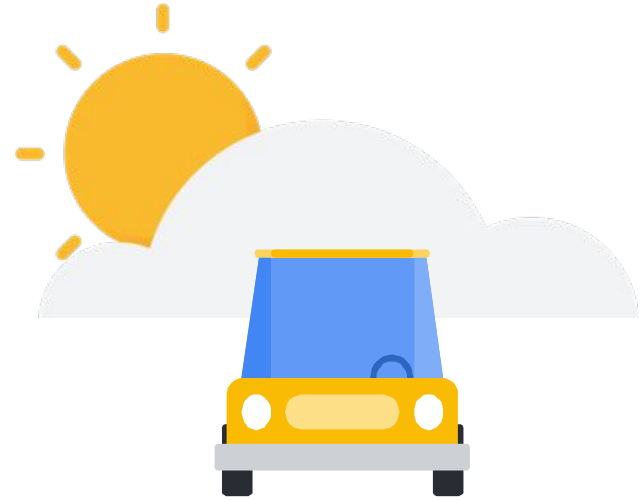


# Self Driving Cloud

IAM Role Recommender





## Lead UX Designer

### Role

I was the **first designer** to join this team and ever since, I've been the **Lead UX Designer** and **thought leader** behind the suite of self driving cloud/policy intelligence tools for three years now.

I've lead every product within SDC/PI from inception to launch cycles. Since I was the first to join the team, I've been the **go-to designer for all x-functional teams** within the Self Driving Cloud ecosystem.

I've also been responsible for leading the initial vision work concepts as well.

# Applying Machine Learning Intelligence and Analytics to security products

## What are we building?

IAM Role Recommender is the **first product launch** within the Self Driving Cloud suite of products. Role Recommender is built on top of IAM (Identity & Access Management) policy.

At the time, **no other competitors** (AWS, Azure) had this tooling available and we were moving at lightning speed to **ship this product out tomorrow**.



### Who are we building it for?

**Security teams** for our existing enterprise customers that are on Google Cloud Platform. Companies such as **Spotify**, Target and Snapchat were some of the big names we worked with on this feature.

Also for **security consultants** (PWC etc) and **3rd party products** that might want to take advantage of this functionality.



**I need help adhering to the principle of least privilege.**

**Nicole**  
Security Engineer at {Tech Company}



## The Problem Statement:

**Least Privilege is hard to measure.**  
It's also hard to get right.

## More constraints

Constraints stacked on constraints stacked on constraints



### Understanding least privilege

There is no easy way to understand how well customers are doing in maintaining least privilege.



### Tracking least privilege

No easy way to track all the resources being created in an organization and who has access to them in the company.



### Revealing when it's over privileged

There is no easy way to see what permissions an individual is using



### When to timebox access?

Most access tends to be indefinite

The Big UX ask:

How does one **visualize** surfacing machine learning **recommendations** while also building **confidence** in users so that they apply them?



# Early Design Explorations

60+ iterations

The screenshot shows the Google Cloud IAM console interface. The main heading is "Change role recommendation for vandy@google.com". A notification banner states: "Replacing the BigQuery Data Viewer role with the BigQuery Job User role will reduce the project member's permissions from 13 to 7." Below this, two columns compare the current permissions and the recommended permissions.

Current permissions in use for BigQuery Data Viewer role		BigQuery Job User role replacement recommendation	
1	bigquery.savedqueries.create	1	bigquery.savedqueries.create
2	bigquery.savedqueries.delete	2	bigquery.savedqueries.delete
3	bigquery.savedqueries.get	3	bigquery.savedqueries.get
4	bigquery.savedqueries.list	4	+ bigquery.savedqueries.list
5	bigquery.tables.list	5	+ bigquery.jobs.create
6	bigquery.tables.update	6	+ bigquery.jobs.list
7	bigquery.tables.updateData	7	- bigquery.tables.list
8	bigquery.tables.create	8	- bigquery.tables.update
9	bigquery.tables.delete	9	- bigquery.tables.updateData
10	bigquery.tables.export	10	- bigquery.tables.create
11	bigquery.datasets.create	11	- bigquery.tables.delete
12	resourcemanager.projects.get	12	- bigquery.tables.export
13	resourcemanager.projects.list	13	- bigquery.datasets.create
		14	- resourcemanager.projects.get
		15	- resourcemanager.projects.list



IAM



### Role recommendations for project "P1"

Role recommendations help you reduce the number of unused permissions granted to project members. Permission usage is analyzed over 90 days, and new roles are recommended based on that usage. [Learn more](#)

<b>Analyzed period</b> ⓘ 90 days ago - 04/20/18	<b>Last policy clean-up</b> ⓘ 24 days ago	<b>Change role recommendations</b> 3	<b>Remove role recommendations</b> 5
--	--	---	---

View by: [Members](#) [Roles](#) [8 new recommendations](#)

Filter by severity, name, member or role

<input type="checkbox"/>	Member ↑	Name	Role	# of permissions used	Recommendation
<input type="checkbox"/>	anita@google.com	Anita	BigQuery Admin BigQuery Data Owner Editor	0 /3,000 0 /1,000 0 /1,385	<a href="#">REMOVE ROLE</a> <a href="#">REMOVE ROLE</a> <a href="#">REMOVE ROLE</a>
<input type="checkbox"/>	vandy@google.com	Vandy	Editor BigQuery Data Viewer	4 /1,385 3 /1,000	<a href="#">CHANGE ROLE</a> <a href="#">REMOVE ROLE</a>
<input type="checkbox"/>	carolyn@google.com	Carolyn Huynh	Owner	3 /1,500	<a href="#">NO NEW ROLE</a>
<input type="checkbox"/>	service-988612@gcp1.iam.gserviceaccount.com	Compute Engine	Service Account Key Admin Service Account Token Creator	3 /10 3 /10	<a href="#">CHANGE ROLE</a> <a href="#">REMOVE ROLE</a>
<input type="checkbox"/>	chris@google.com	Chris L	Editor	600 /1,385	<a href="#">REMOVE ROLE</a>
<input type="checkbox"/>	matt@google.com	Matt T.	Editor Owner	695 /1,385 750 /1,500	<a href="#">NO NEW ROLE</a> <a href="#">NO NEW ROLE</a>



IAM



Role recommendations for project "P1"

Role recommendations help you reduce the number of unused permissions granted to project members. Permission usage is analyzed over 90 days, and new roles are recommended based on that usage. [Learn more](#)

Last policy clean-up <b>!</b> 24 days ago	Role replacement recommendations 3	Role removal recommendations 5
--	---------------------------------------	-----------------------------------

View by: [Members](#) [Roles](#) [Recommendations](#)

Filter by severity, name, member or role

<input type="checkbox"/>	Member ↑	Name	Role	Recommendation	Unused permissions
<input type="checkbox"/>	anita@google.com	Anita	BigQuery Admin BigQuery Data Owner Editor	<a href="#">Remove role</a> <a href="#">Remove role</a> <a href="#">Remove role</a>	100%
<input type="checkbox"/>	vandy@google.com	Vandy	Editor BigQuery Data Viewer	<a href="#">Replace role</a> <a href="#">Remove role</a>	99%
<input type="checkbox"/>	carolyn@google.com	Carolyn Huynh	Owner	?	98%
<input type="checkbox"/>	service-988612@gcp1.iam.gserviceaccount.com	Compute Engine	Service Account Key Admin Service Account Token Creator	<a href="#">Replace role</a> <a href="#">Remove role</a>	49%
<input type="checkbox"/>	chris@google.com	Chris L	Editor	<a href="#">Replace role</a>	47%
<input type="checkbox"/>	matt@google.com	Matt T.	Editor Owner	?	55%

**Something was not right.**

**We weren't visualizing  
machine learning intelligence  
in a more powerful way.**

**¿ML?**

1

## Back to the drawing board

We needed more [research](#)

2

## Ran customer research sessions

A lot of [qualitative chats](#)

3

## Customer whiteboarding sessions

...mixed with [hands on brainstorming](#)

4

## Designing on the spot in front of customers

A quick and dirty [yes? no?](#)

# The Light Bulb Moment

I was designing with roles. But customers wanted to go as **granular as the permissions** *within* the roles, which are **hidden in the UI** and only **exposed via the API**.

# Research taught us that when it came to changing permissions, we had to be as *explicit* as possible

## **We talked to a lot of customers. A lot.**

Based off foundational research, customer whiteboarding sessions, and several low-low fi concepts, my UX researcher and I were able to discern that in order for us to **gain trust from our customers to apply Google recommendations, we needed to be as granular as possible.**

After combing through all the qualitative data, I couldn't get my mind off off of the granularity when it comes to *displaying* trust.

**Especially in the security space.**

Users wanted to know exactly what we were removing, what we were adding and what was the machine learning recommended permission.

So, I decided to bring back the **trusty code diff** and give it a **makeover** to show exactly what we were **removing** (-), what we were **adding** (+) , and which part was **machine learning** (ML).



# What a standard code diff looks like

the -/+ pattern is key here

```
94  +- (RACSignal *)enqueueRequest:(NSURLRequest *)request fetchAllPages:(BOOL)fetchAllPages;
95  +
82  96  // Enqueues a request to fetch information about the current user by accessing
83  97  // a path relative to the user object.
84  98  //
    ④ @@ -241,11 +255,13 @@ - (id)initWithServer:(OCTServer *)server {
241 255  NSString *userAgent = self.class.userAgent;
242 256  if (userAgent != nil) [self setDefaultHeader:@"User-Agent" value:userAgent];
243 257  - self.parameterEncoding = AFJSONParameterEncoding;
244  - [self setDefaultHeader:@"Accept" value:@"application/vnd.github.beta+json"];
245  -
246  -
247 258  [AFHTTPRequestOperation addAcceptableStatusCodes:[NSIndexSet indexSetWithIndex:OCTClientNotModifiedStatusCode]]
248  - [AFJSONRequestOperation addAcceptableContentTypes:[NSSet setWithObject:@"application/vnd.github.beta+json"]];
    259  +
260  + NSString *contentType = [NSString stringWithFormat:@"application/vnd.github.%@+json", OCTClientAPIVersion];
261  + [self setDefaultHeader:@"Accept" value:contentType];
262  + [AFJSONRequestOperation addAcceptableContentTypes:[NSSet setWithObject:contentType]];
263  +
264  + self.parameterEncoding = AFJSONParameterEncoding;
249 265  [self registerHTTPOperationClass:AFJSONRequestOperation.class];
250 266
```

# Wait. We're still missing the ML part.

# Stay with me. The -/+ pattern is still key here.

Google Cloud Platform

IAM

PERMISSIONS

Change role from BigQuery Data Viewer to BigQuery Job User for vandyr@google.com

Replacing the BigQuery Data Viewer role with the BigQuery Job User role will reduce the project member's permissions from 13 to 7.

Current permissions in use for BigQuery Data Viewer role		BigQuery Job User role replacement recommendation	
Last used on 08/01/2018	1 bigquery.savedqueries.create	1	bigquery.savedqueries.create
	2 bigquery.savedqueries.delete	2	bigquery.savedqueries.delete
	3 bigquery.savedqueries.get	3	bigquery.savedqueries.get
	4 bigquery.savedqueries.list	4	bigquery.savedqueries.list
	5 bigquery.tables.list	5	+ bigquery.jobs.create
	6 bigquery.tables.update	6	- bigquery.tables.list
	7 bigquery.tables.updateData	7	- bigquery.tables.update
	8 bigquery.tables.create	8	- bigquery.tables.updateData
	9 bigquery.tables.delete	9	- bigquery.tables.create
	10 bigquery.tables.export	10	- bigquery.tables.delete
	11 bigquery.datasets.create	11	- bigquery.tables.export
	12 resourcemanager.projects.get	12	- bigquery.datasets.create
	13 resourcemanager.projects.list	13	resourcemanager.projects.get
		14	resourcemanager.projects.list

# ...what if we added ML into the traditional -/+ pattern?

The screenshot shows the Google Cloud Platform IAM console. The main heading is "5 change role recommendations for chris@google.com". A light gray box contains a recommendation: "Replacing the Owner role with the following five roles below will help reduce down to 124 total permissions." The recommended roles and their permission counts are:

- BigQuery Admin role, 41 permissions
- BigQuery Data Editor, 23 permissions
- Cloud Datastore Owner, 35 permissions
- Cloud Schedule Viewer, 7 permissions
- Cloud KMS Admin, 18 permissions

Below this, it states "Analysis is based off of the last 60 days." The interface also shows a list of "Current permissions in use for Owner role" and a dropdown menu for the "BigQuery Admin role (41 permissions)".

Current permissions in use for Owner role		BigQuery Admin role (41 permissions)	
1	accesscontextmanager.policies.update	7	accesscontextmanager.policies.update
2	accesscontextmanager.servicePerimeters.create	8	accesscontextmanager.servicePerimeters.create
3	accesscontextmanager.servicePerimeters.delete	9	accesscontextmanager.servicePerimeters.delete
4	accesscontextmanager.servicePerimeters.update	10	appengine.instances.list
5	androidmanagement.enterprises.manage	11	automl.annotationSpecs.create
6	appengine.applications.create	12	automl.annotationSpecs.delete
7	appengine.applications.get	13	androidmanagement.enterprises.manage
8	appengine.applications.update	14	appengine.applications.create
9	automl.annotationSpecs.create	15	appengine.applications.get

IAM ADD

5 change role recommendations for chris@google.com

PERMISSIONS REC

Permissions for project “

These permissions affect this pro

Analysis of permission recommendations

View by: **Members** Roles

Filter by name or role

- Member ↑
- service-87123@cl
- anita@google.com
- vandy@google.com
- chris@google.com
- service-988612@cl

Replacing the Owner role with the following five roles below will help reduce down to 124 total permissions.

- BigQuery Admin role, 41 permissions
- BigQuery Data Editor, 23 permissions
- Cloud Datastore Owner, 35 permissions
- Cloud Schedule Viewer, 7 permissions
- Cloud KMS Admin, 18 permissions

Analysis is based off of the last 60 days.

Current permissions in use for Owner role

- Last analyzed 01/05/2019
- 1 accesscontextmanager.policies.update
  - 2 accesscontextmanager.servicePerimeters.create
  - 3 accesscontextmanager.servicePerimeters.delete
  - 4 accesscontextmanager.servicePerimeters.update
  - 5 androidmanagement.enterprises.manage
  - 6 appengine.applications.create
  - 7 appengine.applications.get
  - 8 appengine.applications.update
  - 9 automl.annotationSpecs.create
  - 10 automl.annotationSpecs.delete
  - 11 bigquery.config.get
  - 12 bigquery.config.update
  - 13 bigquery.datasets.create
  - 14 bigquery.datasets.delete
  - 15 bigquery.datasets.get
  - 16 bigquery.datasets.getIamPolicy
  - 17 bigquery.datasets.setIamPolicy
  - 18 bigquery.datasets.update
  - 19 bigquery.jobs.create

BigQuery Admin role (41 permissions)

- 7 accesscontextmanager.policies.update
- 8 accesscontextmanager.servicePerimeters.create
- 9 accesscontextmanager.servicePerimeters.delete
- 10 appengine.instances.list
- 11 automl.annotationSpecs.create
- 12 automl.annotationSpecs.delete
- 13 androidmanagement.enterprises.manage
- 14 appengine.applications.create
- 15 appengine.applications.get
- 16 appengine.applications.update
- 17 bigquery.savedqueries.get
- 18 bigquery.savedqueries.list
- 19 bigquery.savedqueries.delete
- 20 bigquery.transfers.get
- 21 bigquery.transfers.update
- 22 bigtable.appProfiles.create
- 23 bigtable.appProfiles.delete
- 24 bigtable.appProfiles.get
- 25 bigtable.appProfiles.list

## Current permissions in use for Owner role

Last analyzed  
01/05/2019

- 1 accesscontextmanager.policies.update
- 2 accesscontextmanager.servicePerimeters.create
- 3 accesscontextmanager.servicePerimeters.delete
- 4 accesscontextmanager.servicePerimeters.update
- 5 androidmanagement.enterprises.manage
- 6 appengine.applications.create
- 7 appengine.applications.get
- 8 appengine.applications.update
- 9 automl.annotationSpecs.create
- 10 automl.annotationSpecs.delete
- 11 bigquery.config.get
- 12 bigquery.config.update
- 13 bigquery.datasets.create
- 14 bigquery.datasets.delete
- 15 bigquery.datasets.get
- 16 bigquery.datasets.getIamPolicy
- 17 bigquery.datasets.setIamPolicy
- 18 bigquery.datasets.update
- 19 bigquery.jobs.create

## 💡 BigQuery Admin role (41 permissions) ▼

- 7 accesscontextmanager.policies.update
- 8 accesscontextmanager.servicePerimeters.create
- 9 accesscontextmanager.servicePerimeters.delete
- 10 **+** appengine.instances.list
- 11 automl.annotationSpecs.create
- 12 automl.annotationSpecs.delete
- 13 androidmanagement.enterprises.manage
- 14 appengine.applications.create
- 15 appengine.applications.get
- 16 - appengine.applications.update
- 17 - bigquery.savedqueries.get
- 18 - bigquery.savedqueries.list
- 19 - bigquery.savedqueries.update
- 20 bigquery.transfers.get
- 21 - bigquery.transfers.update
- 22 - bigtable.appProfiles.create
- 23 - bigtable.appProfiles.delete
- 24 - bigtable.appProfiles.get
- 25 - bigtable.appProfiles.list

Current permissions in use for Owner role

Filter current permissions in use

Last analyzed 01/05/2019	9	container.services.create
	10	container.services.delete
	11	container.services.get
	12	container.services.getStatus
	13	container.services.list
	14	container.services.proxy
	15	container.services.update
	16	container.services.updateStatus
	17	container.statefulSets.create
18	container.statefulSets.delete	
Unused permissions	19	appengine.instances.list
	20	appengine.memcache.get
	21	appengine.memcache.getKey
	22	appengine.memcache.list
	23	appengine.memcache.update
	24	appengine.operations.get
	25	appengine.operations.list
	26	appengine.runtimes.actAsAdmin
	27	appengine.services.delete

Custom BigQuery Admin role replacement recommendation

Filter current permissions in use: automl.annotationSpecs.create

9	38	automl.annotationSpecs.create
10	39	automl.annotationSpecs.delete
11	40	bigquery.savedqueries.get
12	41	bigquery.savedqueries.list
13	42	bigquery.savedqueries.update
14	43	bigquery.transfers.get
15	44	compute.firewalls.get
16	45	compute.firewalls.list
17	46	compute.forwardingRules.get
18	47	compute.forwardingRules.list
19	48	compute.globalAddresses.get
20	49	compute.globalAddresses.list
21	50	compute.globalForwardingRules.get
22	51	compute.globalForwardingRules.list
23	52	compute.globalOperations.get
24	53	compute.globalOperations.getIamPolicy
25	54	compute.globalOperations.list
26	55	compute.healthChecks.get
27	56	compute.healthChecks.list

APPLY

DISMISS CANCEL

10



```
appengine.instances.list
```



## Meet the ML sparkles

Design Patent filed GP-300272-00-US-DP on 09/16/2019

For surfacing machine learning recommendation in a code diff.

No design challenge is too small or too big to take on.



**Now, let's walk through  
the whole product from  
start to finish.**

### Permissions for project "P1"

These permissions affect this project and all of its resources. [Learn more](#)

Analysis of permission usage over the last 60 days has resulted in change role and remove role recommendations [LEARN MORE](#)

View by: Members Roles

Filter by name or role

<input type="checkbox"/>	Member ↑	Name	Role	Permissions in use	Inheritance	
<input type="checkbox"/>	service-87123@cloud-tpu..	TPU Service Agent	Cloud TPU API Service Agent	<a href="#">7/15</a>		
<input type="checkbox"/>	anita@google.com	Anita	BigQuery Admin	<a href="#">0/30</a>		
			Compute Engine Admin	<a href="#">0/1,000</a>	Data Folder	
<input type="checkbox"/>	vandy@google.com	Vandy	Editor	<a href="#">4/1,385</a>		
			Owner	<a href="#">4/1,816</a>		
<input type="checkbox"/>	chris@google.com	Chris L	Owner	<a href="#">18/1,816</a>		
<input type="checkbox"/>	service-988612@gcp1.iam...	Compute Engine	Service Account Key Admin	<a href="#">5/10</a>		
			Service Account Token Creator	<a href="#">5/10</a>		

### Permissions for project "P1"

These permissions affect this project and all of its resources. [Learn more](#)

Analysis of permission usage over the last 60 days has resulted in change role and remove role recommendations [LEARN MORE](#)

View by: Members Roles

Filter by name or role

<input type="checkbox"/>	Member ↑	Name	Role	Permissions in use	Inheritance		
<input type="checkbox"/>	service-87123@cloud-tpu..	TPU Service Agent	Cloud TPU API Service Agent	<a href="#">7/15</a>			
<input type="checkbox"/>	anita@google.com	Anita	BigQuery Admin	<a href="#">0/30</a>			
			Compute Engine Admin	<a href="#">0/1,000</a>	Data Folder		
<input type="checkbox"/>	vandy@google.com	Vandy	<b>Recommended role change</b>	<a href="#">4/1,385</a>			
			There are 18 out of 1,816 permissions in use for the role of Owner. There is a recommendation to change this role to reduce permissions.	<a href="#">4/1,816</a>			
<input type="checkbox"/>	chris@google.com	Chris L		<a href="#">18/1,816</a>			
<input type="checkbox"/>	service-988612@gcp1.iam...	Compute Engine	Service Account Key Admin	<a href="#">5/10</a>			
			Service Account Token Creator	<a href="#">5/10</a>			

### Change role recommendation for chris@google.com

#### Permissions for project

These permissions affect this project

Analysis of permissions

View by: **Members** Roles

Filter by name or role

- Member ↑
- service-87123@cloud
- anita@google.com
- vandy@google.com
- chris@google.com
- service-988612@cloud

Replacing the Owner role with the BigQuery Admin role will reduce the project member's permissions from 1,816 to 31. Analysis is based off of the last 60 days.

#### Current permissions in use for Owner role

Last analyzed 01/05/2019	9	container.services.create	
	10	container.services.delete	
	11	container.services.get	
	12	container.services.getStatus	
	13	container.services.list	
	14	container.services.proxy	
	15	container.services.update	
	16	container.services.updateStatus	
	17	container.statefulSets.create	
	18	container.statefulSets.delete	
	Unused permissions	19	appengine.instances.list
		20	appengine.memcache.get
		21	appengine.memcache.getKey
		22	appengine.memcache.list
		23	appengine.memcache.update
		24	appengine.operations.get
		25	appengine.operations.list
		26	appengine.runtimes.actAsAdmin
27		appengine.services.delete	

#### BigQuery Admin role replacement recommendation

1	-	accesscontextmanager.policies.update
2	-	accesscontextmanager.servicePerimeters.create
3	-	accesscontextmanager.servicePerimeters.delete
4	-	androidmanagement.enterprises.manage
5	-	appengine.applications.create
6	-	appengine.applications.get
7	-	appengine.applications.update
8	-	appengine.instances.list
9	-	automl.annotationSpecs.create
10	-	automl.annotationSpecs.delete
11	-	bigquery.savedqueries.get
12	-	bigquery.savedqueries.list
13	+	bigquery.savedqueries.update
14	-	bigquery.transfers.get
15	-	bigquery.transfers.update
16	-	bigtable.appProfiles.create
17	-	bigtable.appProfiles.delete
18	-	bigtable.appProfiles.get
19	-	bigtable.appProfiles.list

**APPLY** DISMISS CANCEL



IAM

ADD

REMOVE



PERMISSIONS

RECOMMENDATIONS LOG



## Recommendations log for project "P1"

History of applied recommendations for this project

### Today

12:53 PM	carolyn@google.com created custom role	Replaced BigQuery Data Viewer role with custom role "BigQuery Custom" for vandy@google.com	<a href="#">REVERT</a>
4:00 PM	carolyn@google.com dismissed recommendation	Dismissed BigQuery Job User role recommendation for vandy@google.com	<a href="#">RESTORE</a>



IAM

+ ADD

- REMOVE



PERMISSIONS

RECOMMENDATIONS LOG



## Recommendations log for project "P1"

History of applied recommendations for this project

### Today

4:00 PM carolyn@google.com reverted recommendation Reverted BigQuery Job User role recommendation for vandy@google.com REVERTED

### Change BigQuery Data Viewer role for Vandy (vandy@google.com)

User	vandy@google.com
Applied by	carolyn@google.com
Date	Jan 28, 2019
Recommendation	Replaced BigQuery Data Viewer role with BigQuery Job user role
Status	Reverted recommendation

#### Current permissions in use for BigQuery Data Viewer role

Last used on	Permission
08/01/2018	1 bigquery.savedqueries.create
	2 bigquery.savedqueries.delete
	3 bigquery.savedqueries.get
	4 bigquery.savedqueries.list
	5 bigquery.tables.list
	6 bigquery.tables.update
	7 bigquery.tables.updateData
	8 resourcemanager.projects.get
	9 resourcemanager.projects.list
	10 bigquery.tables.create
	11 bigquery.tables.delete
	12 bigquery.tables.export
	13 bigquery.datasets.create

#### BigQuery Job User role replacement recommendation

1	bigquery.savedqueries.create
2	bigquery.savedqueries.delete
3	bigquery.savedqueries.get
4	bigquery.savedqueries.list
5	+ bigquery.jobs.create
6	- bigquery.tables.list
7	- bigquery.tables.update
8	- bigquery.tables.updateData
9	- bigquery.tables.create
10	- bigquery.tables.delete
11	- bigquery.tables.export
12	- bigquery.datasets.create
13	resourcemanager.projects.get

# Key Takeaways & Reflections

As the **first team** to ship a **ML product** within **self driving cloud...**



1

## Start with the user/customer first

A PM's idea is good and all, but early collaboration from the beginning can not just shape the API but the UI as well.

The whiteboarding/brainstorming session with our customers in the iteration phase garnered some of the best data.



2

## UX the API. ...as *much* as possible.

Un-engineer the API as much as possible. UX the hell out of it.

Language in the API desperately needs a UX writer, and features that are API first without any UX consultation only creates more tech debt in the future.



3

## Anything can be patented.

Yes, even icons in a pattern.





**The UI is so easy, my mom  
could use it!**

**Customer on GCP**  
Name and Company redacted

(I swear they said this).



Debuted as the **keynote product** at **Google Cloud NEXT** last year.

Many of our **top customers**  
(Snapchat, Uber, Spotify, etc) use it  
frequently.



**Thank You**