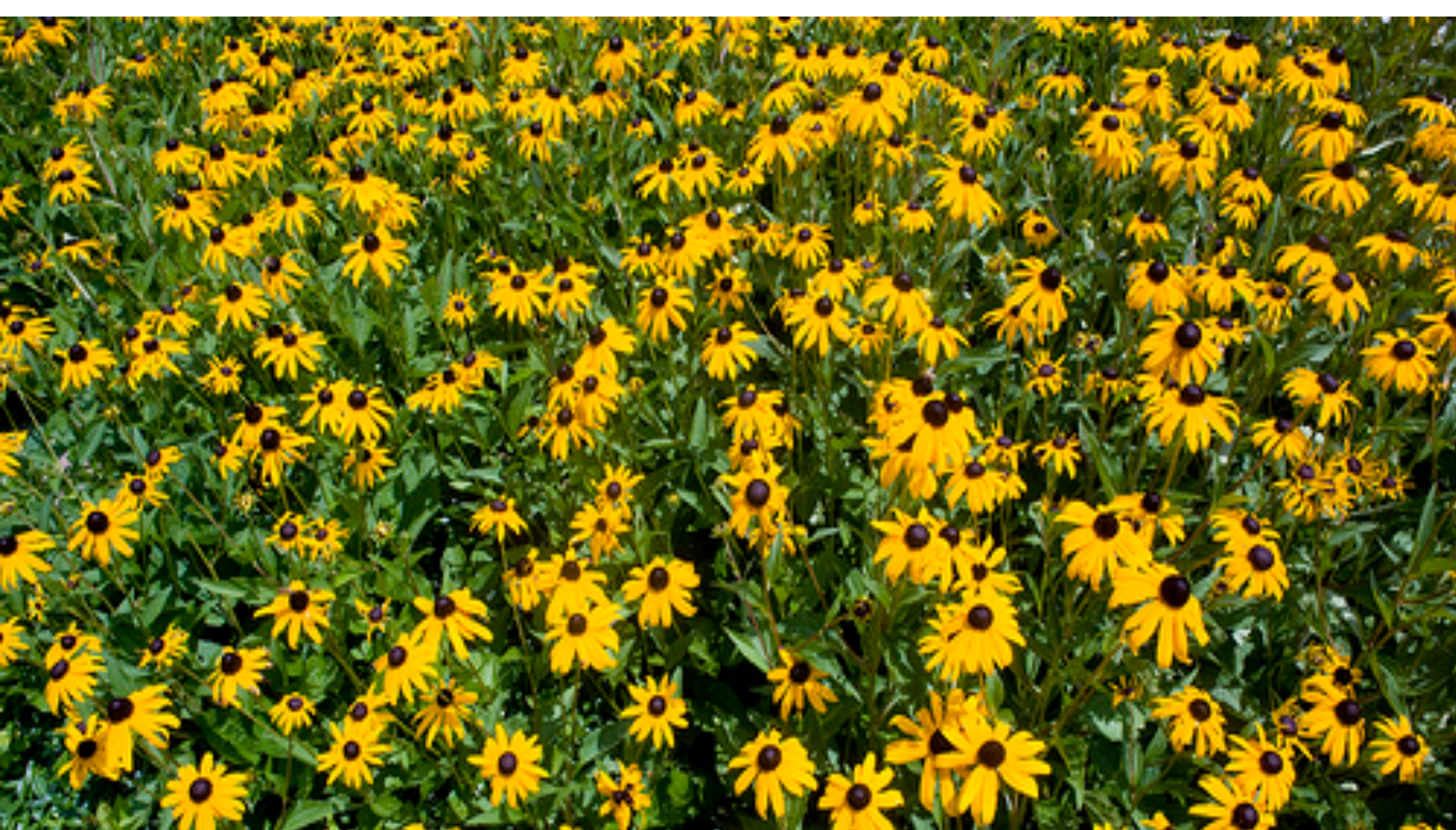
Agenda

- History of the Netflix API
- The Cloud
- Development and Testing
- Resiliency
- Future of the Netflix API

Techniques for Scaling the Netflix API

Agenda

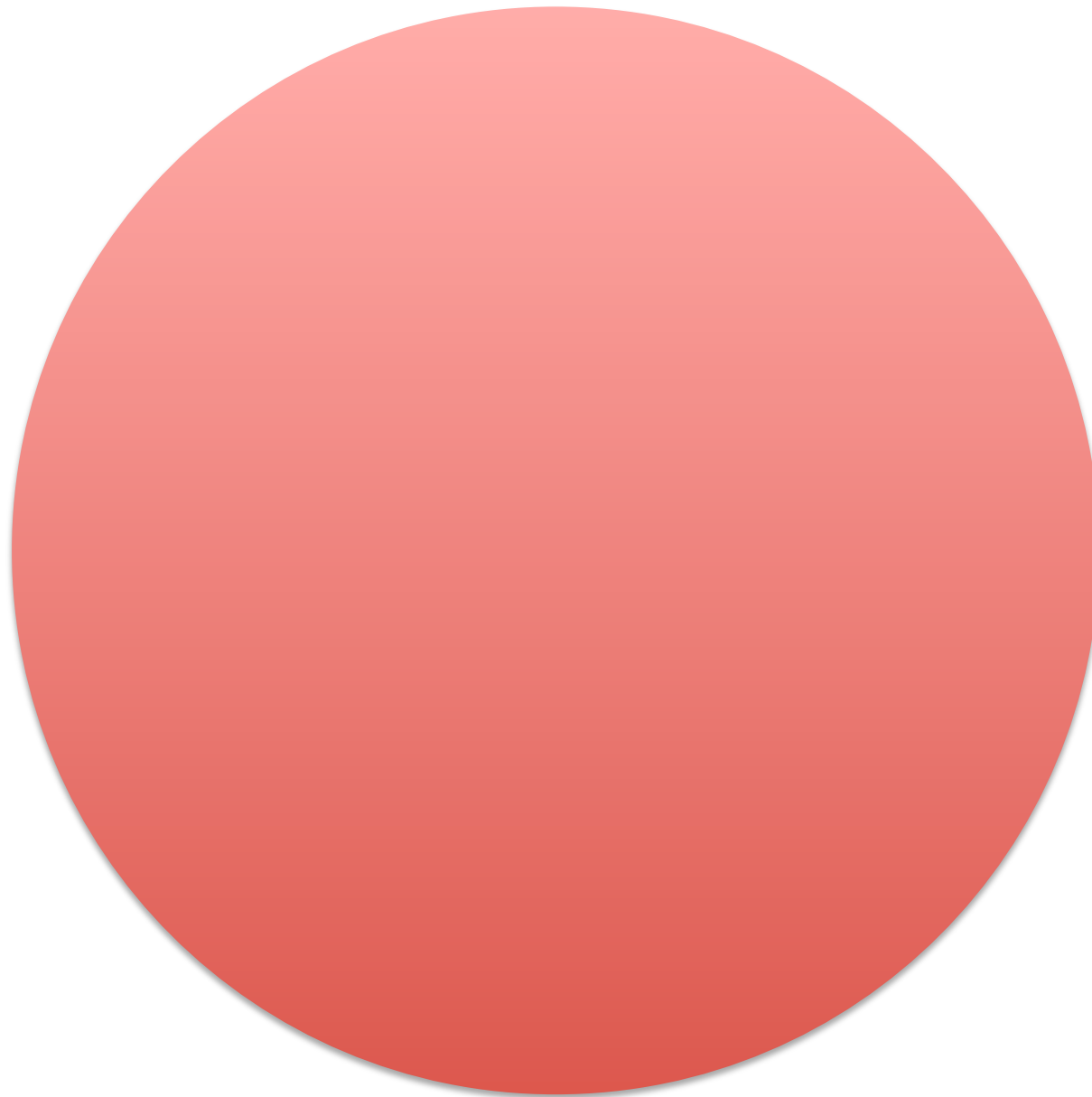
- History of the Netflix API
- The Cloud
- Development and Testing
- Resiliency
- Future of the Netflix API



Netflix
API

Netflix API Requests by Audience

At Launch In 2008



- Netflix Devices
- Open API Developers

instant**w**atcher.com



FeedFliks
get your money's worth from Netflix



jazzedTM

BOXEE



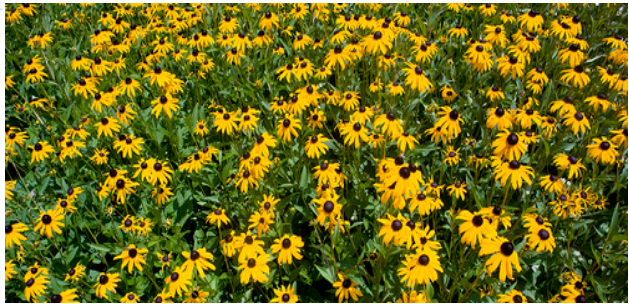
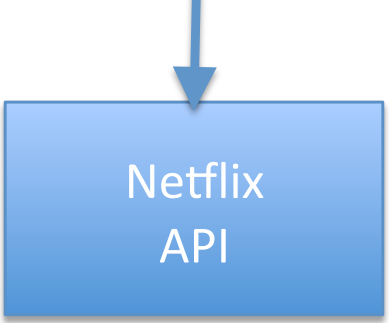
New From Netflix

Watch Movies Instantly On Your PC

Congratulations! You now have access to our instant movie watching feature.

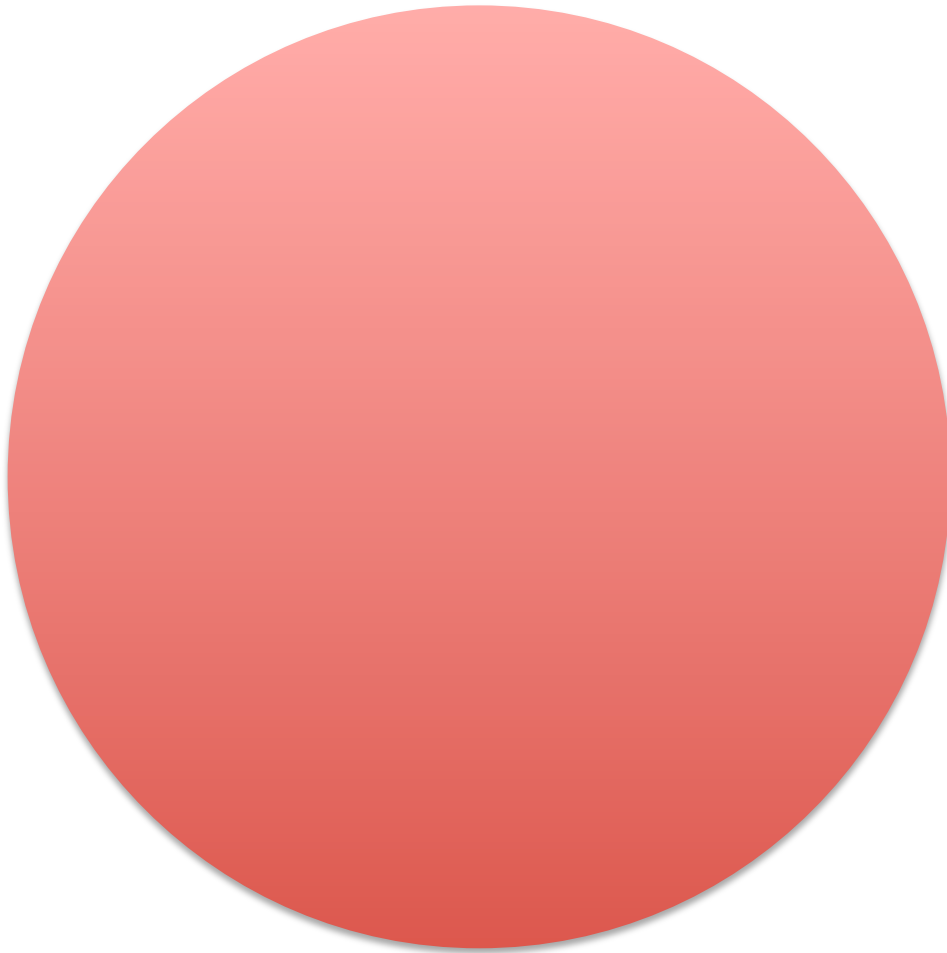
[Get Started Now](#)



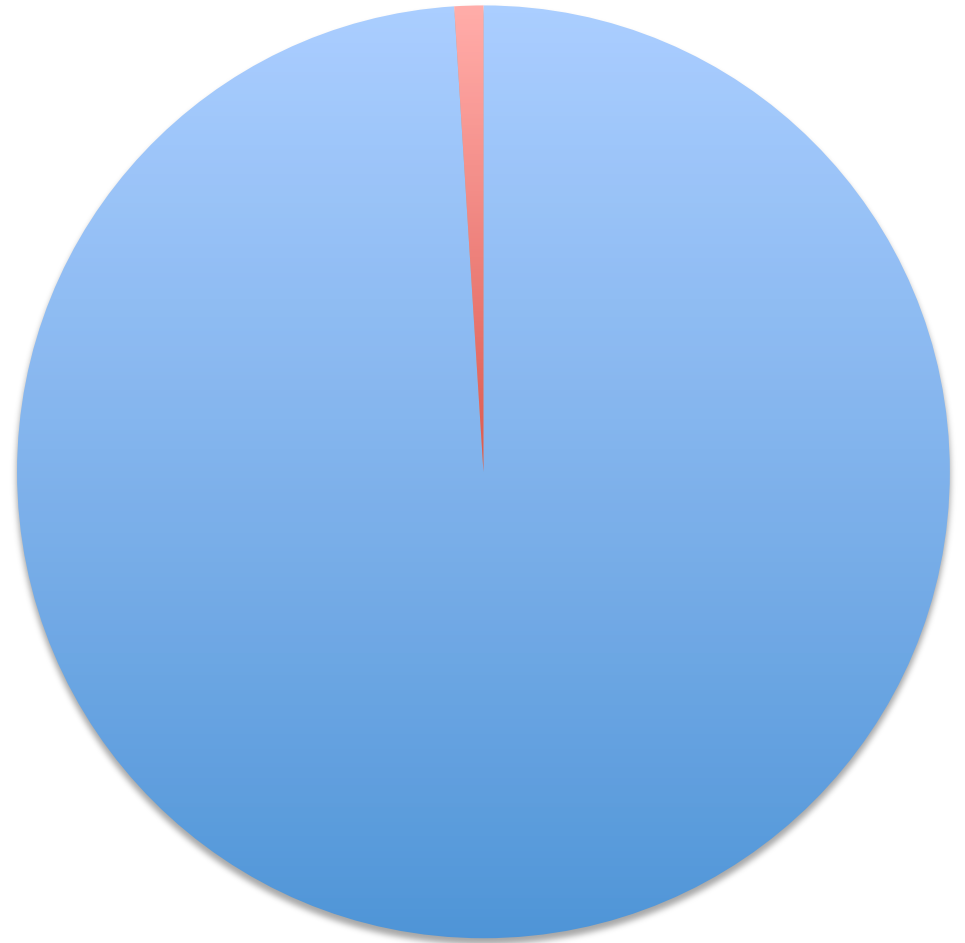


Netflix API Requests by Audience

At Launch



Today



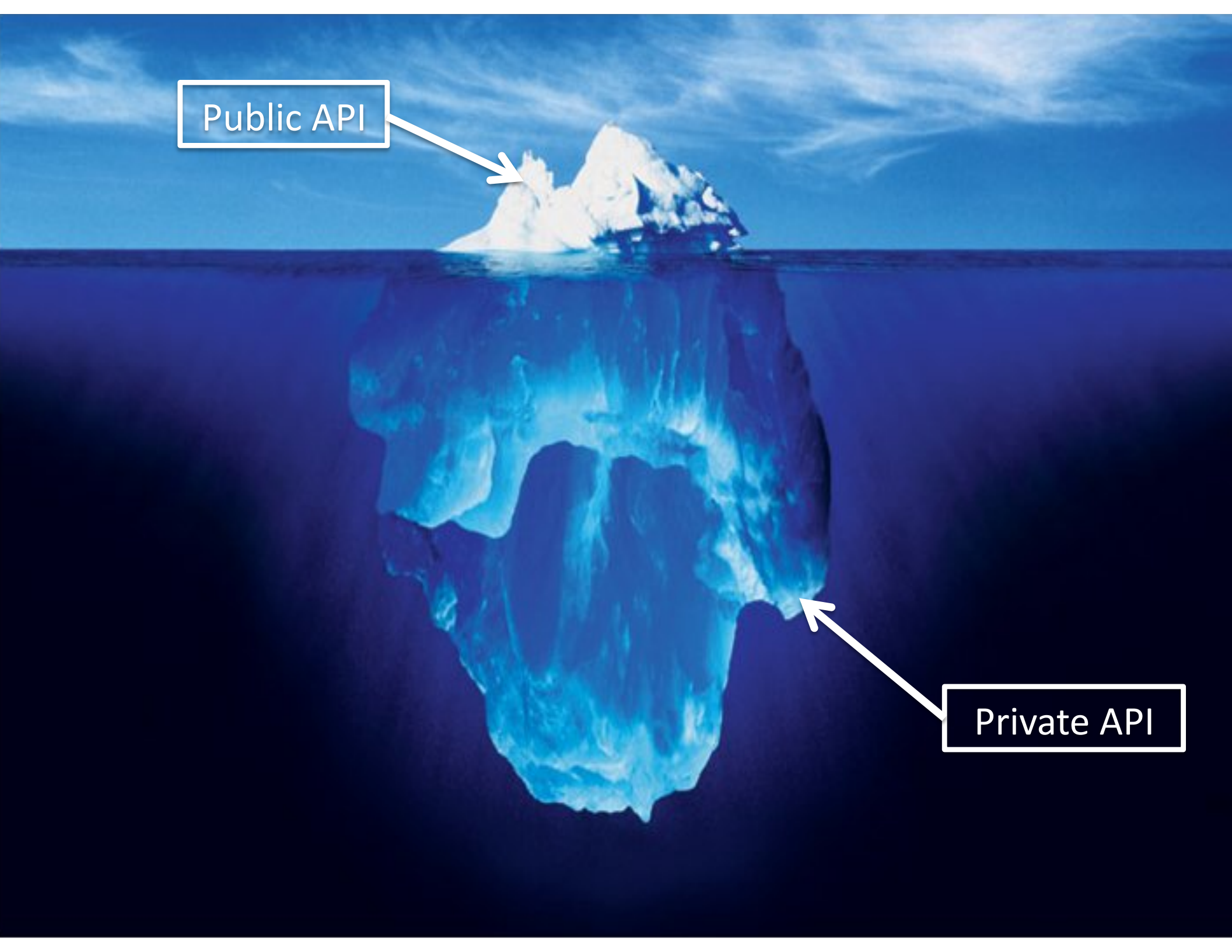
■ Netflix Devices

■ Open API Developers

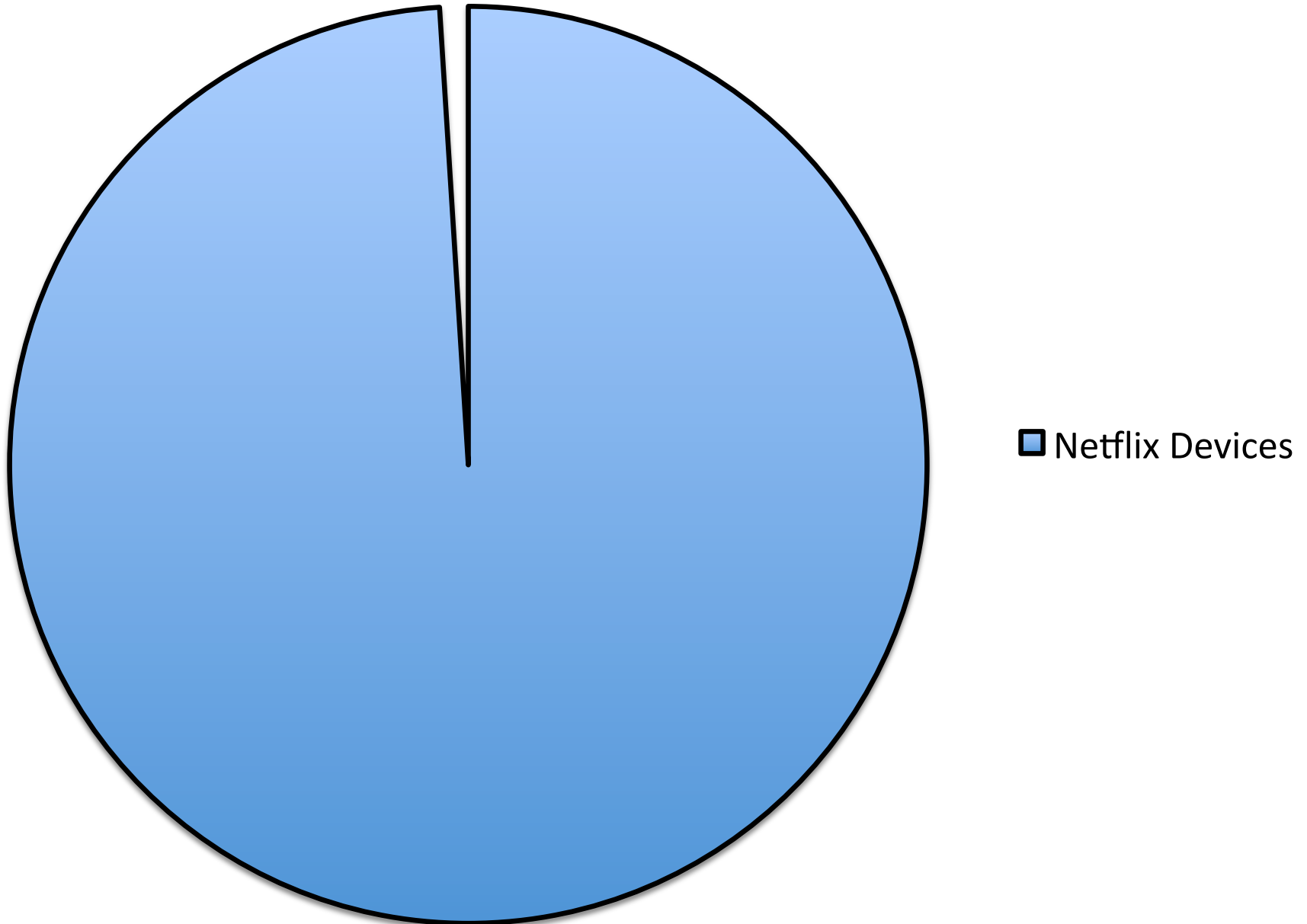
Public API



Private API



Current Emphasis of Netflix API



Techniques for Scaling the Netflix API

Agenda

- History of the Netflix API
- **The Cloud**
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- Future of the Netflix API

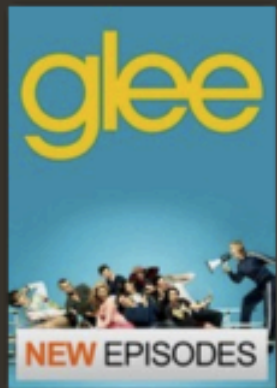


Discovery

NETFLIX

2 / 75

New Arrivals: TV



T.U.F.F. Puppy

2010 TV-Y7 10 episodes

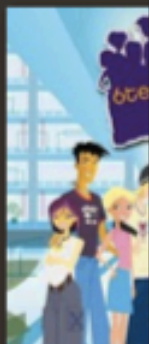
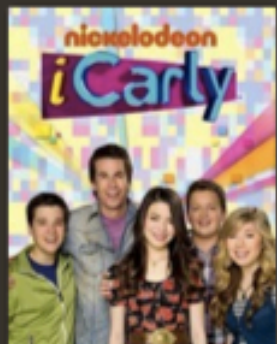
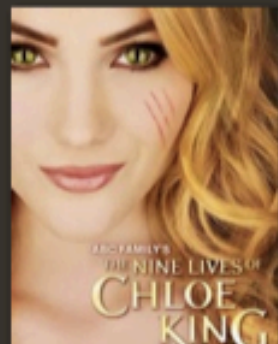


This drama follows Amy Dudley's mom from her new beau, keep good guy Keswick from switching to the dark side and much more.

Jerry Trainor, Grey DeLisle, Daran Norris

TV Shows, Kids' TV

TV



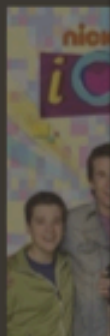
Discovery

NETFLIX

New Arrivals: TV



TV



30 Rock

2006 TV-14 102 episodes



This smartly crafted sitcom follows Liz Lemon, an unlucky-in-love New Yorker who heads up a ragtag team of writers on a fictional NBC variety show.

Tina Fey, Tracy Morgan, Jack McBrayer

TV Shows, TV Comedies

Play S2 : E2

More episodes

Add to instant Queue



Audio and subtitles

Streaming



30 Rock: Season 2, Ep. 2 - Jack Gets in the Game

00:01 - 21:18

HD



Subtitles

Full Screen



More Episodes

Back to Browsing

Netflix API Powers Discovery

NETFLIX 2 / 75

New Arrivals: TV

T.U.F.F. Puppy
2010 TV-Y7 10 episodes
★★★★☆

This drama follows Amy Dudley's mom from her new beau, keep good guy Keswick from switching to the dark side.

30 ROCK
TUFF PUPPY
glee
HOW MUCH WOULD YOU PAY FOR WHAT'S BEHIND THIS DOOR?
How

NETFLIX

New Arrivals: TV

30 Rock
2006 TV-14 102 episodes
★★★★★ HD

This smartly crafted sitcom follows Liz Lemon, an unlucky-in-love New Yorker who heads up a ragtag team of writers on a fictional NBC variety show.

Tina Fey, Tracy Morgan, Jack McBrayer

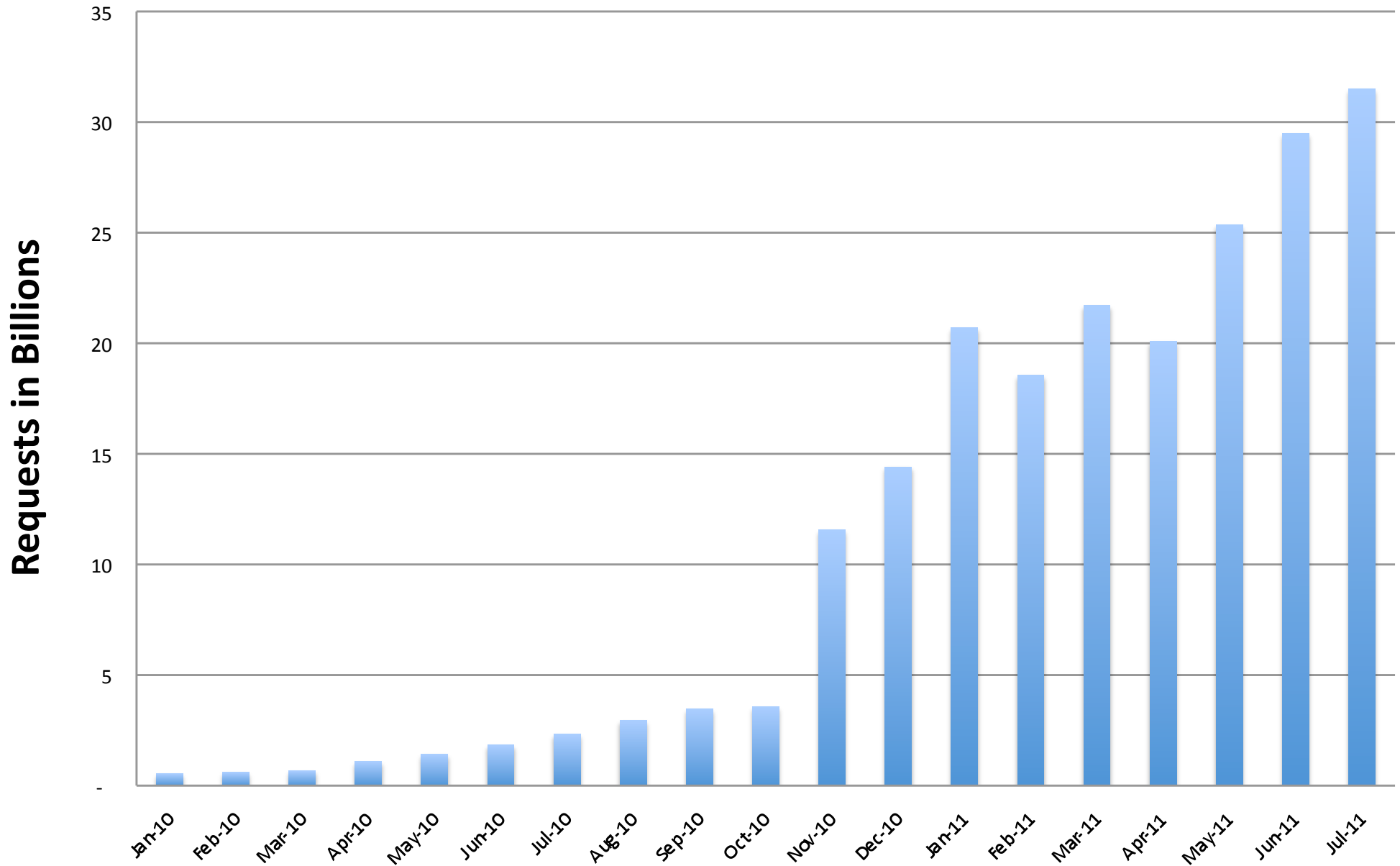
TV Shows, TV Comedies

TV

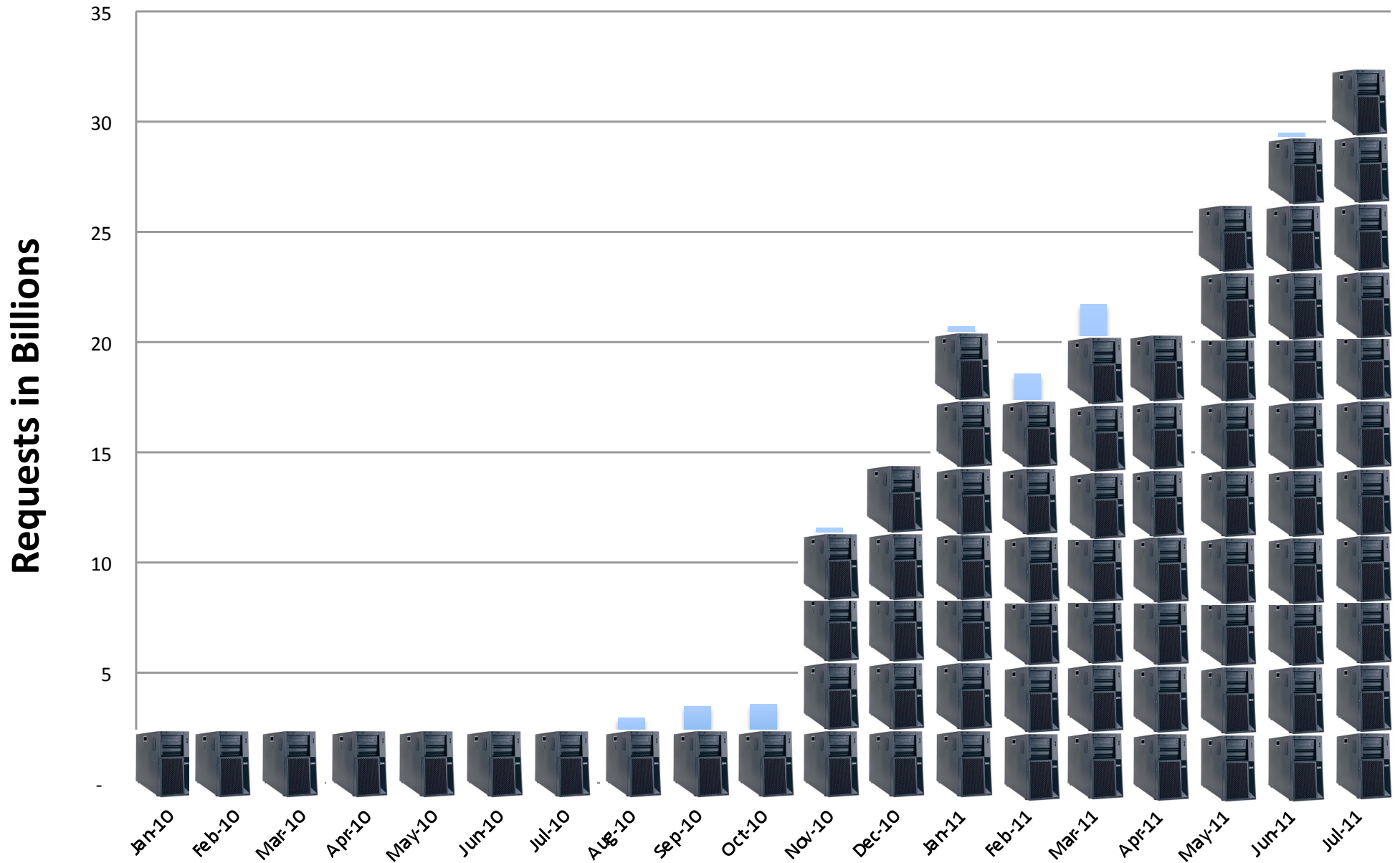
POGOYO
30 ROCK
Switched at Birth
CHLOE KING

Play S2 : E2
More episodes
Add to instant Queue
★★★★★ Loved It
Audio and subtitles

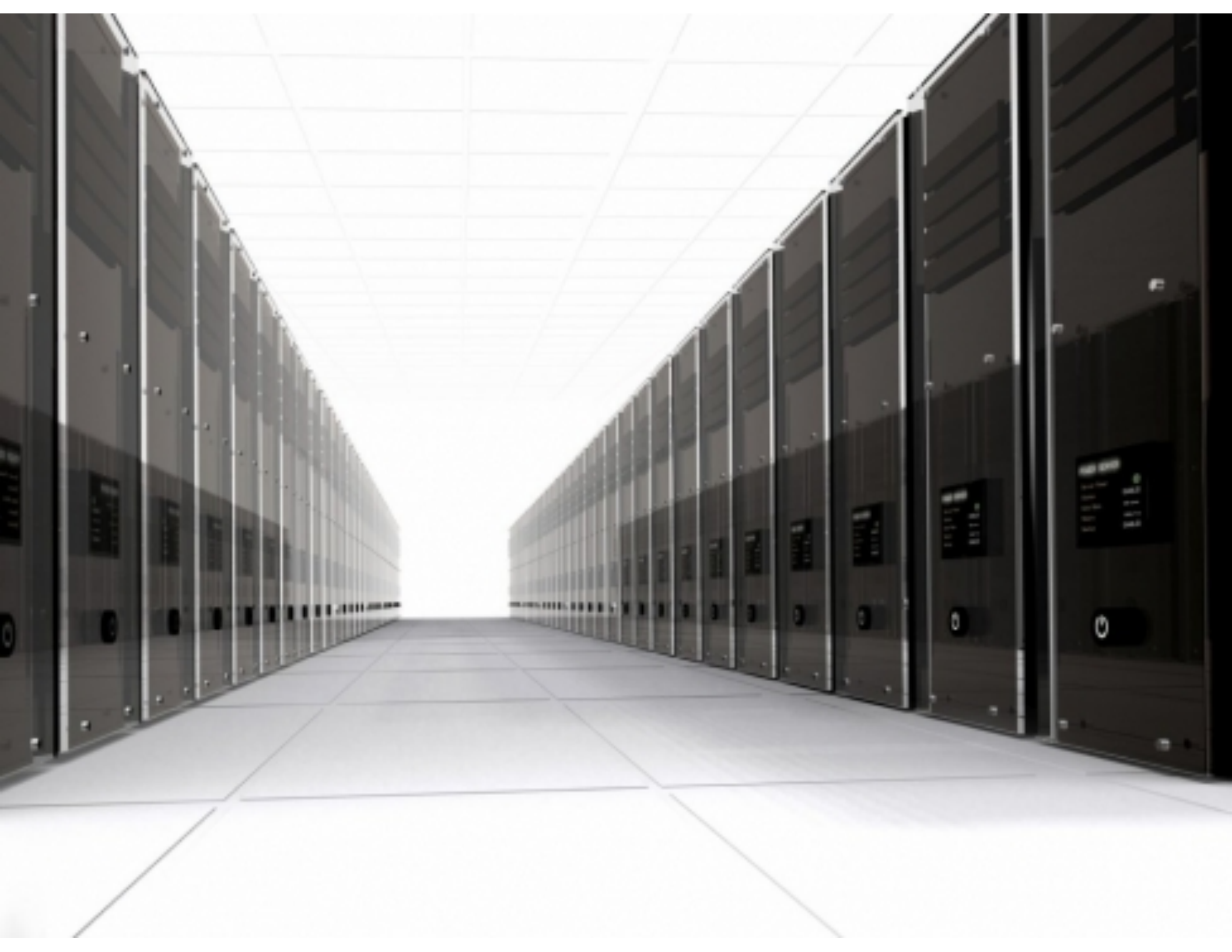
Netflix API : Requests Per Month



Netflix API : Requests Per Month









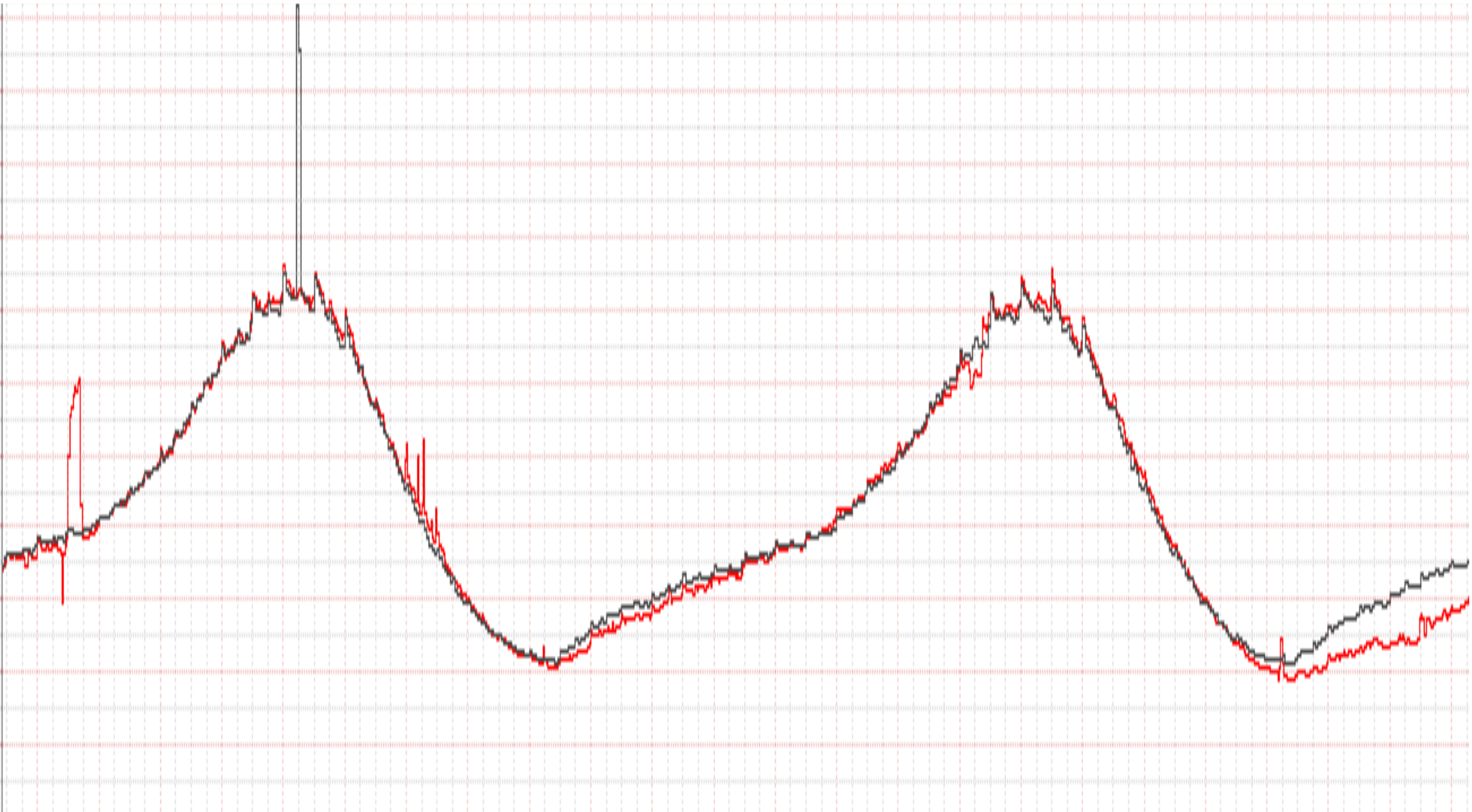
amazon
web services™

Running Instances in us-east-1 (Virginia)

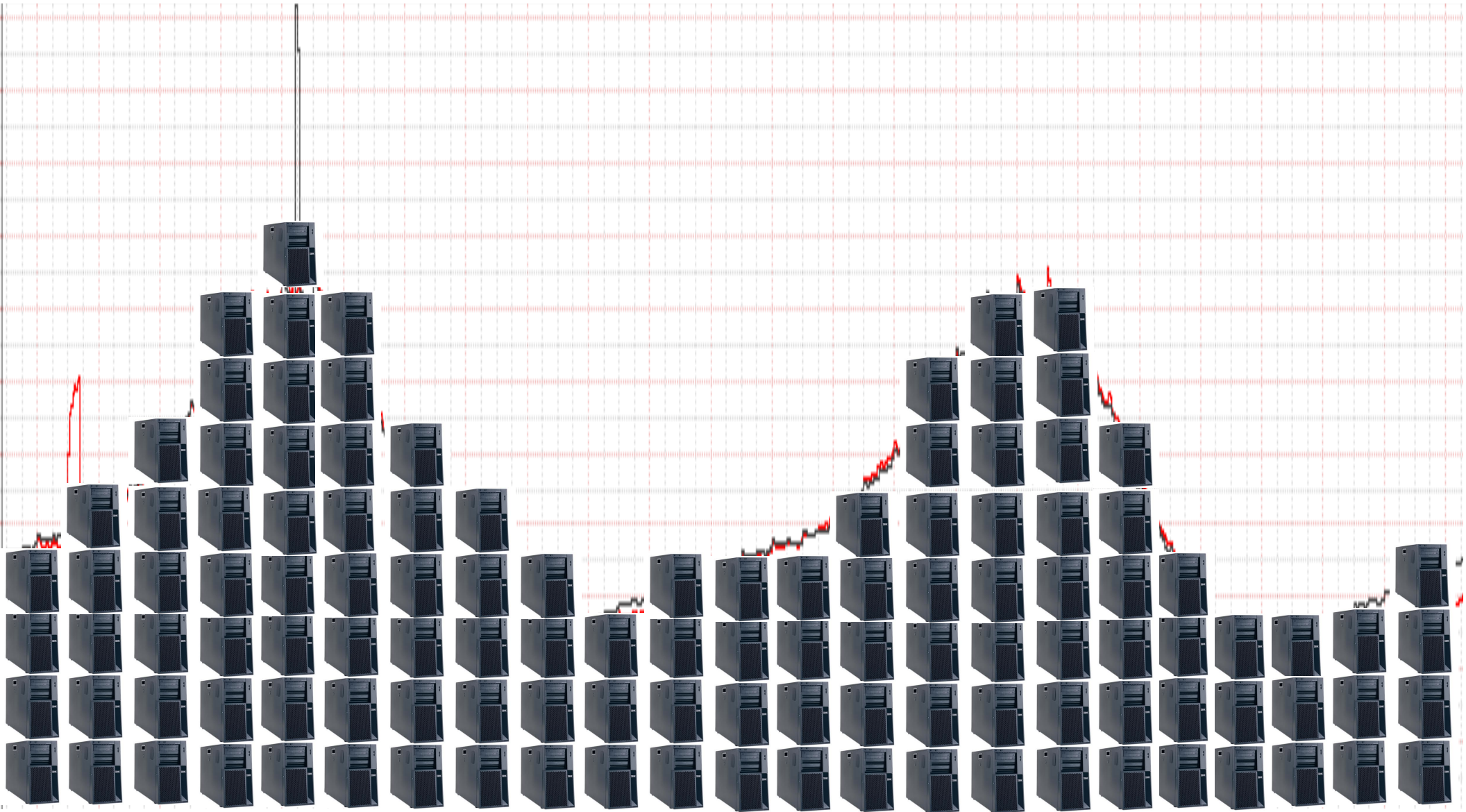
Terminate Instance(s)
 Audit Ungrouped Instances

x	Application	Auto Scaling Group	VIP & Hostname	Port	Status	Instance ID	Image ID	Inst Type
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<input type="checkbox"/>	abadmin	abadmin-v004	abadmin:7001 ec2-184-73-16-36.compute-1.amazonaws.com	7001	running	i-8e74e0ee	ami-69579500	m1.large
<input type="checkbox"/>	abadmin	abadmin-v003	abadmin:7001 ec2-184-72-192-33.compute-1.amazonaws.com	7001	running	i-2a64b14a	ami-ad3dfec4	m1.large
<input type="checkbox"/>	abadmin	abadmin-v003	abadmin:7001 ec2-50-19-143-54.compute-1.amazonaws.com	7001	running	i-9a6db8fa	ami-ad3dfec4	m1.large
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<input type="checkbox"/>	abcache	abcache--abcloudEnabling	ec2-50-16-178-16.compute-1.amazonaws.com:8080 ec2-50-16-178-16.compute-1.amazonaws.com	8080	running	i-a1290dcf	ami-889169e1	m2.2xlarge
<input type="checkbox"/>	abcache	abcache--abcloudEnabling	ec2-174-129-114-120.compute-1.amazonaws.com:8080 ec2-174-129-114-120.compute-1.amazonaws.com	8080	running	i-cf9ec6a1	ami-889169e1	m2.2xlarge

Autoscaling



Autoscaling





Techniques for Scaling the Netflix API

Agenda

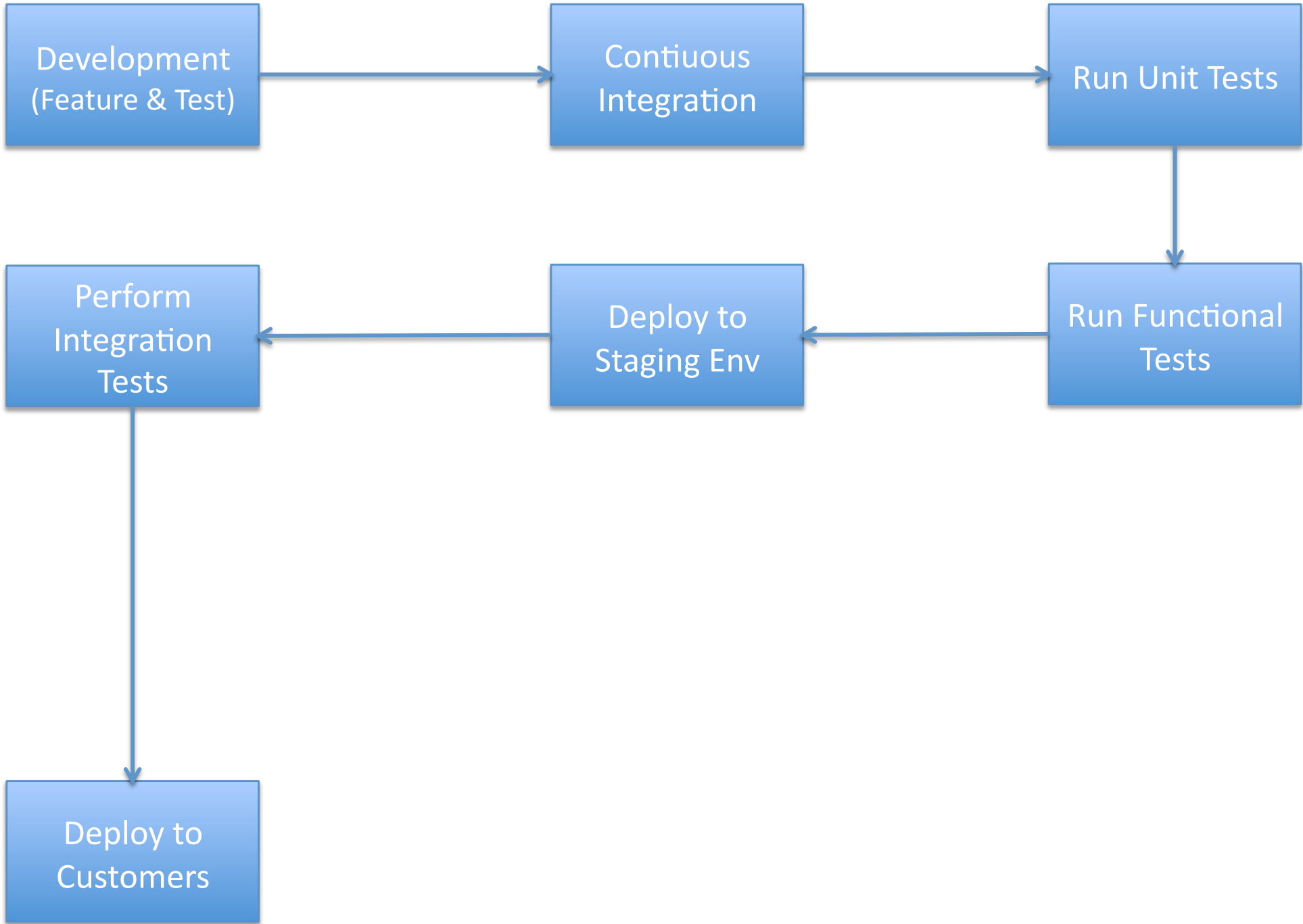
- History of the Netflix API
- The Cloud
- **Development and Testing**
- Resiliency
- Future of the Netflix API

Development / Testing Philosophy

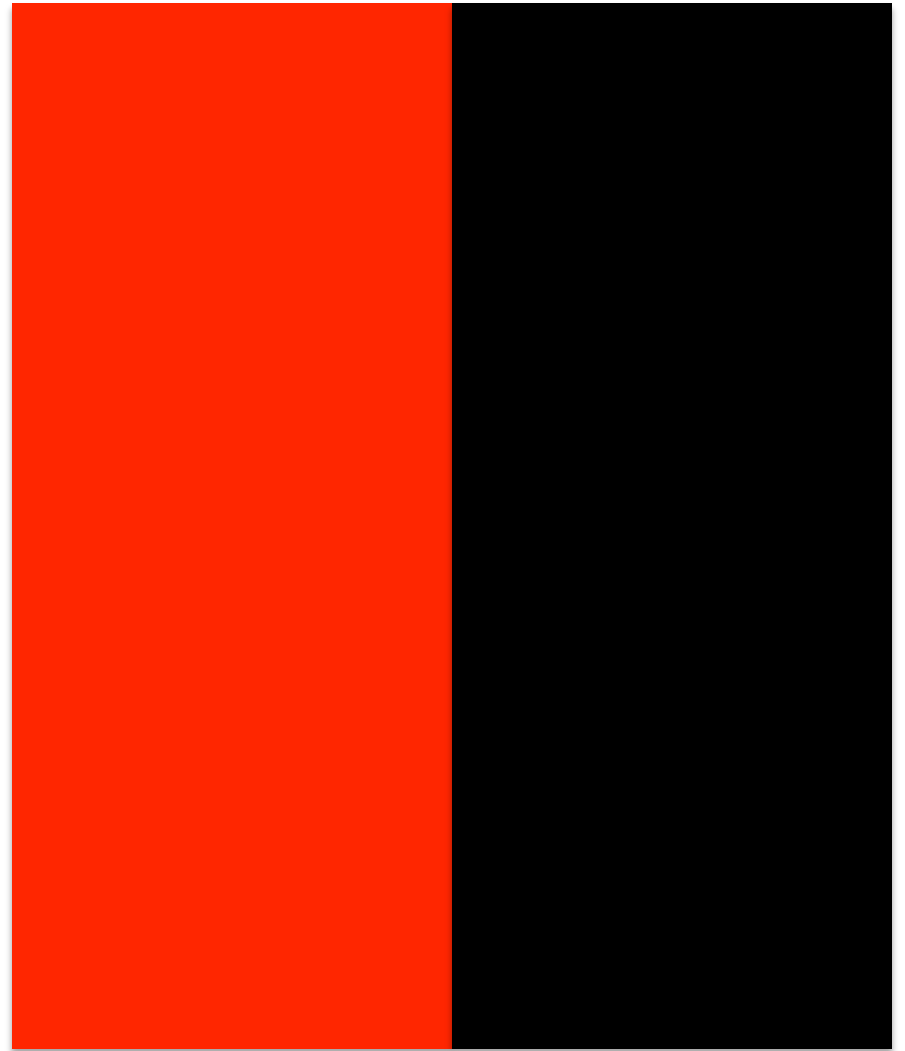
Act fast, react fast

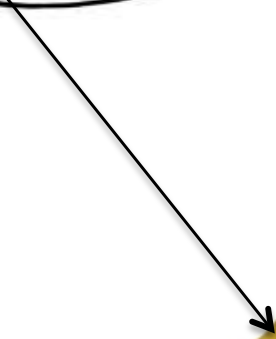
That Doesn't Mean We Don't Test

- Unit tests
- Functional tests
- Regression scripts
- Continuous integration
- Capacity planning
- Load / Performance tests



Cloud-Based Deployment Techniques



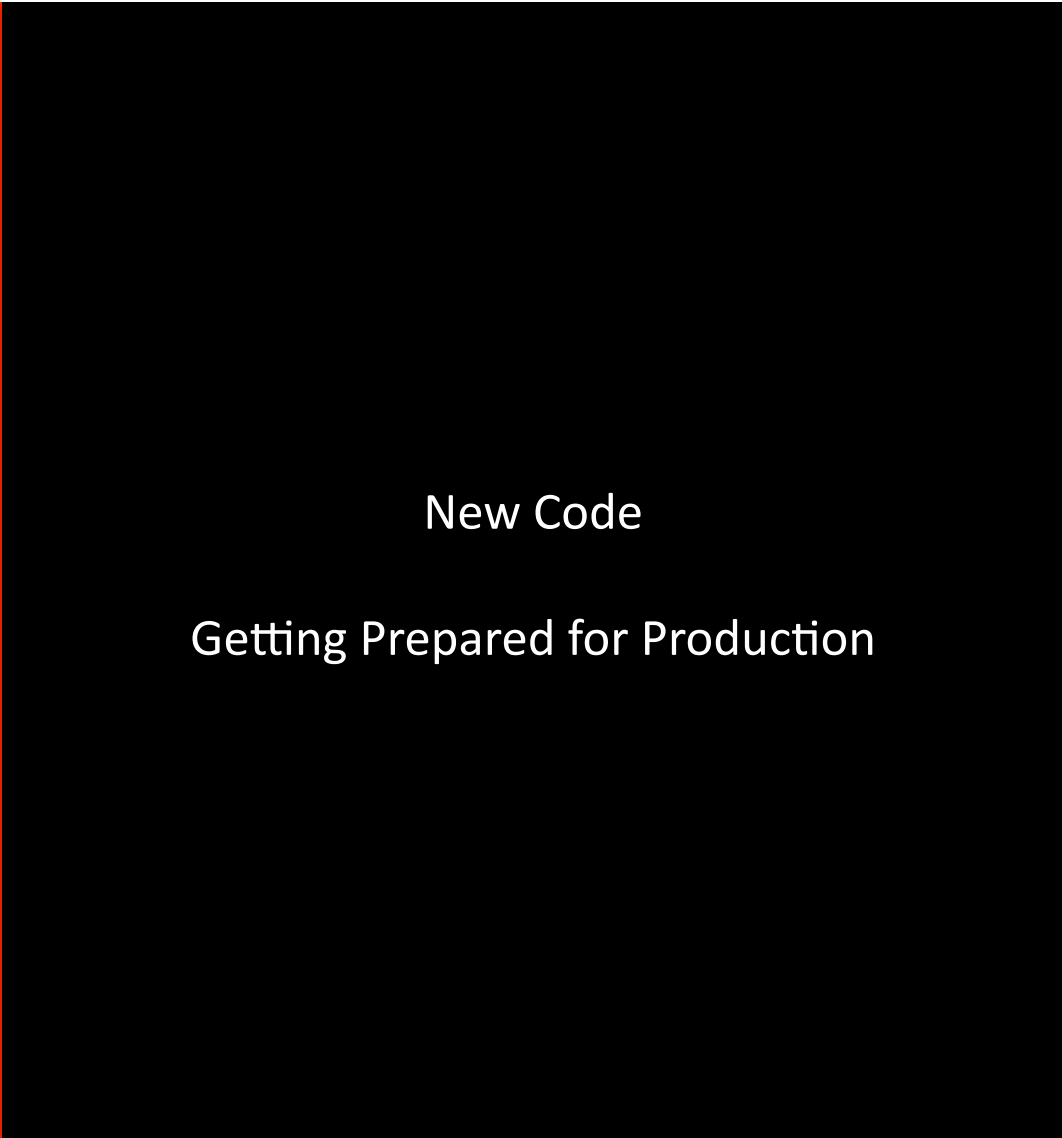
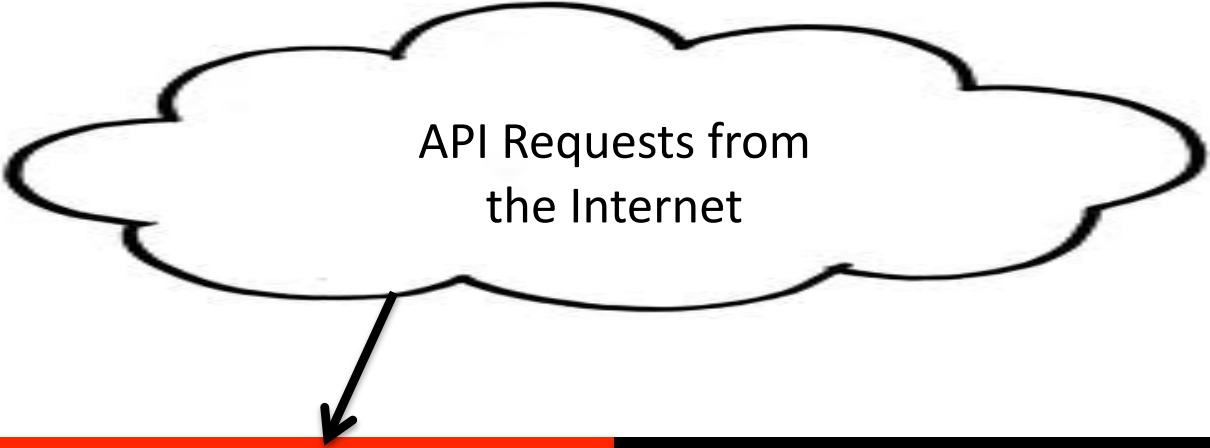


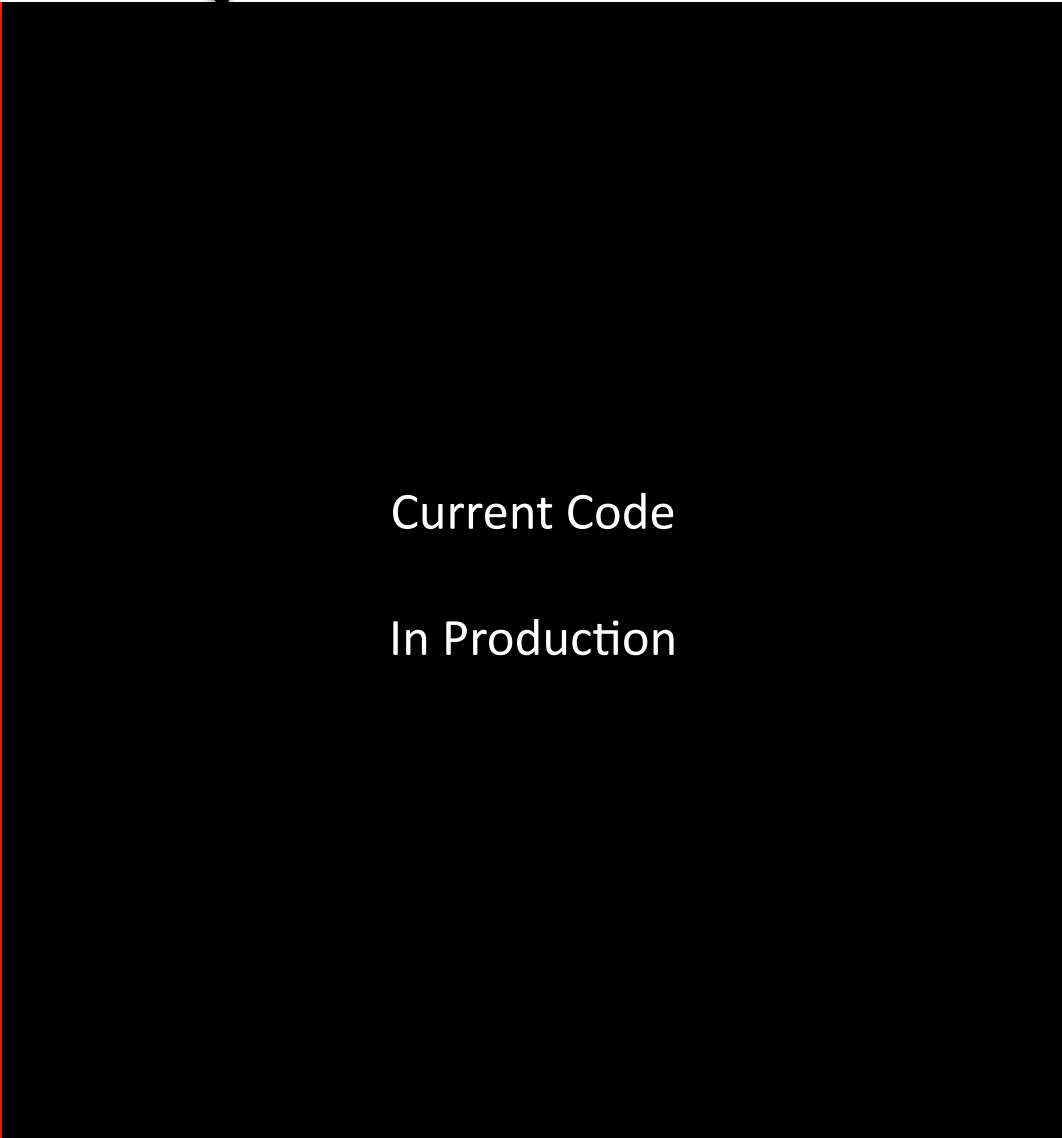
Current Code
In Production

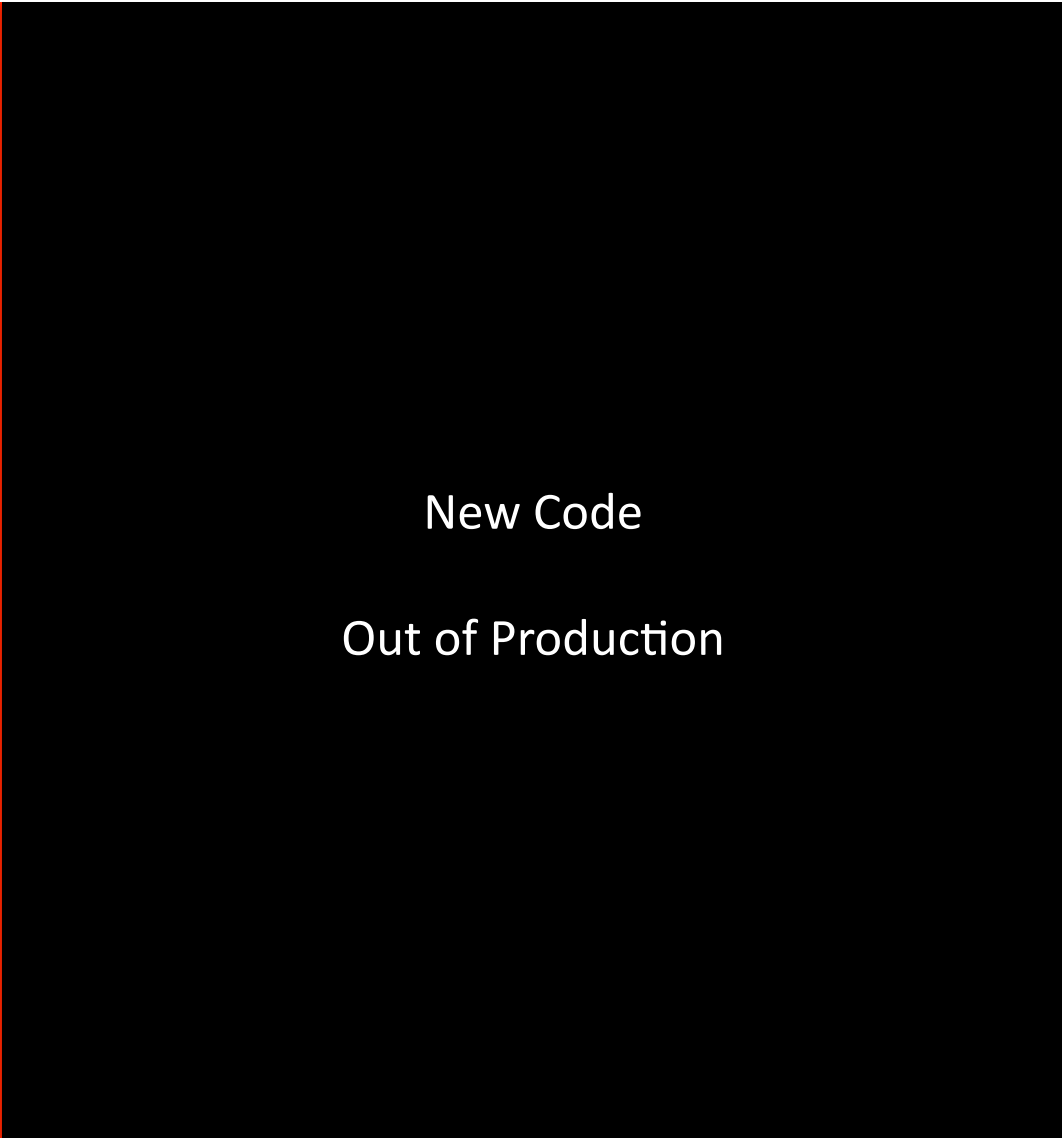
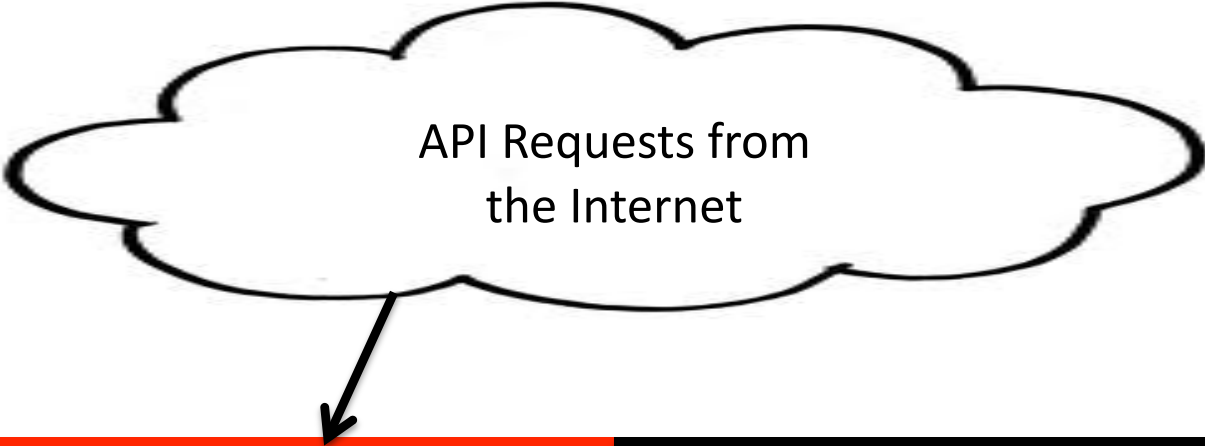


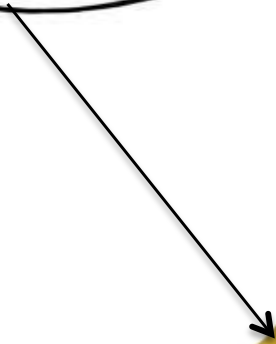
Single Canary Instance
To Test New Code with Production Traffic
(typically around 1-5% of traffic)

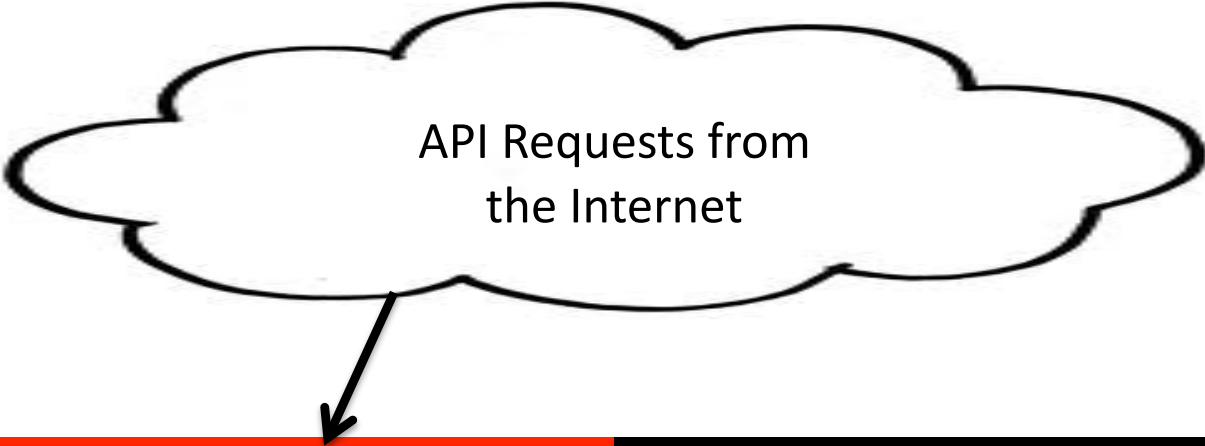










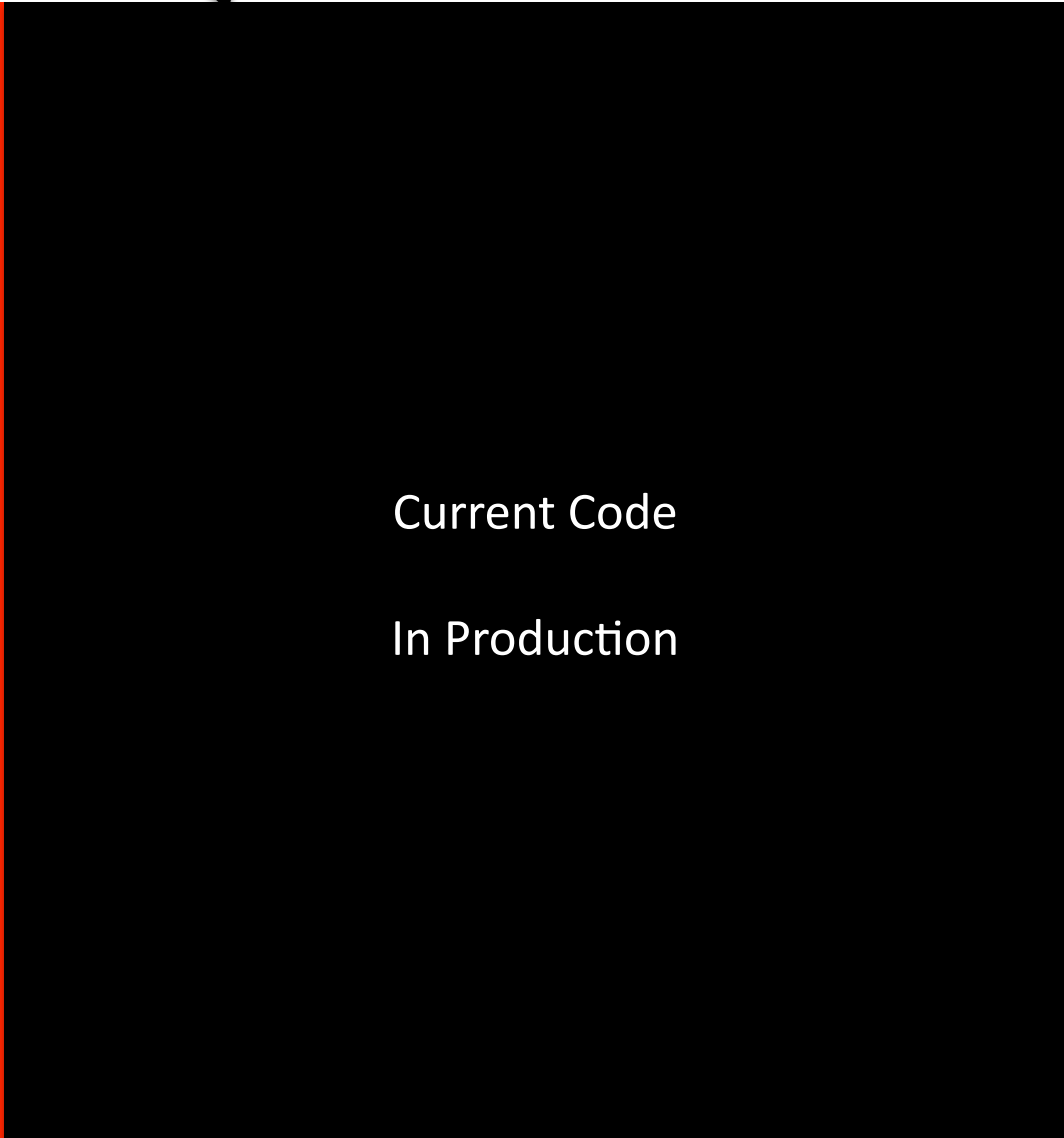


Current Code

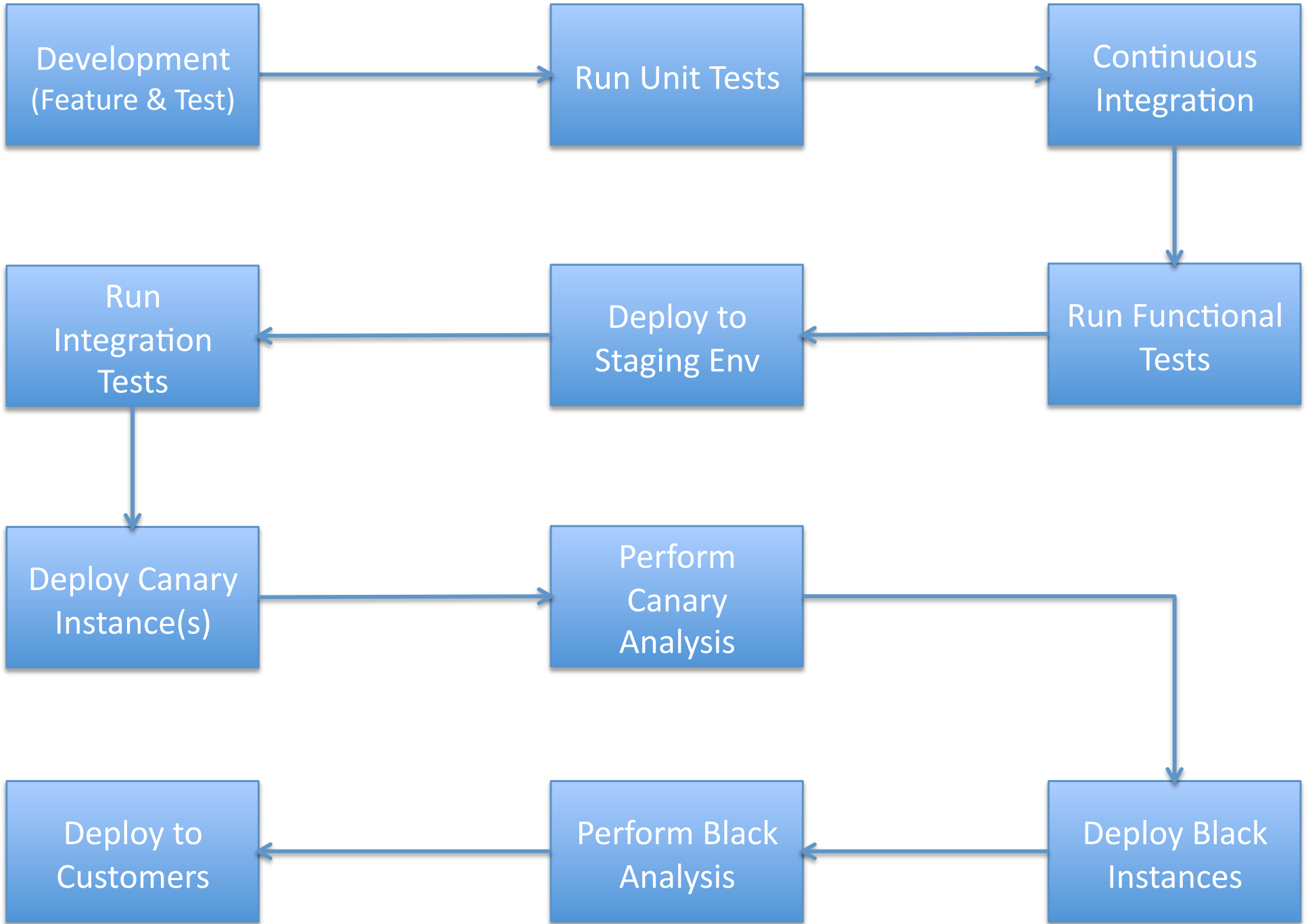
In Production

New Code

Getting Prepared for Production



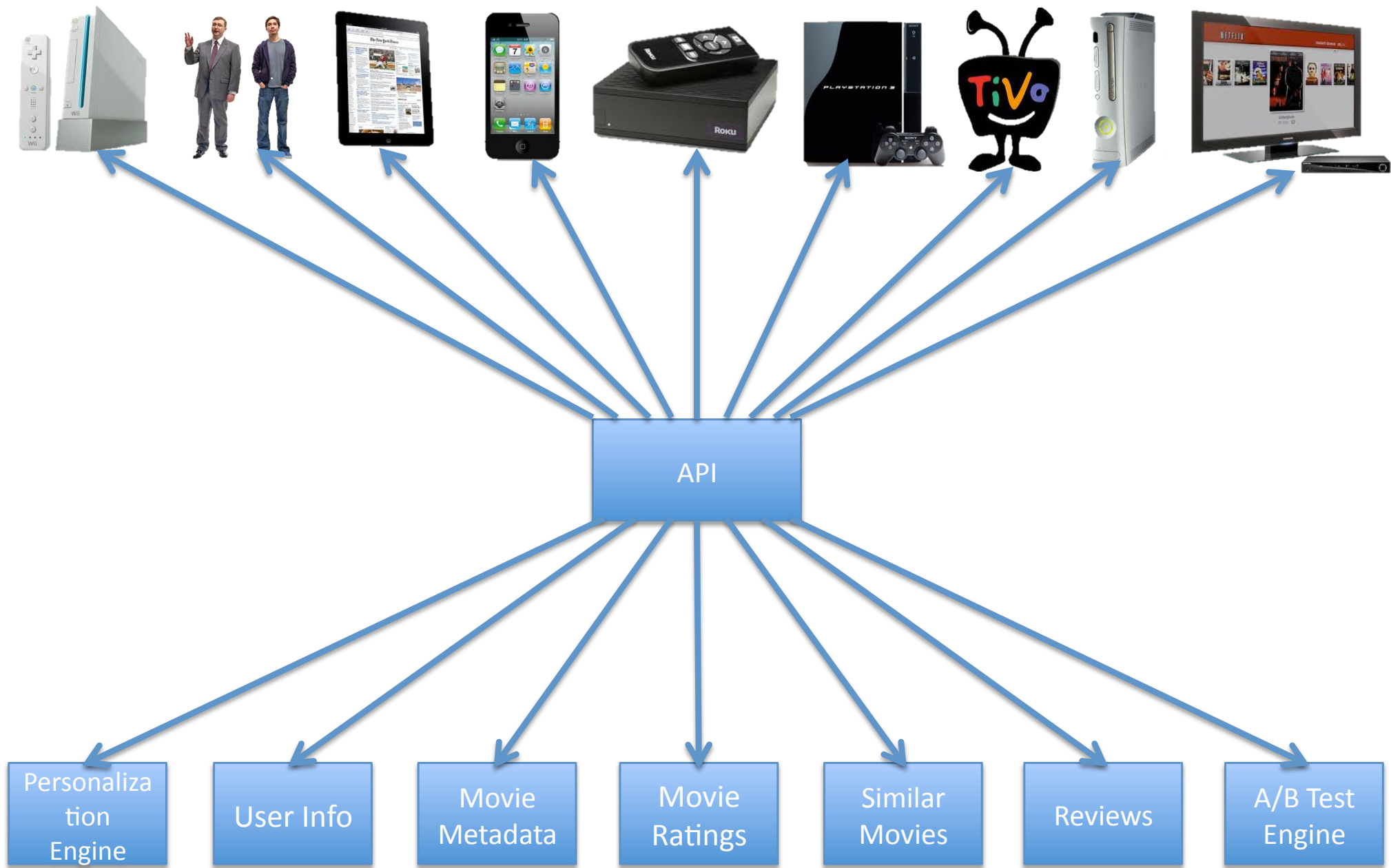


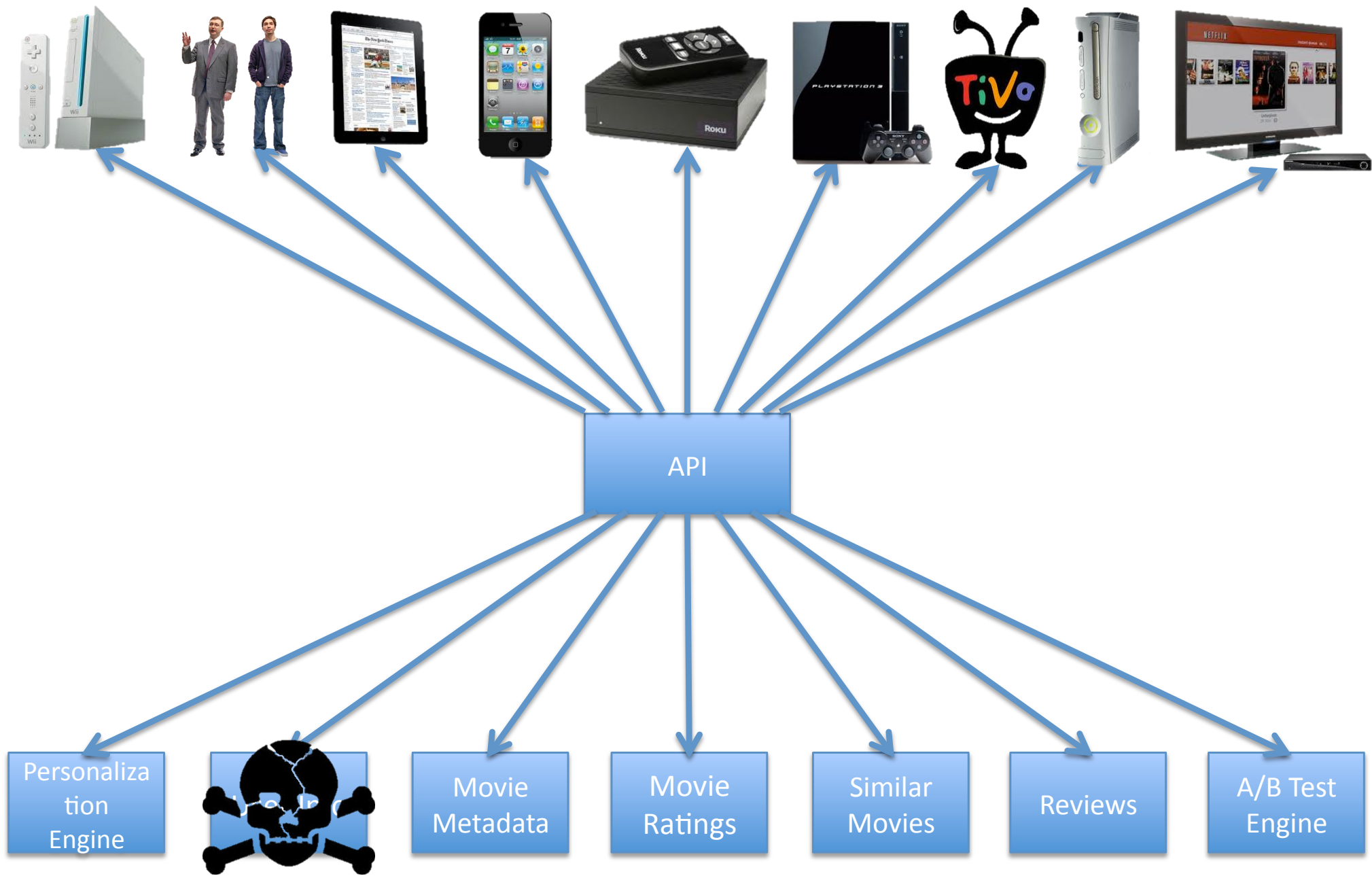


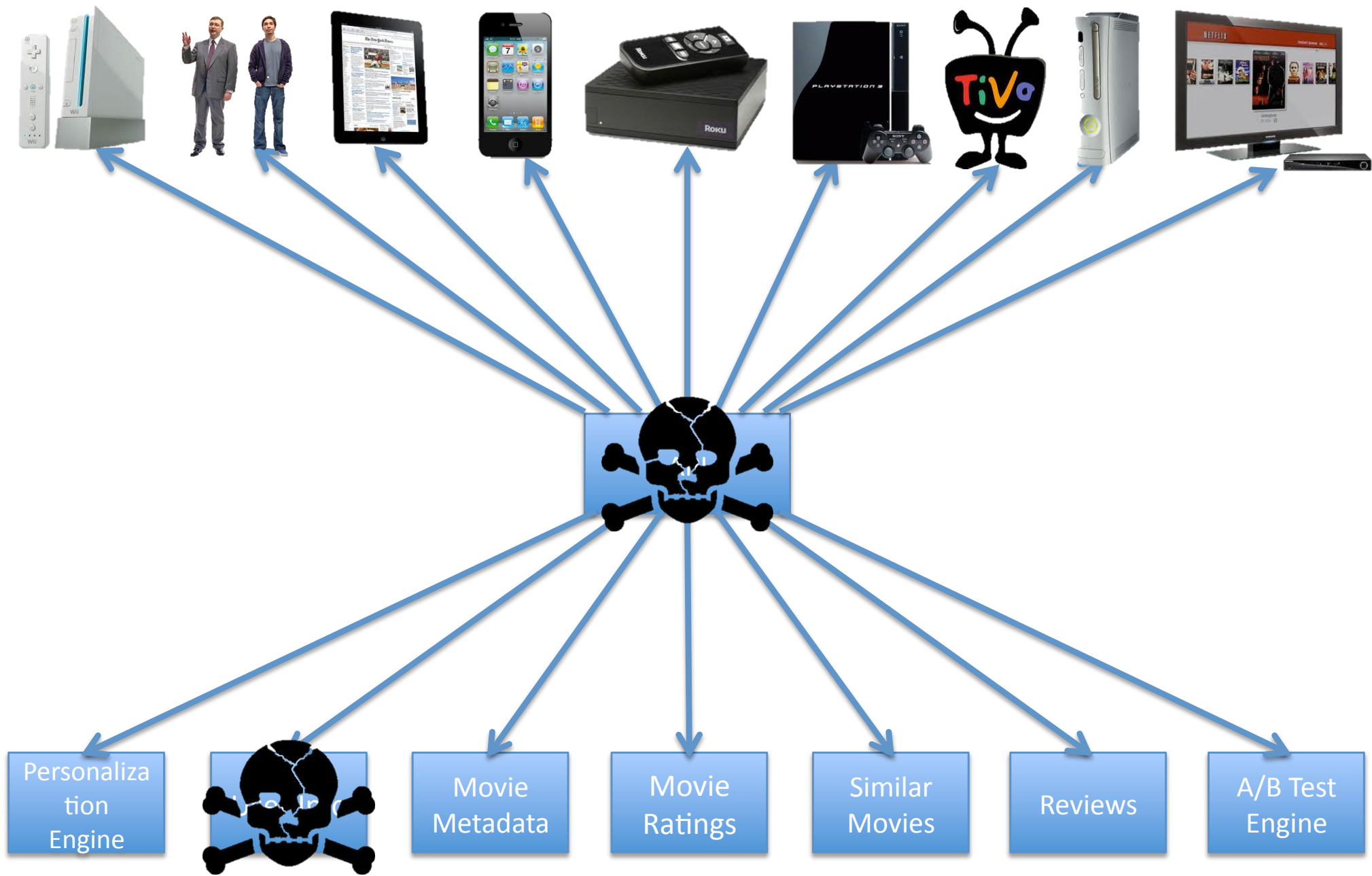
Techniques for Scaling the Netflix API

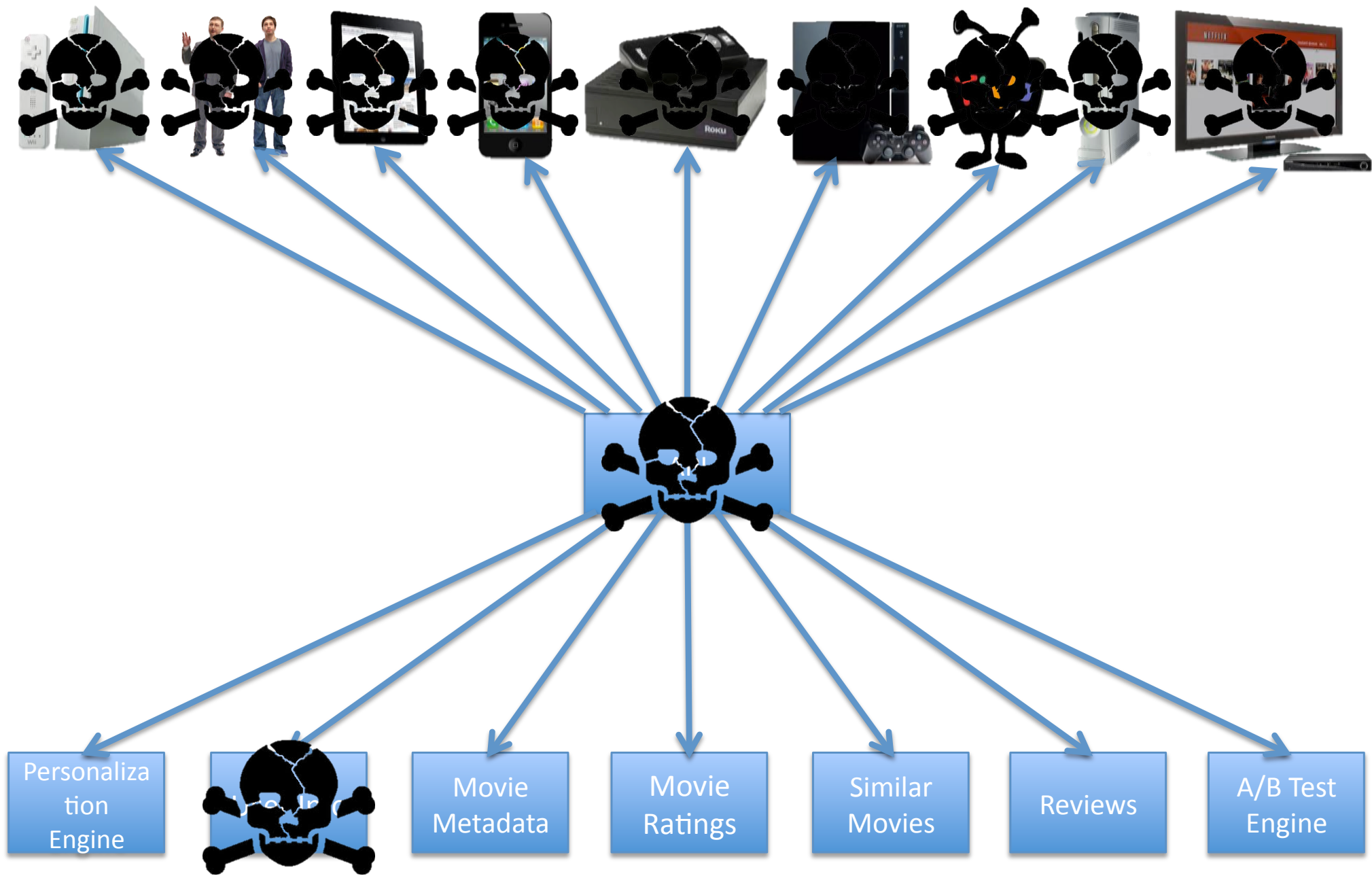
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- Future of the Netflix API







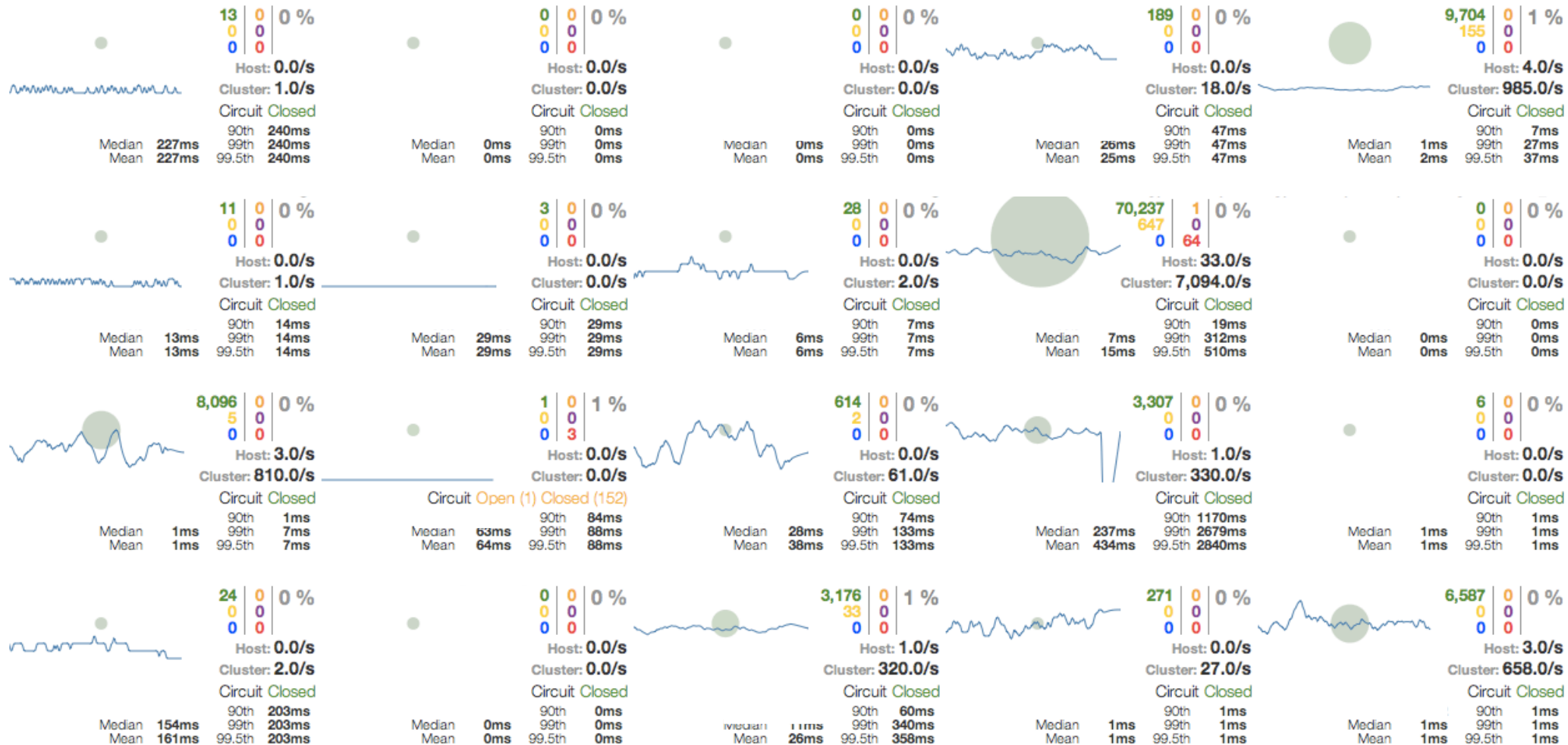


Circuit Breaker Dashboard

API Dependencies Monitor

Sort: [Alphabetical](#) | [Volume](#) | [Success](#) | [Latent](#) | [Short-Circuited](#) | [Timeout](#) | [Rejected](#) | [Failure](#) | [Error %](#) | [Bugs or Requests](#) | [Architecture](#) | [Fallbacks](#) | [Home](#)

Circuit Breakers





68,965	1	0 %
801	0	
0	64	

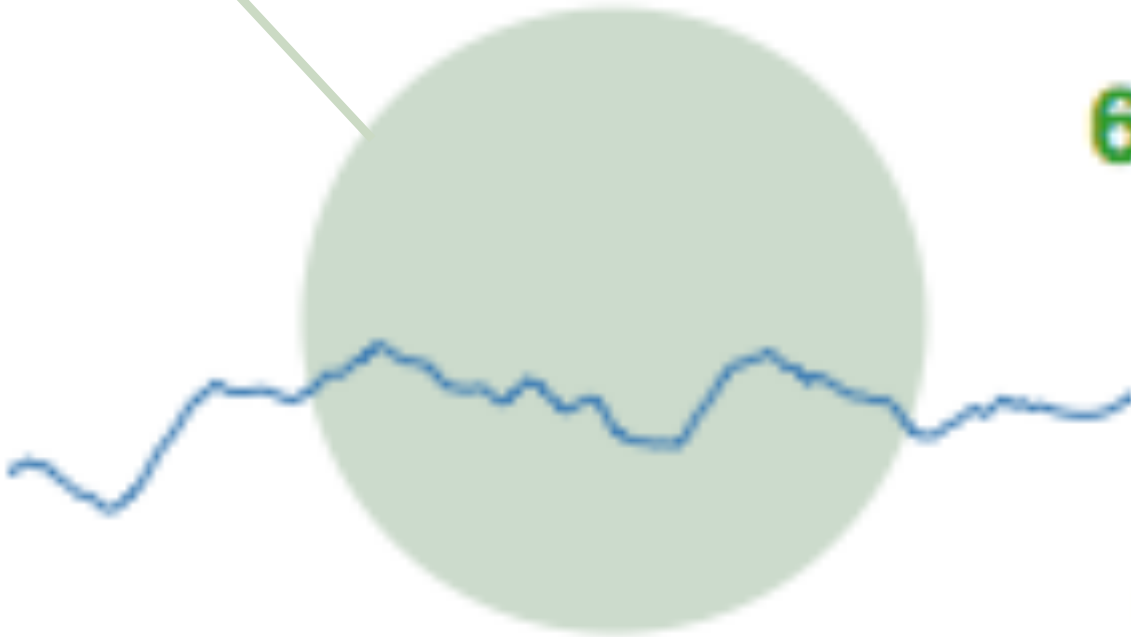
Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Call Volume and Health / Last 10 Seconds



68,965	1	0 %
801	0	
0	64	

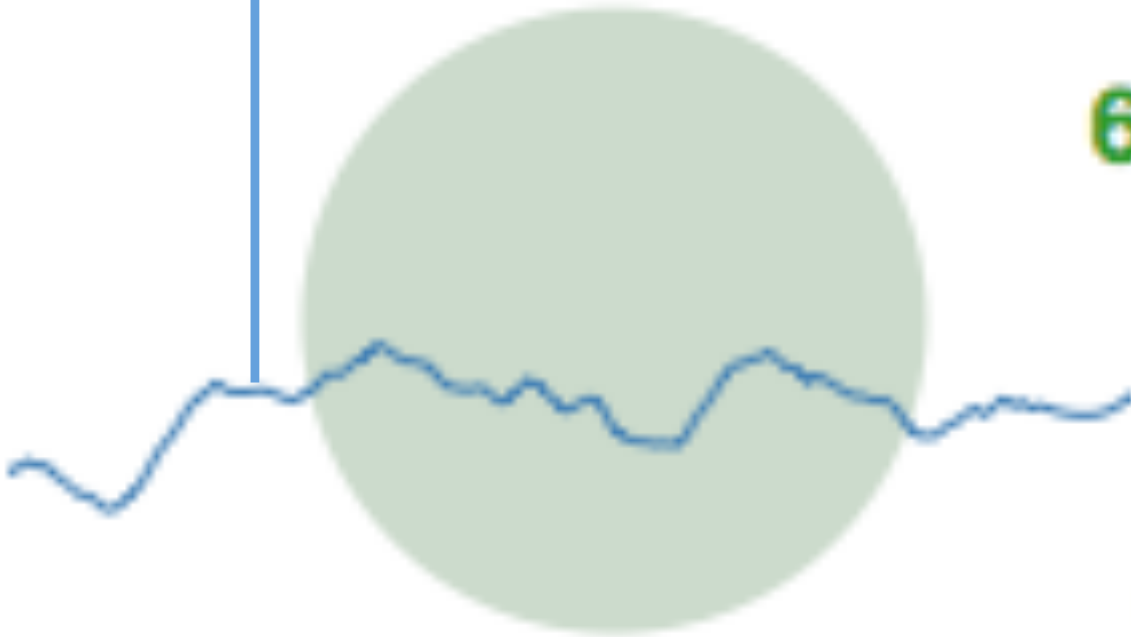
Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Call Volume / Last 2 Minutes



68,965	1	0 %
801	0	
0	64	

Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms



Successful Requests

68,965

801

0

1

0

64

0 %

Host: 32.0/s

Cluster: 6,983.0/s

Circuit Closed

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Successful, But Slower Than Expected



68,965

1

0 %

801

0

0

64

Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

Median

6ms

90th

18ms

Mean

14ms

99th

306ms

99.5th

510ms

Short-Circuited Requests, Delivering Fallbacks



68,965	1	0 %
801	0	
0	64	

Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Timeouts, Delivering Fallbacks



68,965	1	0 %
801	0	
0	64	

Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Thread Pool & Task Queue Full, Delivering Fallbacks



68,965	1	0 %
801	0	
0	64	

Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Exceptions, Delivering Fallbacks



68,965

801

0

1

0

64

0 %

Host: 32.0/s

Cluster: 6,983.0/s

Circuit Closed

Median

6ms

90th

18ms

Mean

14ms

99th

306ms

99.5th

510ms

$$\# + \# + \# + \# / (\# + \# + \# + \# + \#) = \text{Error Rate}$$

Error Rate

0 %

68,965

801

0

1

0

64

Host: **32.0/s**

Cluster: **6,983.0/s**

Circuit **Closed**

90th

18ms

Median

6ms

99th

306ms

Mean

14ms

99.5th

510ms





Status of Fallback Circuit

68,965	1	0 %
801	0	
0	64	

Host: 32.0/s

Cluster: 6,983.0/s

Circuit Closed

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms

Requests per Second, Over Last 10 Seconds



68,965	1	0 %
801	0	
0	64	

Host: 32.0/s
Cluster: 6,983.0/s

Circuit Closed

		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms



SLA Information

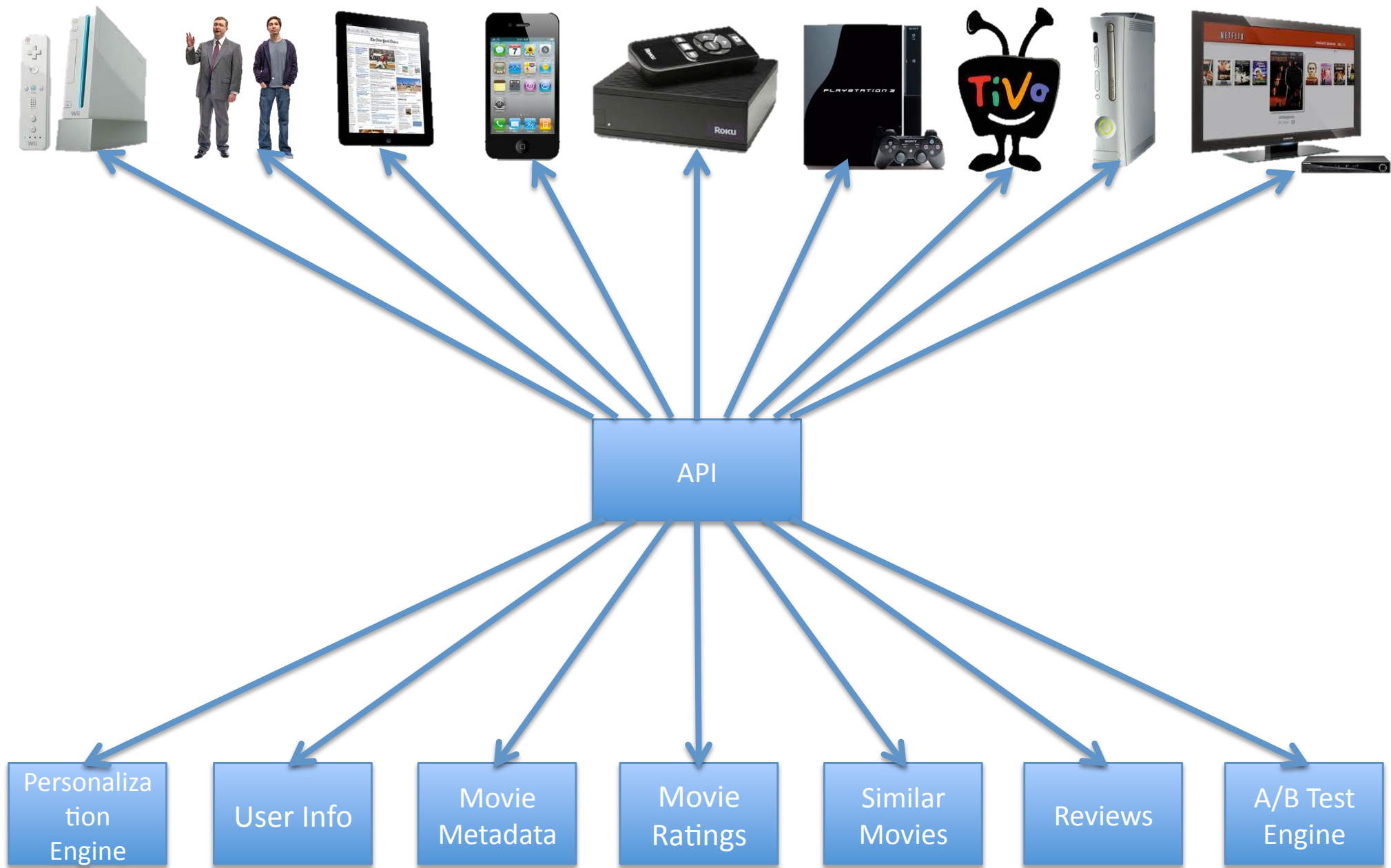
68,965	1	0 %
801	0	
0	64	

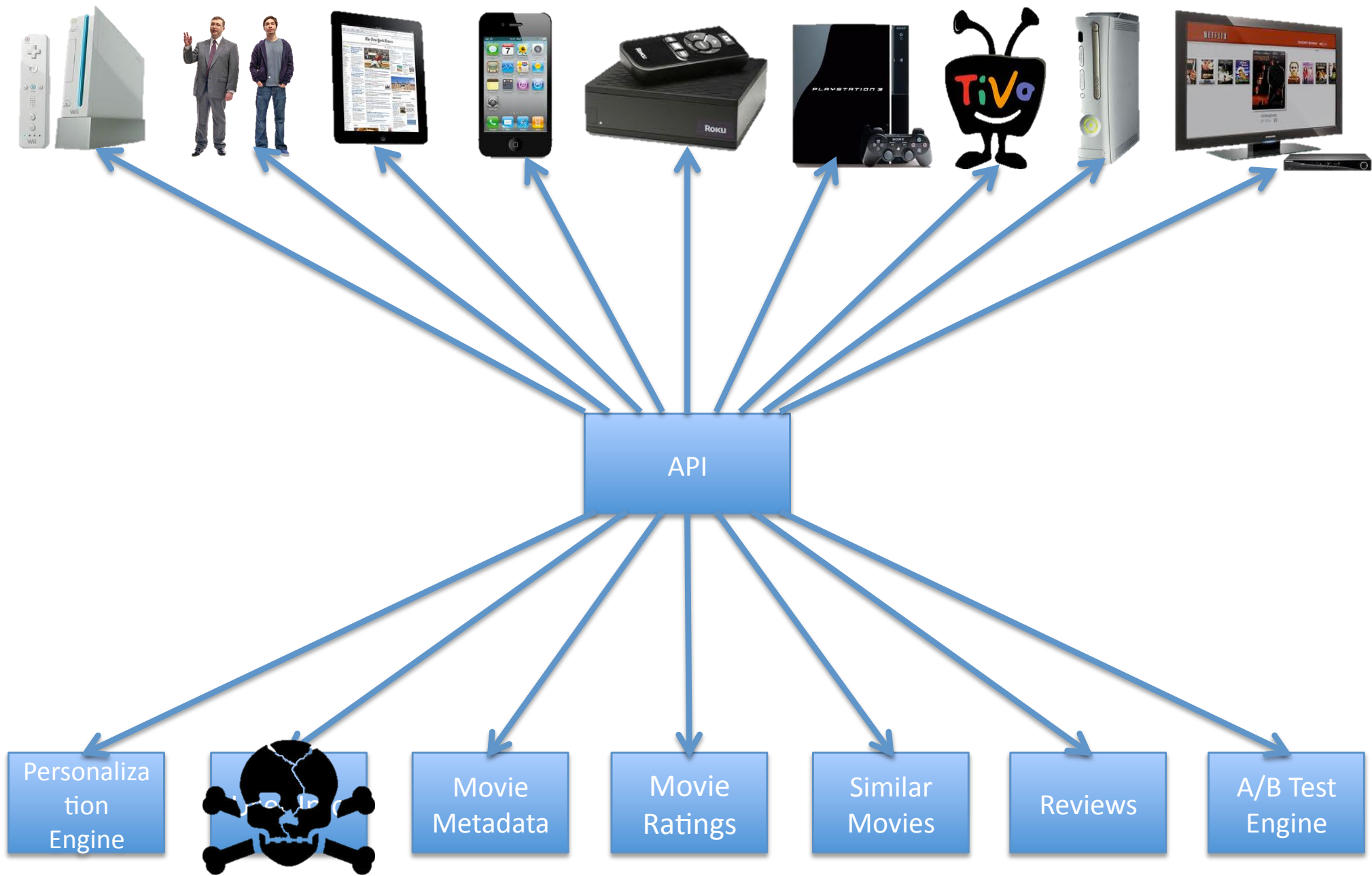
Host: **32.0/s**

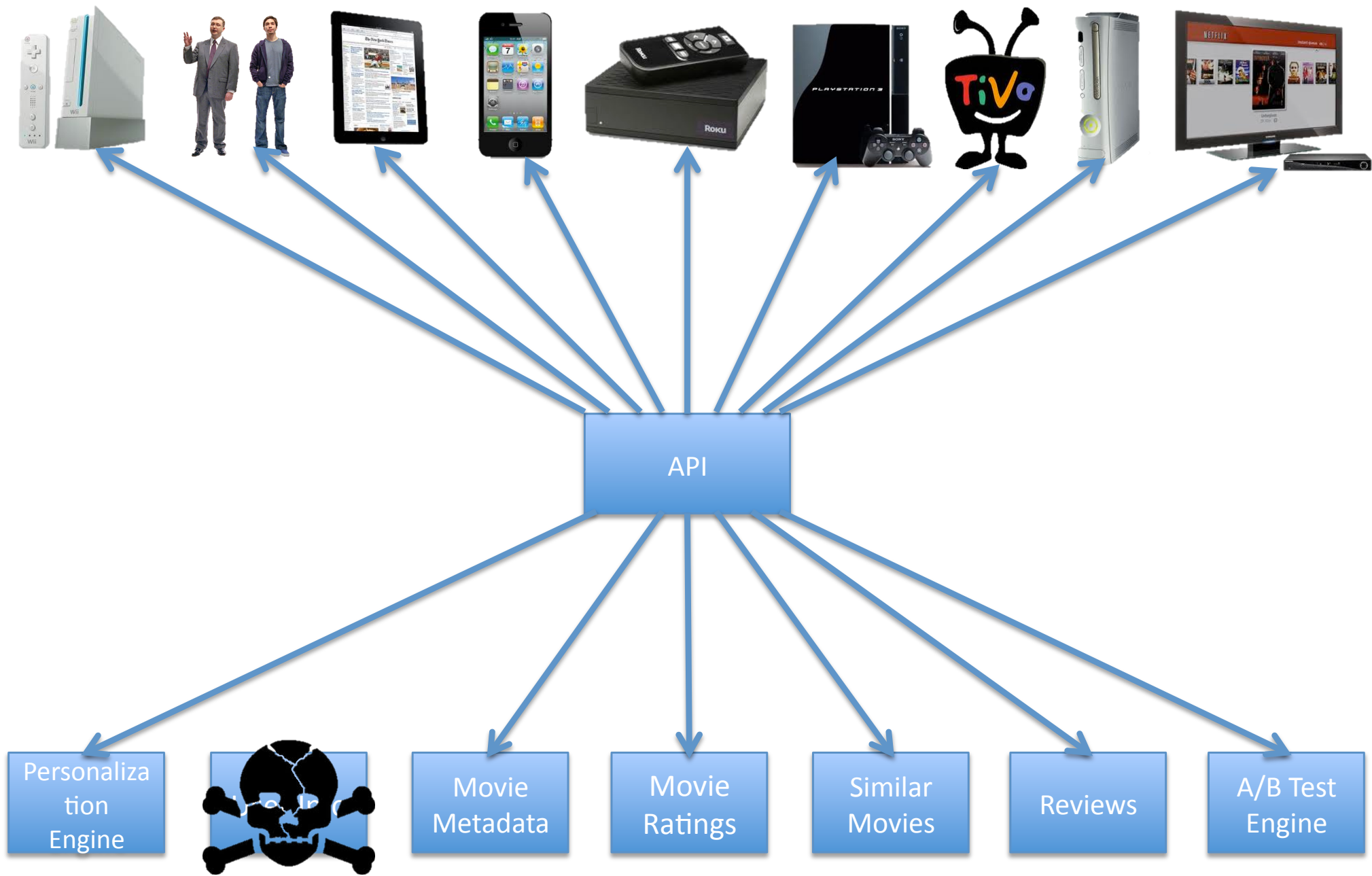
Cluster: **6,983.0/s**

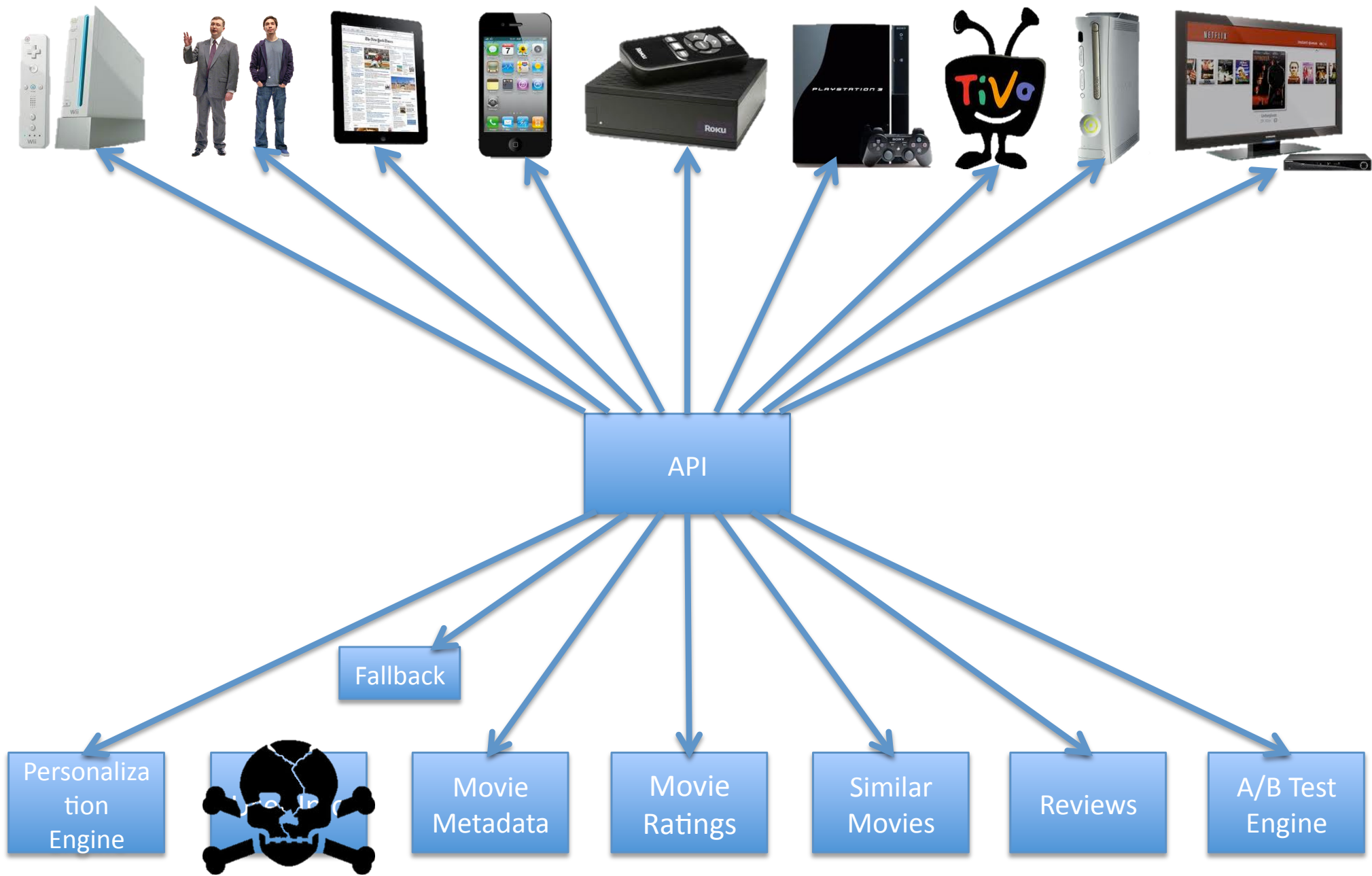
Circuit **Closed**

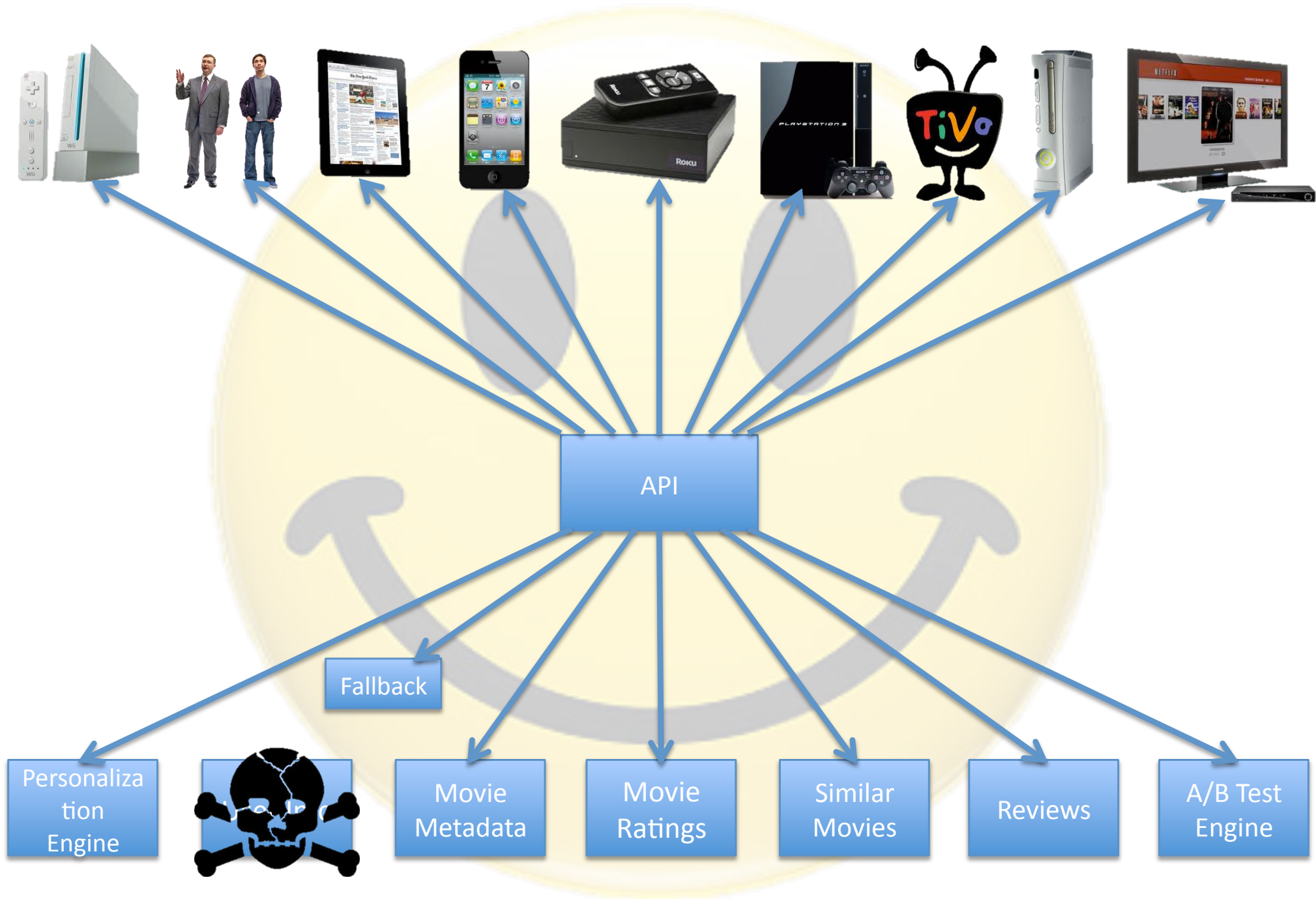
		90th	18ms
Median	6ms	99th	306ms
Mean	14ms	99.5th	510ms







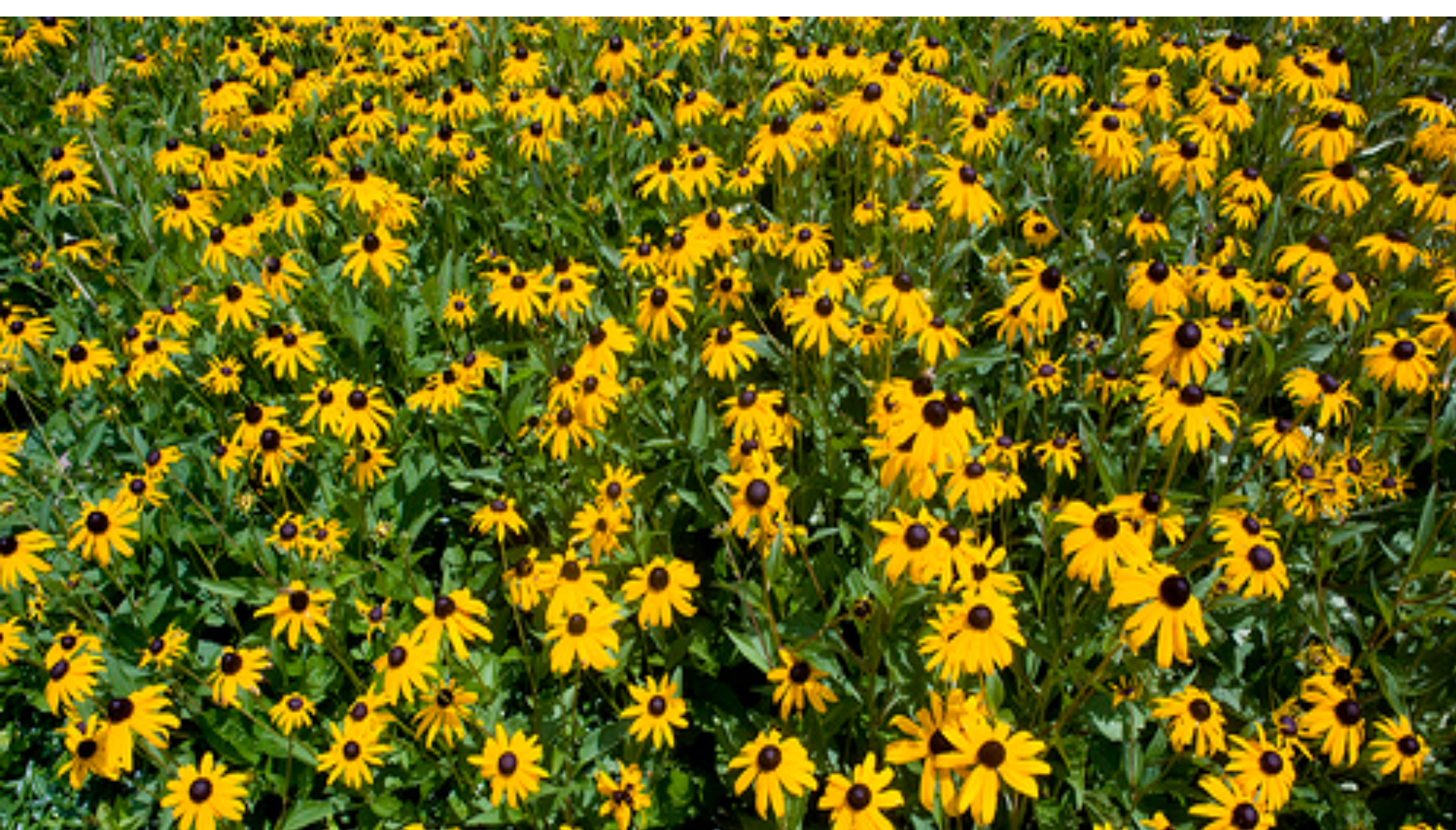




Techniques for Scaling the Netflix API

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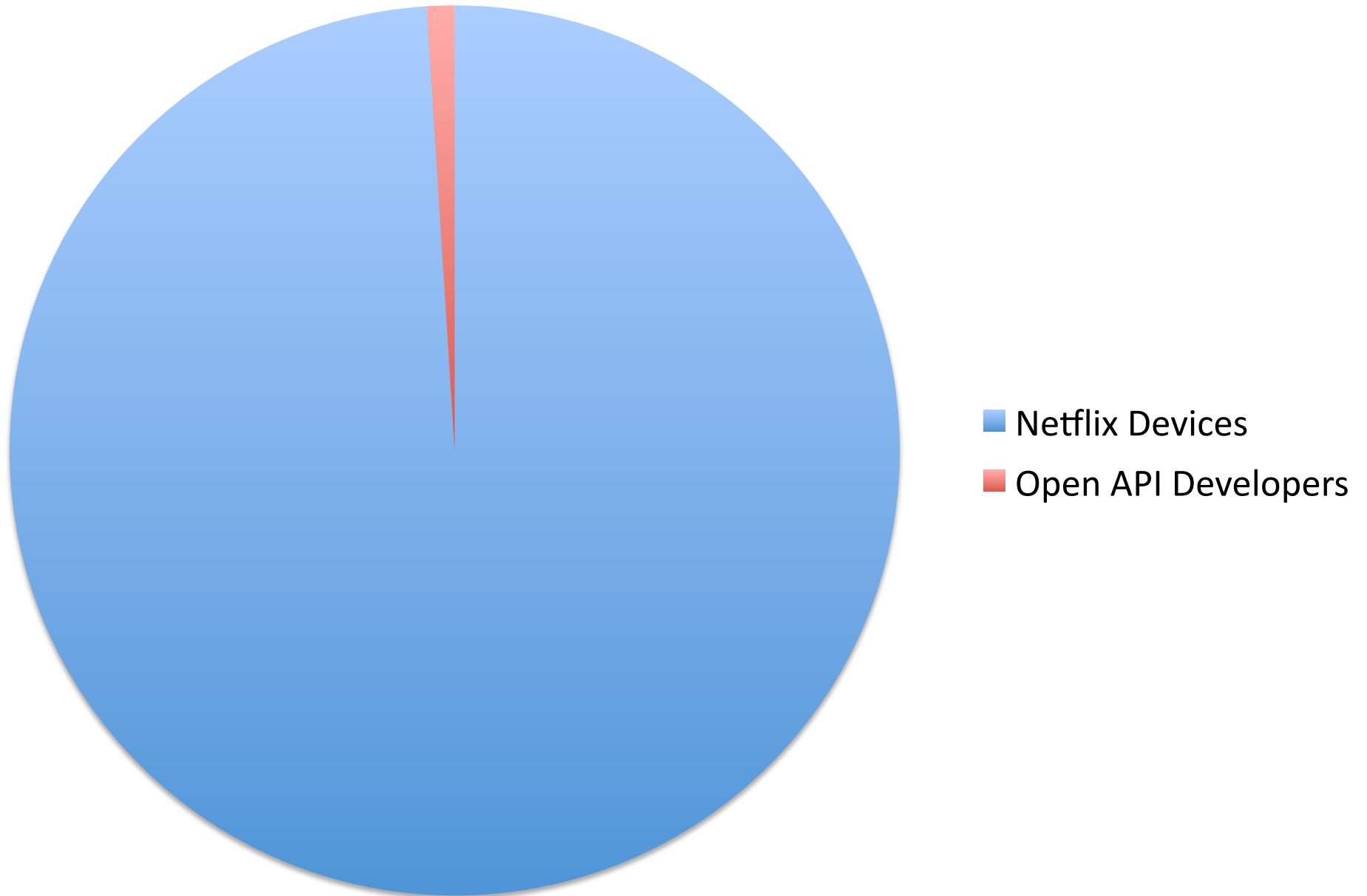
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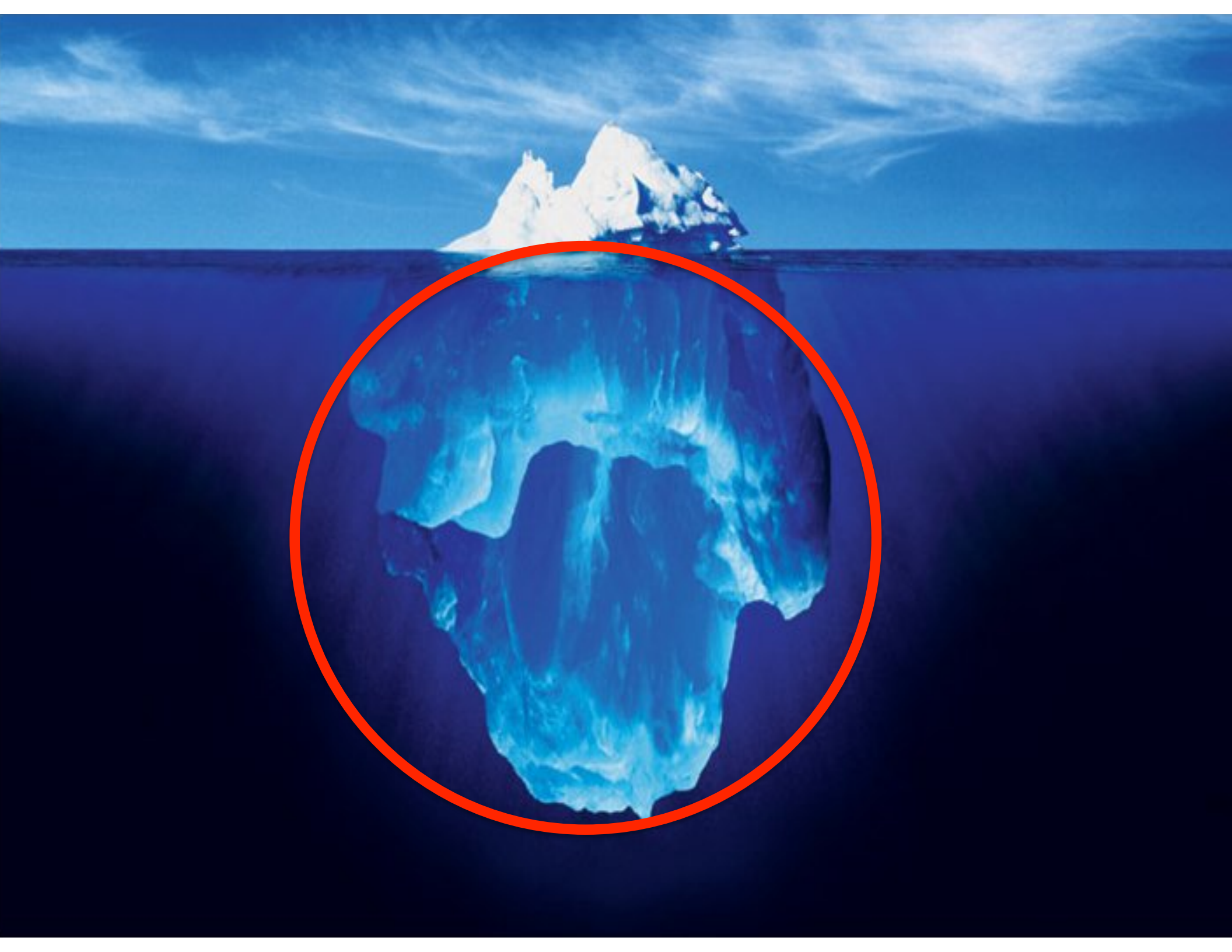


Netflix
API

Netflix API Requests by Audience

Supporting Streaming Devices Today

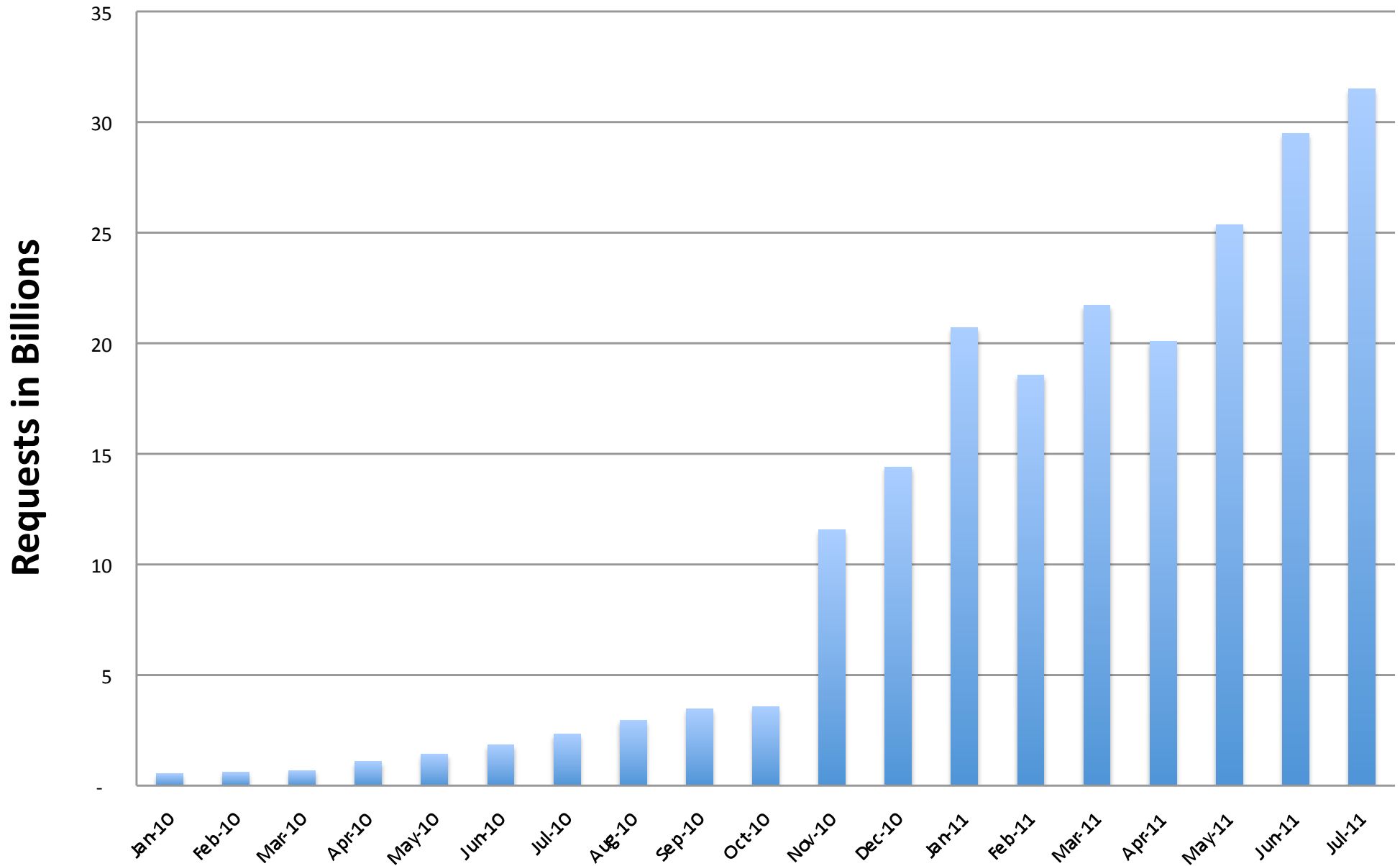




Redesign the API



Netflix API : Requests Per Month



Growth of the Netflix API



Over 30 Billion requests per month
(Peaks at about 20,000 requests per second)



FIND A STATION

SEARCH

go

Search is supported by:



home

news

arts & life

music

programs ▾

listen ▾

HOURLY NEWS

PODCASTS

News > Opinion > Simon Says

Twitter (17) Facebook (104) Share Comments (19) Recommend (13)



Simon Says

by Scott Simon

It's A Girl! The New iPhone Speaks



Listen to the Story

[2 min 49 sec]

- Add to Playlist
- Download
- Transcript



October 22, 2011

text size **A** **A** **A**

Why is Siri female?

Siri is the name of a new talking virtual assistant feature on the latest iPhone that can tell you when you have an appointment, where to find a

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<link href="http://api.netflix.com/catalog/titles/movies/60021896/languages_and_audio" rel="http://schemas.netflix.com/catalog/titles/languages_and_audio"
title="languages and audio"></link>
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<link href="http://www.netflix.com/Movie/Star/60021896" rel="alternate" title="webpage"></link>
</catalog_title>
<catalog_title>
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<box_art small="http://alien2.netflix.com/us/boxshots/tiny/17985448.jpg" medium="http://alien2.netflix.com/us/boxshots/small/17985448.jpg" large=""></box_art>
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formats"></link>
<link href="http://api.netflix.com/catalog/titles/movies/17985448/languages_and_audio" rel="http://schemas.netflix.com/catalog/titles/languages_and_audio"
title="languages and audio"></link>
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</catalog_title>
</catalog_titles>
```

```
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"regular":"Rosencrantz and Guildenstern Are Dead"},
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"average_rating":3.7,
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"64pix_w":"http://cdn-7.nflximg.com/en_US/boxshots/small/60034967.jpg",
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"similar":"http://api.netflix.com/catalog/titles/movies/60034967/similar",
"format_availability":"http://api.netflix.com/catalog/titles/movies/60034967/format_availability"}
}}
```

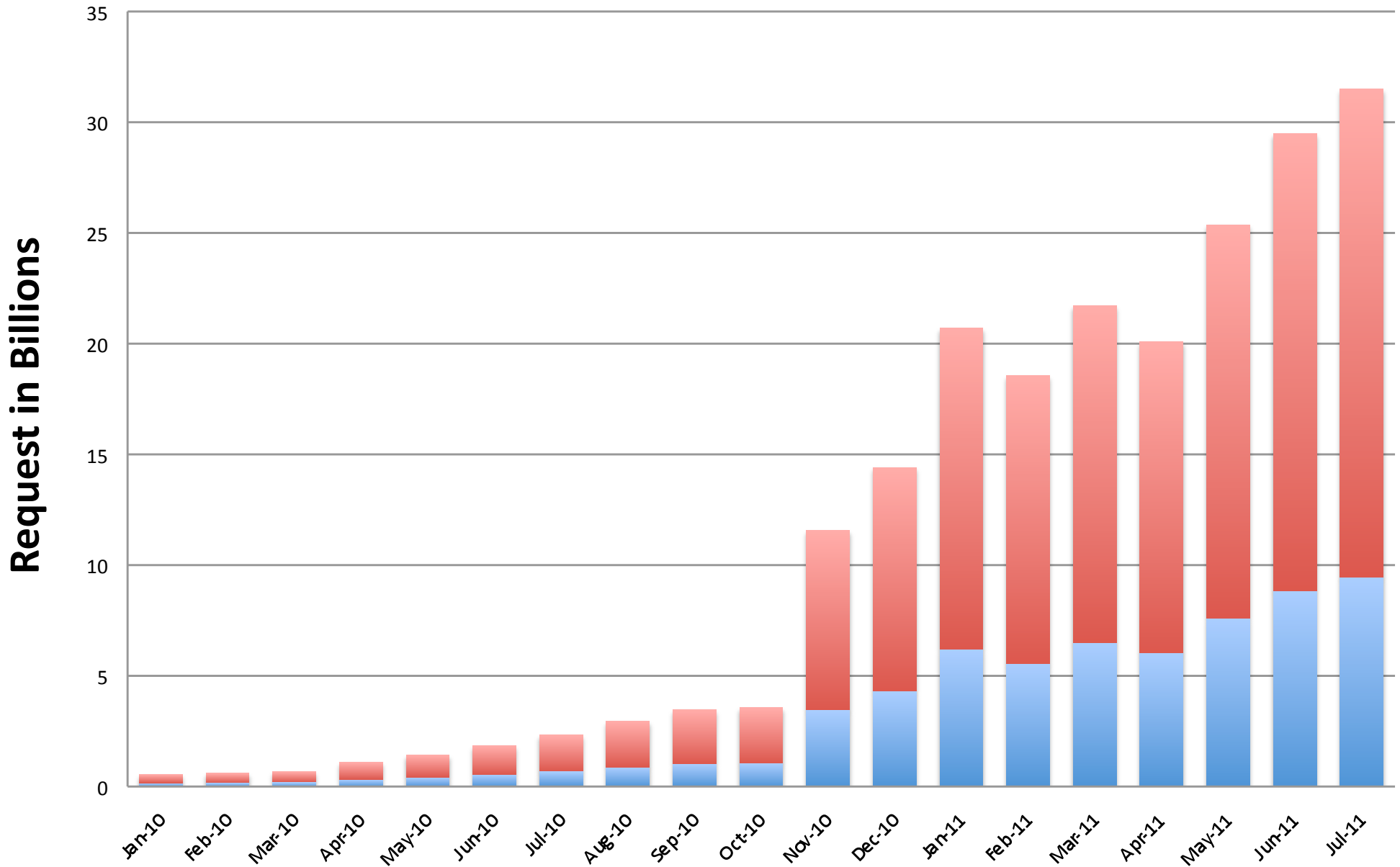
Improve Efficiency of API Requests



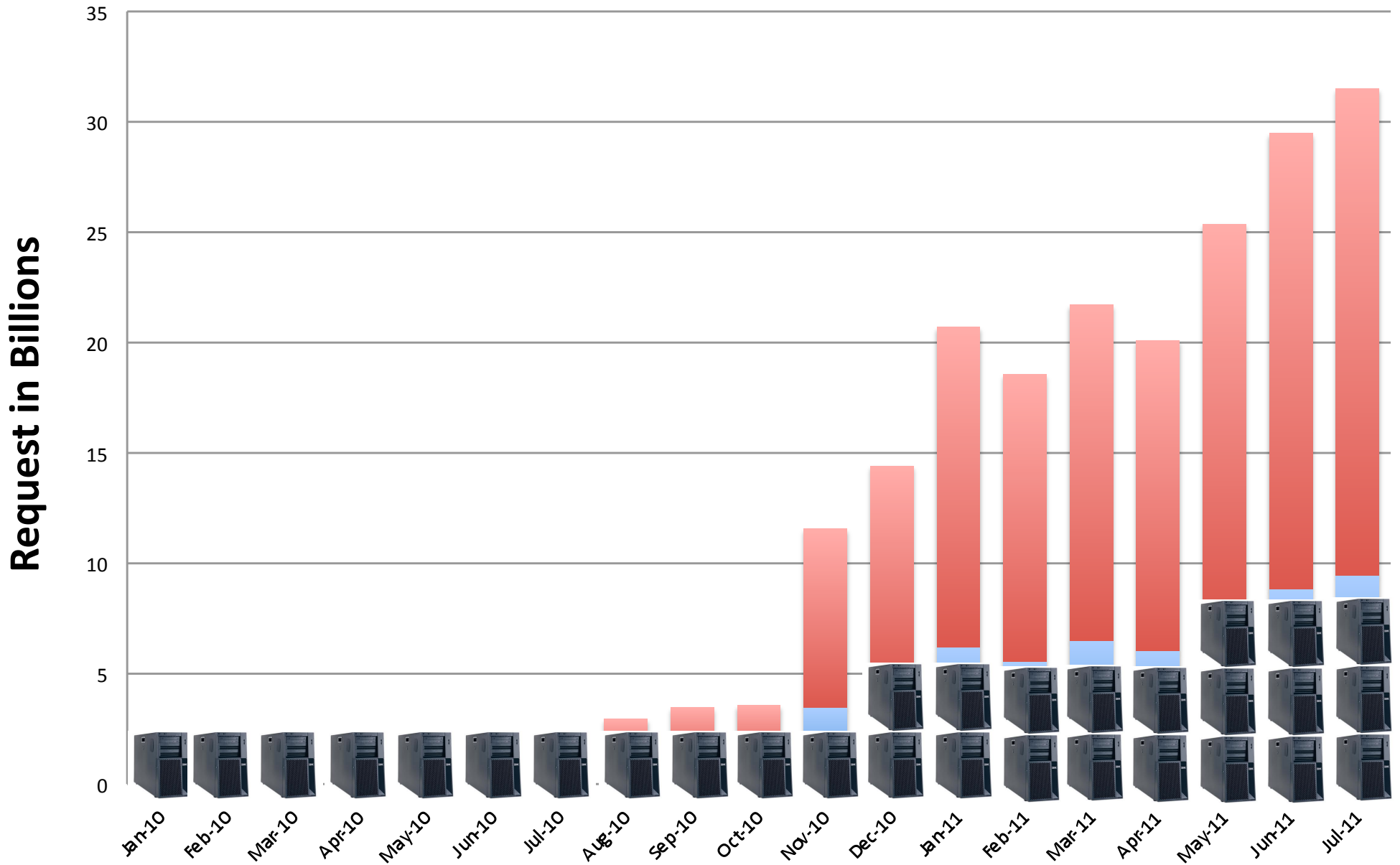
Could it have been 5 billion requests per month? Or less?

(Assuming everything else remained the same)

Netflix API : Requests Per Month



Netflix API : Requests Per Month



API Billionaires Club



13 billion API calls / day *(May 2011)*



Over 260 billion objects stored in S3 *(January 2011)*



5 billion API calls / day *(April 2010)*



5 billion API calls / day *(October 2009)*



1 billion API calls / day *(October 2011)*



8 billion API calls / month *(Q3 2009)*



3.2 billion API-delivered stories / month *(October 2011)*



3 billion API calls / month *(March 2009)*

API Billionaires Club



13 billion API calls / day *(May 2011)*



Over 260 billion objects stored in S3 *(January 2011)*



5 billion API calls / day *(April 2010)*



5 billion API calls / day *(October 2009)*



~~1 billion API calls / day *(October 2011)*~~



8 billion API calls / month *(Q3 2009)*



3.2 billion API-delivered stories / month *(October 2011)*



3 billion API calls / month *(March 2009)*

Two Major Objective for API Redesign

- Improve performance for devices
 - Minimize network traffic (one API call, if possible)
 - Only deliver bytes that are needed
- Improve ability for device teams to rapidly innovate
 - Customized request/response patterns per device
 - Deployment is independent from API schedules

Current Client / Server Interaction

CLIENT APPS



API SERVER

AUTH

SETUP

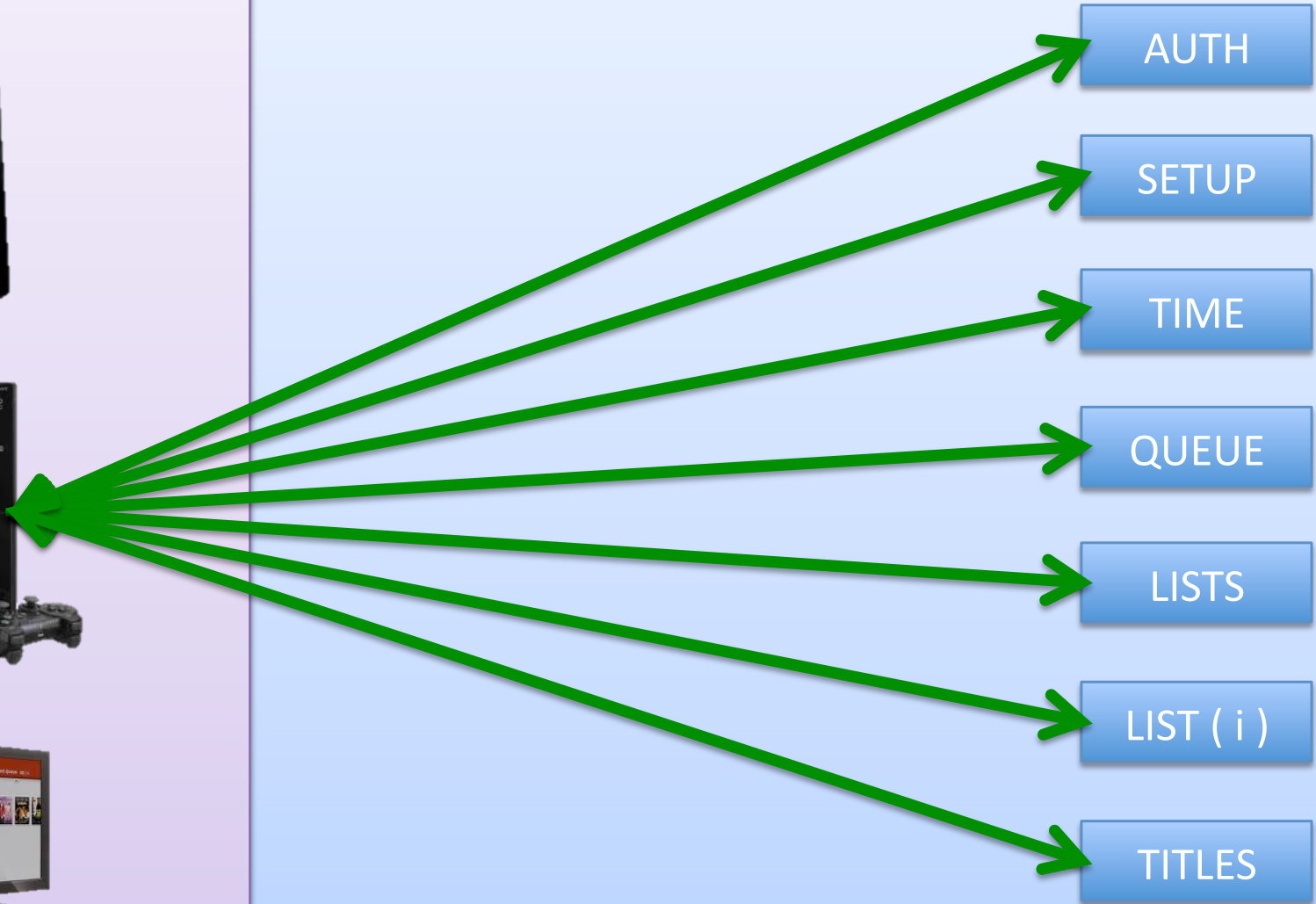
TIME

QUEUE

LISTS

LIST (i)

TITLES

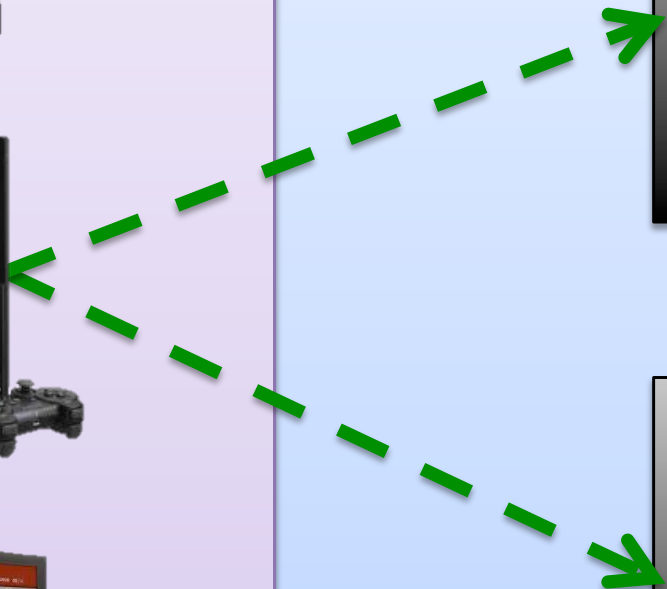
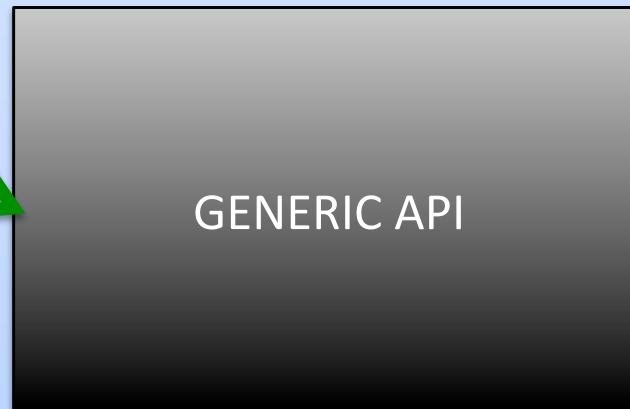


Future Client / Server Interaction

CLIENT APPS



API SERVER



Custom Scripting Tier Interaction

CLIENT APPS



API SERVER

CUSTOM
SCRIPTING
TIER

PS3
HOME
SCREEN
CUSTOM
ENDPOINT

Owned and operated
by the UI teams

AUTH

SETUP

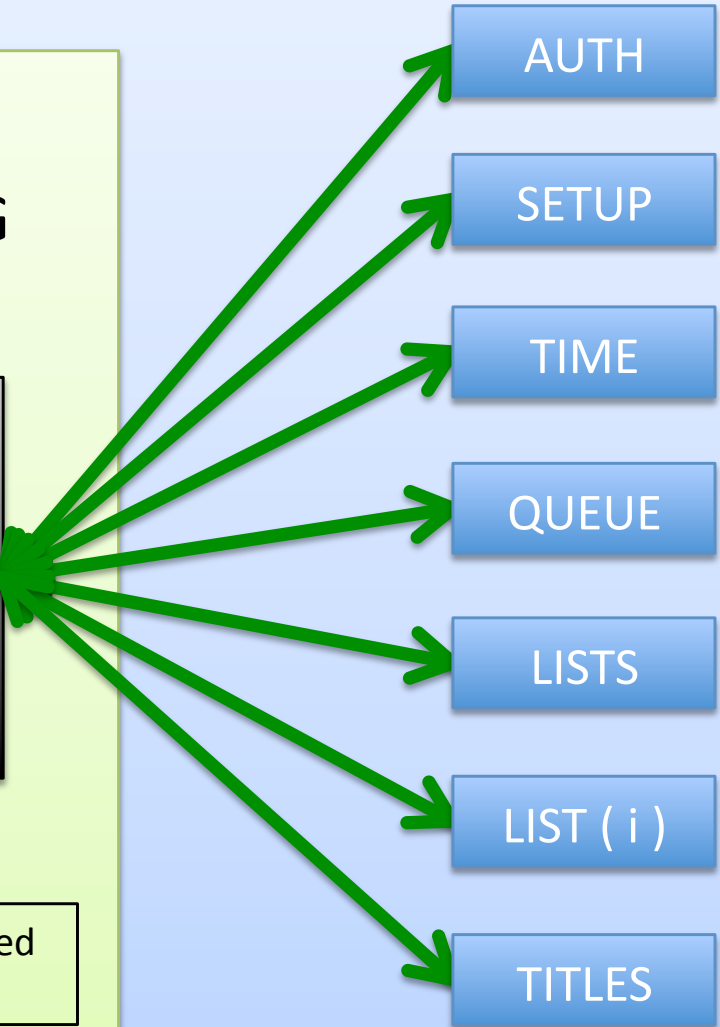
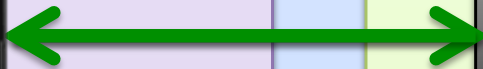
TIME

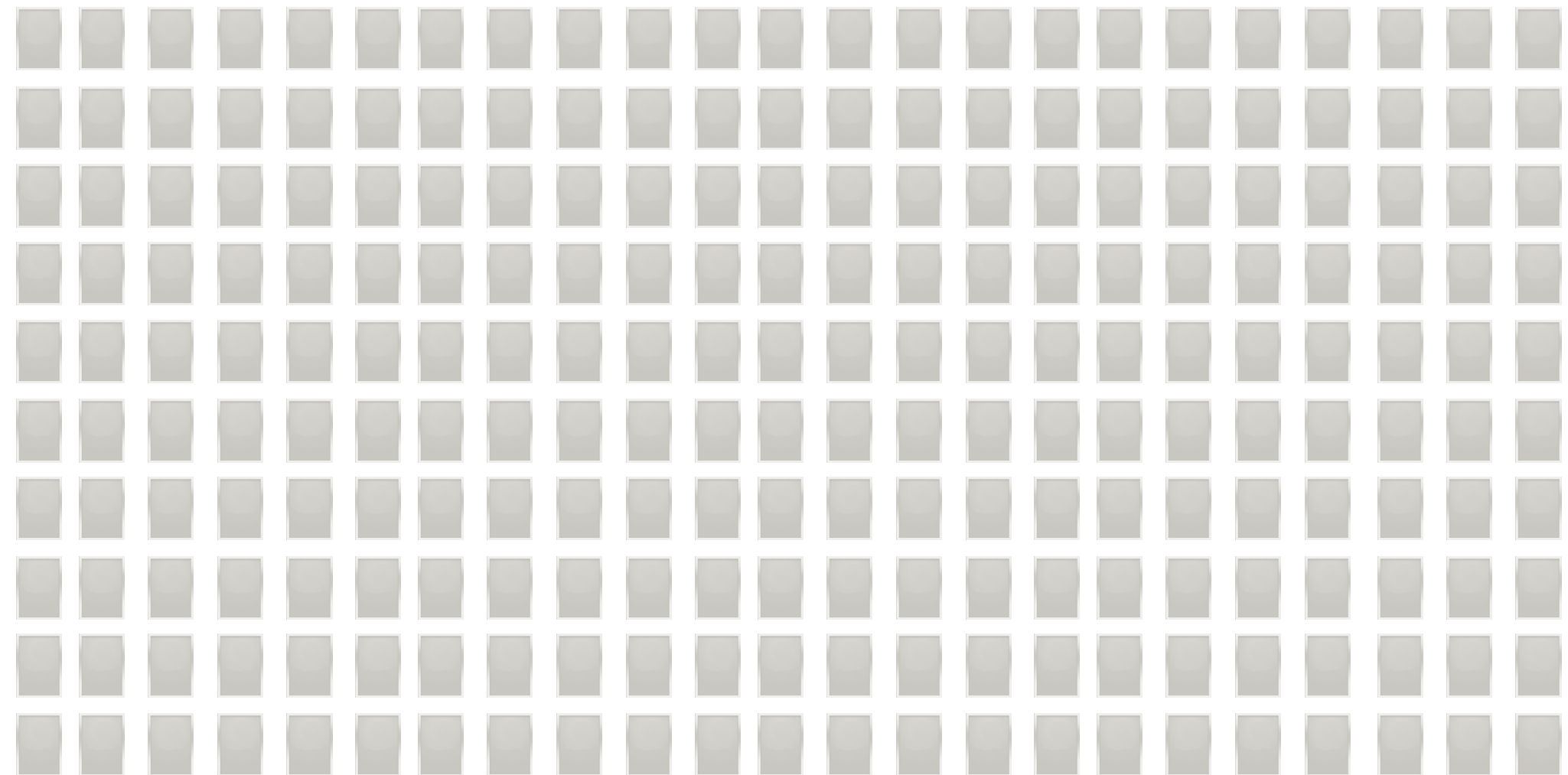
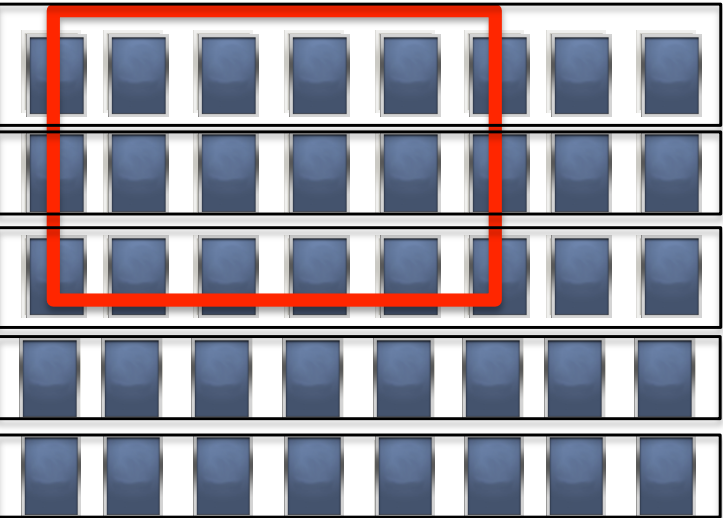
QUEUE

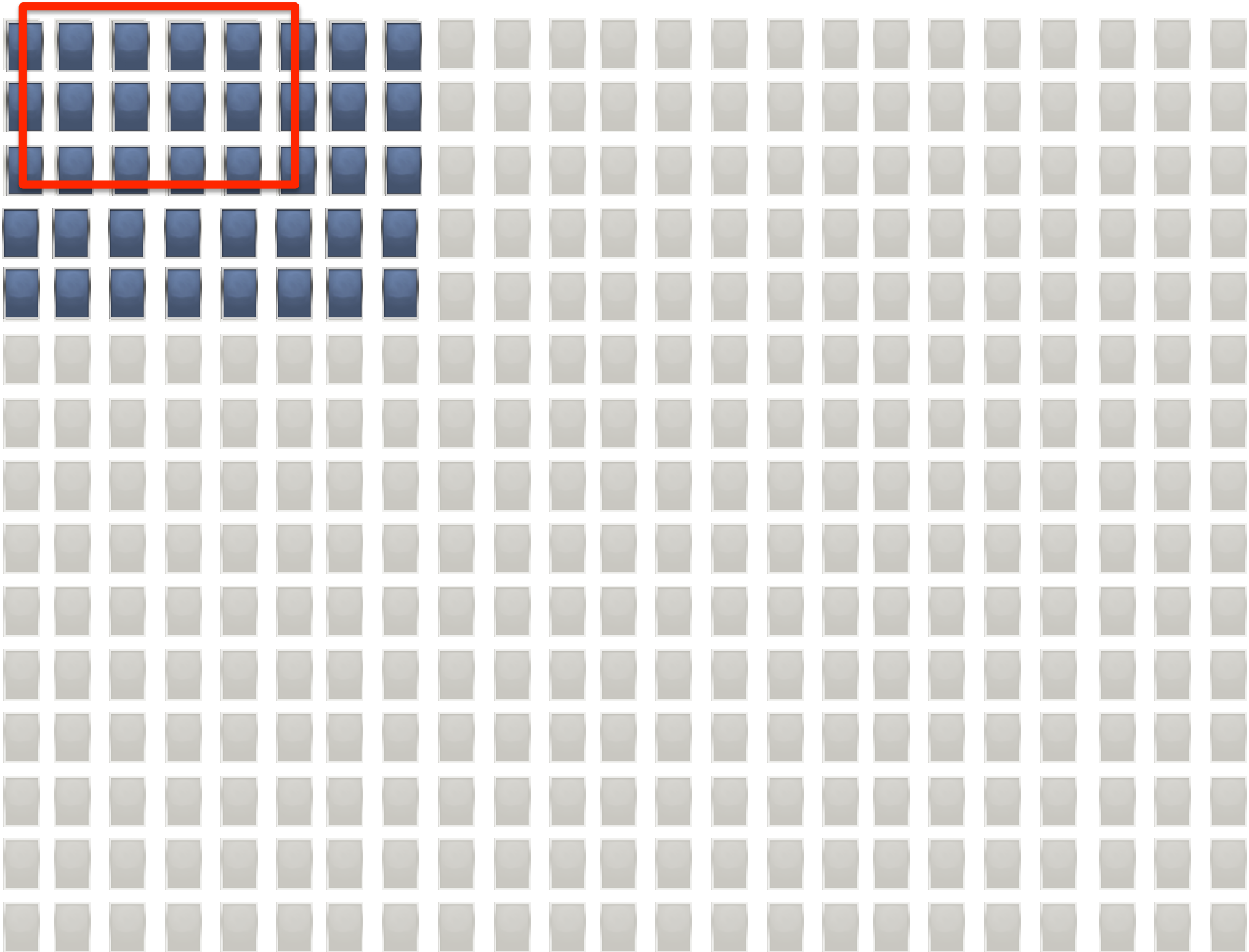
LISTS

LIST (i)

TITLES

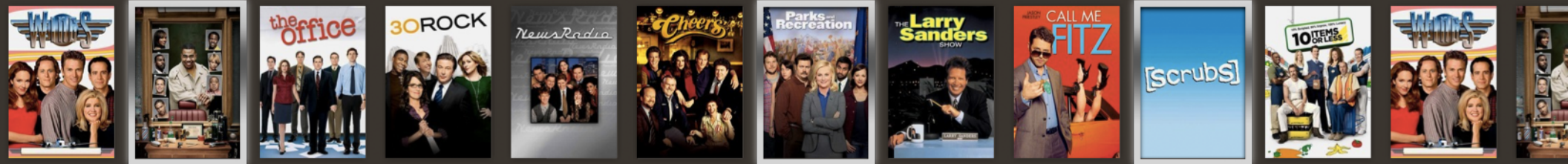






For More Titles From a List

Workplace Sitcoms



Generic API Interaction

CLIENT APP



API SERVER

GENERIC
SCRIPT

SIMPLE
CATALOG
REQUEST
TO API

Owned and operated
by the API team

AUTH

CONFIG

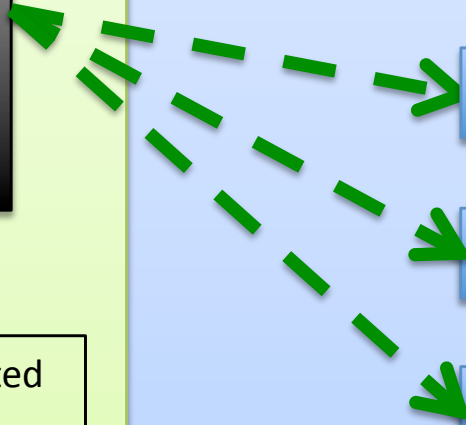
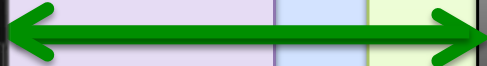
TIME

QUEUE

LISTS

LIST (i)

TITLES



Technologies

CLIENT
LANGUAGE

GROOVY
COMPILED
INTO
JVM

JAVA

AUTH

CONFIG

TIME

QUEUE

LISTS

LIST (i)

TITLES



API Production Servers

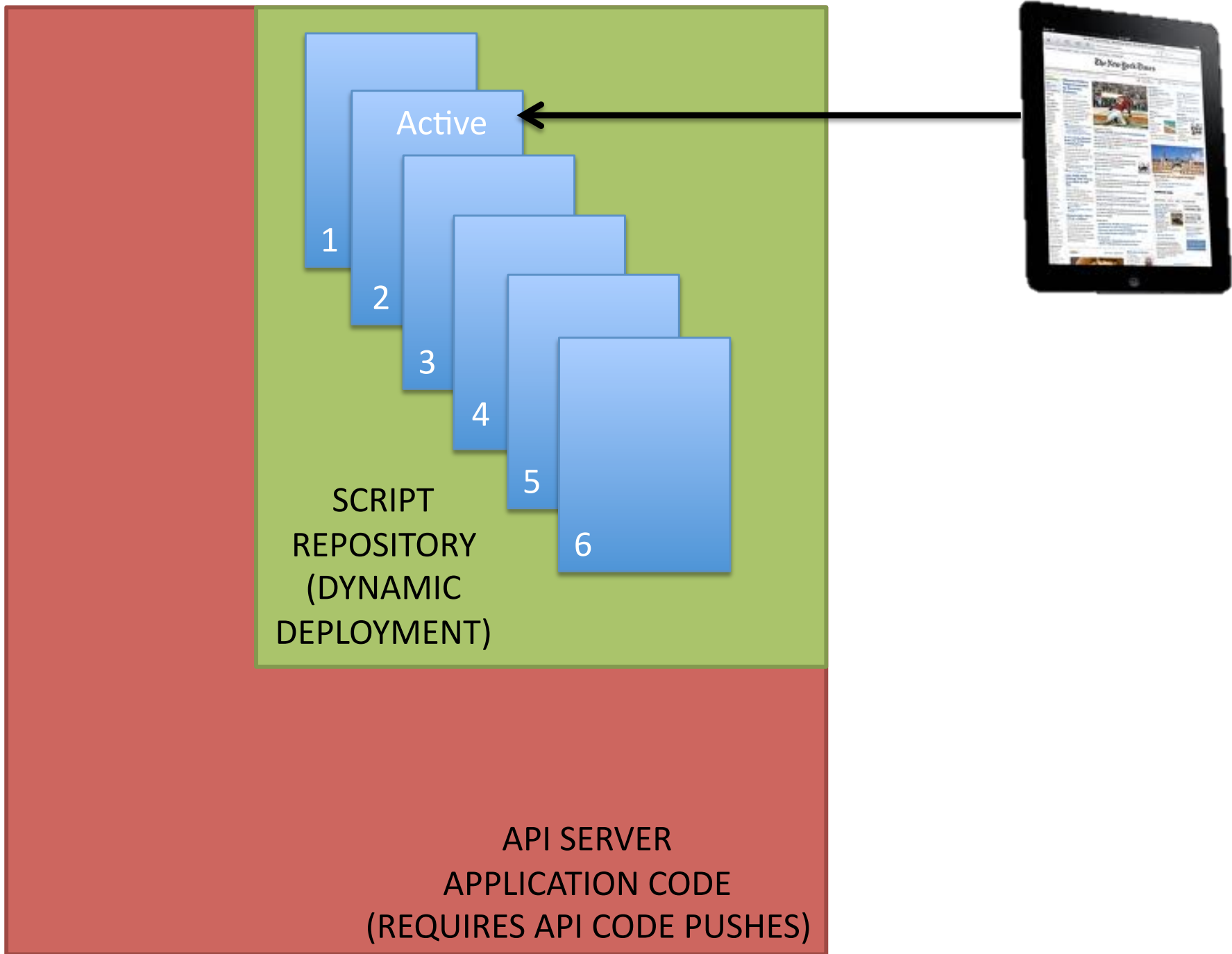


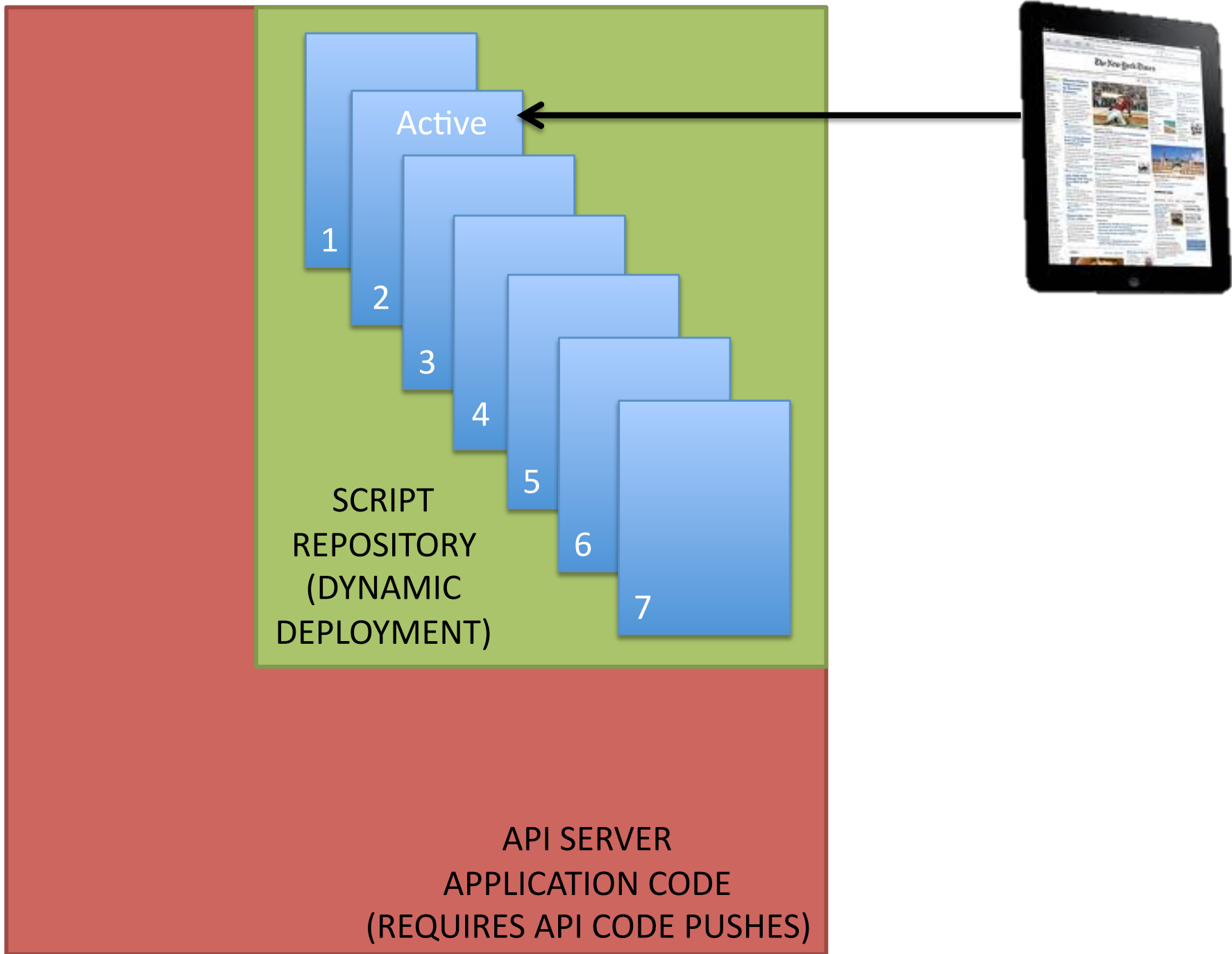
Cassandra Cluster

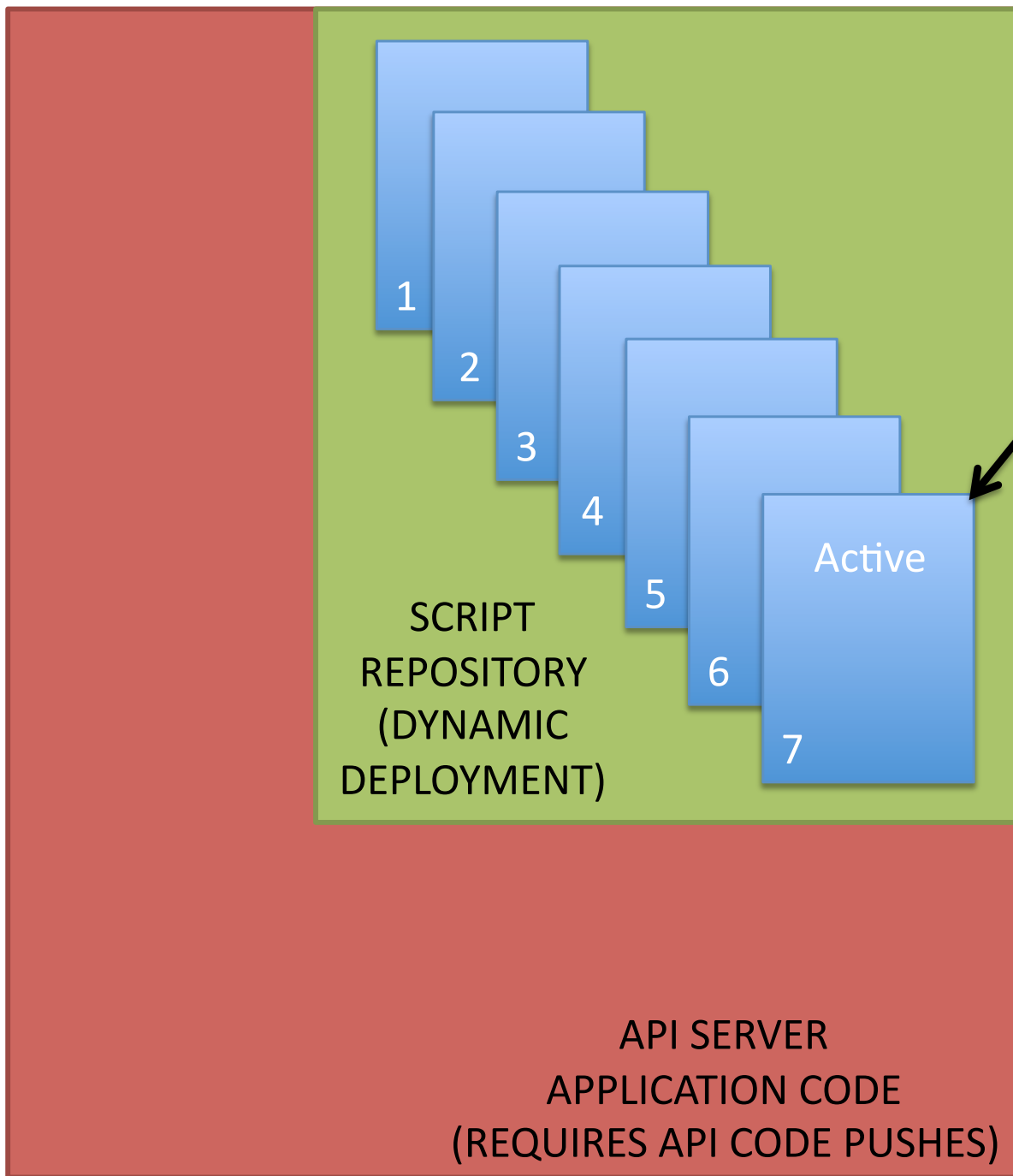
```
C:\Program Files\OpenSSH\bin>ssh 129.144.82.20
Warning: Permanently added '129.144.82.20' (ssh) to the list of known hosts.
129.144.82.20:~$ curl http://129.144.82.20:8080/
{"status": "OK", "data": [{"id": 1, "name": "Groovy"}, {"id": 2, "name": "P4"}]}
129.144.82.20:~$
```



UI Engineers











If you are interested in helping us solve these problems,
please contact me at:

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@daniel_jacobson

<http://www.linkedin.com/in/danieljacobson>

<http://www.slideshare.net/danieljacobson>

