

# **STATCAN Economic API Inventory**

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<b>Part 1: Introduction to APIs</b>	<b>2</b>
<b>Part 2: APIs With Good Potential</b>	<b>3</b>
2.1. Twitter	3
2.2. Reddit	6
2.3. Foursquare	8
2.4. Yelp	10
2.5. Google	12
<b>Part 3: APIs With Limited Potential</b>	<b>14</b>
3.1. TicketMaster	14
3.2. Indeed	15
3.3. Eventbrite	16
3.4. Valve API & SteamSpy	17
<b>Part 4: Practically Infeasible APIs</b>	<b>19</b>
4.1. Airbnb	19
4.2. Facebook/ Instagram	20
4.3. Tripadvisor	21
4.4. Skyscanner and Similar	22
4.5. YouTube	22
4.6. Netflix	23
4.7. Uber Eats	23
4.8. Fitness APIs	24
<b>References</b>	<b>25</b>

# Part 1: Introduction to APIs

## 1.1. Overview

An Application Programming Interfaces (API) is software which acts as an intermediary between two applications. Through APIs, developers can retrieve information from other companies and integrate it directly into their software.

## 1.2. Architecture

Most modern APIs are REST (Representational State Transfer), which means they adhere to a number of constraints designed for ease of use and security<sup>1</sup>. Some of these constraints include a client-server architecture, stateless client-server communication, cacheable data, and a uniform interface<sup>2</sup>. Commonly, REST APIs will return information in Javascript Object Notation (JSON).

## 1.3. Security

APIs typically require users to have access to an API key. This is a unique identifier associated with a particular program which tracks and controls how the API is used<sup>3</sup>. API creators give out keys in various ways, but typically users are required to either sign up for a developer account, or send in a request for API use<sup>4</sup>. Keys ensure that each project is only accessing the functions of the API they are authorized for, as well as ensuring that projects do not exceed the APIs **rate limit** (the number of calls allowed in a given time period).

Depending on the particular function, additional authorization may be required. Many APIs are designed to allow for interactions between applications and another company's customer base (for example, logging into Facebook on a mobile game to gain access to one's friend list). In order to access user data, most APIs require authorization of the user whose data is being accessed. This is commonly done using the OAuth2 protocol<sup>5</sup>, which is a method of securely authenticating a user without disclosing their credentials to the application<sup>6</sup>. Many APIs contain functions of varying scope, some of which are accessible with the API key alone, while others require OAuth user authentication. While there are some alternatives, every API covered in this report which required user authentication used OAuth2.

## 1.4. Costs

Most APIs are offered in tiers of service, differentiated by cost and allocated calls. Many APIs have a free tier which are typically designed with low rate limits. These free versions are often useful for individuals or for learning purposes, but the low rate limits allow for limited scalability. Most professional uses will typically require a paid tier, where users incur either a

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<sup>1</sup> D. Szalai, "Modern API design," Medium, Mar. 14, 2019.

<https://medium.com/@szalaidavid960721/modern-api-design-b20fd813a8a1> (accessed Jun. 08, 2021).

<sup>2</sup> "What is a REST API?" Redhat, May 08, 2020. <https://www.redhat.com/en/topics/api/what-is-a-rest-api> (accessed Jun. 08, 2021).

<sup>3</sup> "What is an API Key?" The Last Call - RapidAPI Blog. <https://rapidapi.com/blog/api-glossary/api-key/> (accessed Jun. 08, 2021).

<sup>4</sup> I did this lots of times while writing this paper

<sup>5</sup> "OAuth 2.0." <https://oauth.net/2/> (accessed Jun. 08, 2021).

<sup>6</sup> M. Raible, "What the Heck is OAuth?," Okta Developer, Jun. 21, 2017.

<https://developer.okta.com/blog/2017/06/21/what-the-heck-is-oauth> (accessed Jun. 08, 2021).

monthly or per-call charge for the use of the API. The higher rate limits given with paid tiers allow for larger scale projects.

## Part 2: APIs With Good Potential

### 2.1. Twitter

#### 2.1.1. About

Twitter is a social networking service that allows instant communication by means of short messages with a maximum length of 140 characters. These messages, known as ‘tweets’, enable linking messages to users (@-mentions), with internet content (URL links) and topics (#hashtags).

#### 2.1.2. Use Case

Use the Twitter API to get historical and real-time data points to develop a real-time business indicator for economic recovery in Canada in the context of COVID-19. Sentiment analysis could be developed to know the overall conversation occurring in Canada and assess the overall sentiment of tweets containing interest keywords.

#### 2.1.3. Functionality<sup>7</sup>

The Twitter API can be used to programmatically retrieve and analyze data. This API provides access to a variety of different resources including the following: tweets, users, direct messages, lists, trends, media, and places.

#### 2.1.4. Capabilities

- Measure Tweet Performance: Build a tool to understand how users’ tweets are performing.
- Stream Tweets in Real-time: Surface and stream Tweets and conversations as they happen.
- Analyze Past Conversations: Search for topics or keywords and analyze the related conversation.
- Explore User’s Tweets: Retrieve and explore the user’s timeline of Tweets from the last seven days.
- Analyze the Sentiment of Tweets

#### 2.1.5. Access

To access Twitter APIs, we must first apply for a developer account. Choose the appropriate track and wait for approval.

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<sup>7</sup> “Twitter API Documentation.” <https://developer.twitter.com/en/docs/twitter-api> (accessed Jun. 08, 2021).

#### 2.1.5.1. Apply and Receive Approval for a Developer Account

Once approved, we can create a Standard or Academic Research Project and an associated developer App which will provide us a set of credentials that we will use to authenticate all requests to the API.

The Twitter API currently consists of two product tracks, two supported versions, as well as different access tiers. The product tracks are Standard and Academic Research, each offering tailored support, access levels, and pricing.

- Academic Research: This product track provides qualified academic researchers access to elevated access and enhanced functionality, including access to the full-archive search endpoint, a higher monthly Tweet cap, and enhanced filtering capabilities with the filtered stream and recent search endpoints.
- Standard: The default product track for most developers. Once approved, it is possible to create and use a Standard Project for a specific use.

##### 2.1.5.1.1.1. Academic Research

Academic researchers with specific research objectives are encouraged to apply. This includes graduate students working on a thesis, PhD candidates working on a dissertation, or research scholars affiliated with or employed by an academic institution. The following eligibility criteria must be met:

- The user is either a master's student, doctoral candidate, post-doc, faculty, or research-focused employee at an academic institution or university.
- The user has a clearly defined research objective and specific plans for how they intend to use, analyze, and share Twitter data from their research.
- The end product is not intended for commercial purposes.

##### 2.1.5.1.1.2. Standard Product Track

The following table summarizes the available version and tiers in the Standard product track:

Version / Tier	Description
Twitter API v2: Early Access	New Twitter API with a modern and more sustainable foundation as well as an improved developer experience. The first endpoints are available but other features and access levels are yet to be released.  The functionality available is production-ready and supported for use at scale.
Standard v1.1	Free standard API.

Premium v1.1	Scaled access to search tweets and account activity API, including a free sandbox tier and multiple paid tiers.
Enterprise	Enterprise-level products to provide access to Twitter's data. It offers the highest level of access and reliability with a managed service and dedicated account team and developer relations support. This option is only offered with annual contract terms.

Twitter recommends using the newest versions (Twitter API v2) where and if available.

#### **2.1.5.2. Save and Secure App's Keys and Tokens**

Once we have been approved for developer access and have created a Project and App, Twitter generates the following credentials within our developer App:

- **API Key and API Secret Key:** This is essentially a username, and allows us to make a request on behalf of our App.
- **Access Token:** This token represents the Twitter account that owns the App and allows us to make a request on behalf of that Twitter account.
- **Access Token Secret:** This token also represents the Twitter account that owns the App and allows us to make a request on behalf of that Twitter account.
- **Bearer Token:** This token represents our App and enables us to authenticate requests that require OAuth 2.0 Bearer Token authentication.

We will use our API Key, API Secret Key, Access Token, and Access Token Secret to make requests that require user authentication with OAuth 2. If we would like to make requests on behalf of another user, we will need to use the 3-legged OAuth flow for them to authorize us.

#### **2.1.5.3. Setup Access**

To access, we must authenticate our requests with keys and tokens from a developer App that is associated with a project. This is done in Twitter's developer portal.

#### **2.1.5.4. Make Requests**

Once we have access, we can get started using the Twitter API. Twitter's website provides several guides for many endpoints, useful tools and libraries and sample code, and tutorials that describe how to build solutions around different use cases.

#### **2.1.6. Drawbacks**

We have not found information on the costs associated with the use of the API in its different product tracks and versions.

There is also no information on the timeframes of the expected release of the new Twitter API version, however, we applied for Standard access and received approval in 4 business days.

Certain endpoints (filtered stream, recent search, user tweet and mention timeline, and likes lookup) have a limit on how many Tweets they can pull per month. In our Standard access we can pull a total of 500,000 tweets per month, with a rate of 450 tweets per 15 minutes window. The Academic product allows access to 10,000,000 tweets per month.

#### **2.1.7. Conclusions**

The Twitter API appears to have significant utility. The rate limits may be somewhat restrictive in our current free tier, but we should be capable of searching Tweets containing our desired hashtags and running them through sentiment analysis software.

## **2.2. Reddit**

### **2.2.1. About**

Reddit is a social platform known by its users as “the front page of the internet”. In essence, Reddit is a platform for hosting user-created forums on any subject. These individual forums are known as “subreddits”. There are subreddits dedicated to any topic imaginable, where users can post and share content related to the particular subject. Most subreddits have a team of moderators who view posts within the subreddit to ensure the content abides by the forum rules and that the content is appropriate. For example, posts about dogs in a subreddit devoted to cats will be removed by moderators.

Users can interact with posts by commenting. They can also “upvote” or “downvote” a post (similar to other social media likes/dislikes systems), or give an “award”. Awards are accolades which users can buy with real money. The quality of a post is determined by the number of upvotes and awards it receives, which determines the priority of a post on users’ feeds. Users who post to Reddit receive “karma” for the upvotes and awards their posts receive, which is a method of keeping track of the general quality a user adds to the Reddit community.

### **2.2.2. Use Case**

The inherent structure of Reddit makes the analysis of data much simpler than other social media platforms. Whereas platforms like Twitter and Facebook allow users to post about anything they want, Reddit forces users to compartmentalize their posts into appropriate subreddits. By only looking at posts within subreddits relevant to one's research goals, they are able to conveniently filter out the vast majority of irrelevant noise. For example, if a user is only interested in posts about Toronto, they can look at Toronto-based subreddits (like r/Toronto) and other posts by users who follow these subreddits (an indicator that they probably live in Toronto).

Similar methods can be used to focus on other demographics. For example, if one wants to learn about conservative opinions, they can look at posts in r/conservative, and posts by users who contribute to r/conservative in other subreddits.

In our case, we can study economic recovery within cities by looking at posts within Canadian-city focused subreddits. We could also examine the job market of specific industries by looking in industry-specific subreddits. City-centric subreddits could be searched for posts

about business closures and reopenings. The comment sections could be read and upvote/downvote ratio calculated for more information on how forum members generally feel about the posts.

### 2.2.3. Functionality<sup>8</sup>

While Reddit's API has many available functions, most are not of use for our goals. The functions that interest us generally involve searching subreddits. Some of the most interesting functions are below:

Function	What it Does
GET [/r/subreddit]/search	Searches posts within a subreddit for keywords.
POST /api/search_subreddits	Returns a list of subreddits which contain a query string.
GET /r/*subreddit*/about/traffic	Returns the daily users of a subreddit
GET /r/*subreddit*/about	Returns information about the queried subreddit

### 2.2.4. Capabilities

While Reddit as a platform is intriguing, the API seems quite limited. There doesn't appear to be any functionality for finding a posts upvote/downvote ratio, or for retrieving comments. OAuth2 authorization is required to retrieve any information about the user. However, an inventory of relevant subreddits could be taken, which could then be searched for relevant posts using keywords. These posts could be passed into image recognition or text analysis programs to get a better sense of what they are, and some interpretation could be done from there.

### 2.2.5. Access

In order to access the Reddit API, users must read the terms of service and fill out an application<sup>9</sup>. Some of the most useful points from the terms of service are outlined below:

- The API is free to use and doesn't have any hard usage limits, but Reddit maintains the authority to impose usage limits at their discretion.
- An OAuth token is required to access and use the API, which is given after a successful application to use the API is made.
- Users of the API must not use it to do anything illegal, spam Reddit users, or attempt to inhibit the functionality of Reddit.

### 2.2.6. Drawbacks

<sup>8</sup> "reddit.com: api documentation." <https://www.reddit.com/dev/api/> (accessed Jun. 08, 2021).

<sup>9</sup> "Reddit API Terms of Use," Google Docs, May 25, 2016.

[https://docs.google.com/forms/d/e/1FAIpQLSezNdDNK1-P8mspSbmtC2r86Ee9ZRbC66u929cG2GX0T9UMyw/viewform?usp=embed\\_facebook](https://docs.google.com/forms/d/e/1FAIpQLSezNdDNK1-P8mspSbmtC2r86Ee9ZRbC66u929cG2GX0T9UMyw/viewform?usp=embed_facebook) (accessed Jun. 08, 2021).



The user base of Reddit skews toward left-leaning, educated, young, and male<sup>10</sup>. Opinions will likely not be representative of the Canadian population as a whole. In particular, very few older adults use the platform. Furthermore, according to the same poll, the majority of Reddit users are from the USA. With seemingly no available functionality for filtering users by location we are limited to viewing content in Canada-specific subreddits. While any social media platform has sample bias, Reddit may be worse than others, as platforms like Facebook and Twitter have become popular with most demographic groups.

Reddit as a platform also has an issue with a “hive mind” mentality, as the upvote/downvote system incentivises users to post content which appeals to the majority of a subreddit’s population. As such, controversial opinions tend to become heavily downvoted and are less likely to appear on a users feed, which then further reinforced the general opinions of the subreddit. Therefore, posted content skews toward popular opinions, and we will receive a somewhat inaccurate idea of the true distribution of opinions in the Canadian population.

### **2.2.7. Conclusion**

The structure of Reddit may allow for information on cities and industries of interest to be found with relative ease, and the API itself has some useful and flexible endpoints. However, sample bias would be a big issue while using Reddit as the demographics of the platform are not representative of the demographics of Canada in general. The most promising course of action with the Reddit API would be to search subreddits dedicated to Canadian geographic areas for posts which contain keywords. We could search for posts about business closures/ reopenings, anti-vaccine sentiment, or other topics which may help predict local pandemic recovery.

## **2.3. Foursquare**

### **2.3.1. About<sup>11</sup>**

Foursquare is a company dedicated to the use of location data. They build software products marketed to businesses, which allows for the integration of location data into devices and business analytics. Foursquare’s main product is their massive database consisting of 105 million global points-of-interest, and the movement and locations of over 500 million devices. Foursquare came to our attention because of an article written on their website which used their location data to estimate Covid-19 recovery on specific businesses<sup>12</sup>. They were able to estimate rates of change in the number of customers to businesses by viewing the foot traffic entering those businesses. This is exactly the kind of work we are trying to accomplish, and similar data through an API would be immensely useful.

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<sup>10</sup> [1]M. Barthel, G. Stocking, J. Holcomb, and A. Mitchell, “Reddit news users more likely to be male, young and digital in their news preferences,” Pew Research Center, Feb. 25, 2016.  
<https://www.journalism.org/2016/02/25/reddit-news-users-more-likely-to-be-male-young-and-digital-in-their-news-preferences/> (accessed Jun. 08, 2021).

<sup>11</sup> “Our Story,” Foursquare. <https://foursquare.com/about/> (accessed Jun. 08, 2021).

<sup>12</sup> “Impact of Coronavirus on Businesses: COVID-19 Recovery Update,” Foursquare, May 24, 2021.  
<https://foursquare.com/article/impact-of-coronavirus-on-businesses-covid-19-recovery-update/> (accessed Jun. 08, 2021).

### 2.3.2. Use Case

Using Foursquares points-of-interest database and real-time location data, we would attempt to estimate the change in customer base for various businesses within Canadian cities. Economic recovery could be estimated by looking at the weekly change in visitors to hard-hit non-essential businesses like bars, gyms, theatres, and music venues. As Provinces open up, weekly changes could be found to see if there are any businesses or cities which aren't recovering as well as expected.

### 2.3.3. Functionality

As a data company, the majority of Foursquares functionality is locked behind their paid services and products. Many of their products are marketed toward businesses as methods of customer targeting and business intelligence<sup>13</sup>. Their *Visits* and *Places* products are most relevant to our goals, and can be used to gather data on device-tracking and locations, respectively.

While most of Foursquare's data are available as data products, they also have a few developer tools available<sup>14</sup>, including one API. The *Places API*<sup>15</sup> can be used to search for locations and can provide profiles on any of the 105 million places in Foursquares database. However, there is no API available to track device locations and visits, which would have been even more useful.

Calls to the API are broken down into **regular** and **premium**. Regular calls return basic information, such as venue categories and IDs, while premium calls return more detailed information, like photos, URLs, ratings.

### 2.3.4. Capabilities

Most of the endpoints available for this API are used to search and explore venues. Most of these search functions do not require user authentication, but there is a function used to get a venue's stats over time which does. User authentication is done with OAuth2.

### 2.3.5. Access

A Foursquare developer account is required to access the Places API. Once signed up, an API key is given and can be found in the developer dashboard. The free developer account grants access to 1,000 API calls per day (950 regular, 50 premium) to the Places API in the "Sandbox tier".

There are additional tiers available:

- Personal (Free): 100,000 calls per day (95,000 regular, 5,000 premium). Requires a credit card to upgrade to this tier.
- Start-up (\$599/month). Comes with a commercial license and no API quotas. However, at this tier API calls are charged at \$0.001 per regular call and \$0.003 per premium call.
- Enterprise (Contact for pricing): For large companies. Higher call volume and technical support.

Regardless of tier, applications can make a maximum of either 5,000 calls per hour to venues/\* endpoints, and 500 calls per hour to other endpoints. When these limits are exceeded, the API will return an error message.

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<sup>13</sup> The full suite of Foursquare products can be found at "Foursquare," Foursquare. <https://foursquare.com/> (accessed Jun. 08, 2021)..

<sup>14</sup> Information about this API and Foursquares other developer tools can be found at "Foursquare Developers," Foursquare. <https://foursquare.com/developer/> (accessed Jun. 08, 2021).

<sup>15</sup> "Places API," Foursquare. <https://developer.foursquare.com/docs/places-api/> (accessed Jun. 08, 2021).

### **2.3.6. Drawbacks**

Only having access to places data through the API is a major drawback, as the hope for foursquare was to use their geolocation data to predict visitors to businesses. It seems that access to this data would require a license for their other products, and would likely come with a high cost.

### **2.3.7. Conclusion**

The Places API alone has limited utility, but could be used as an inventory of Canadian businesses. The most useful data would likely require a costly license of one of Foursquares data products.

## **2.4. Yelp**

### **2.4.1. About**

Yelp is a platform used to publish crowd-sourced reviews of businesses. While the primary function of yelp is restaurant reviews, many other businesses are also featured on the platform, including contractors, mechanics, salons, and gyms. Beyond reviews, information is included for each business including location, hours, prices, and menus for restaurants.

Yelp allows users to post reviews on a scale from 1 to 5 stars, which are then aggregated to give each business an overall score between 1 and 5. Users are able to rate individual reviews as “helpful”, “funny”, or “cool”. These ratings are used by Yelp to help determine which reviews are the best written and should be prominently featured. Businesses are able to publicly respond to individual reviews, which gives the business an opportunity to share their point of view and call out false reviews or unreasonable clients.

Each user of the platform must create a profile before sharing a review. Information is gathered for each user, including their hometown, the distribution of stars given for their reviews, and the number of votes their reviews have received in each category.

### **2.4.2. Use Case**

User interaction with a business on the Yelp site can be used to determine the general intent of people to visit that business. For example, if there are 1000 unique users viewing restaurants in downtown Kelowna on a single night, that number gives some information on the amount of people in the area looking to eat out. As restaurants were heavily affected by the pandemic, tracking the recovery of these businesses is very important. Furthermore, Yelp reviews can often contain information on how well businesses follow public health orders. For example, if staff are not wearing masks, health-conscious clients will mention that in Yelp reviews. By tracking views of a restaurant's Yelp page, and parsing new reviews, we could gain valuable insight into which restaurants are being visited often, and which restaurants are abiding by health mandates.

### **2.4.3. Functionality<sup>16</sup>**

Yelp has a number of development tools available which may be useful for our purposes:

#### **2.4.3.1. Yelp Knowledge**

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<sup>16</sup> An overview of developer tools can be found at “Yelp Developers,” Yelp. <https://www.yelp.ca/developers> (accessed Jun. 08, 2021)..

Yelp Knowledge is a platform available to enterprise level licensees, but not individuals or academics. Through this platform, businesses can gain access to a number of different analytic tools and insights. The most promising tool available with Yelp Knowledge is the “Engagement Metrics” tool, which provides “high intent consumer actions on yelp ... per individual store location”<sup>17</sup>.

#### 2.4.3.2. Yelp Fusion

Yelp Fusion is a more typical API with very limited functionality at present. Most of the available endpoints allow users to search for specific information about a business. There are only seven endpoints available, and the three most interesting are described below:

Function Name	Description
Business Search	Search for business by keyword, category, location, price level, etc.
Business Details	Get rich business data, such as name, address, phone number, photos, Yelp rating, price levels and hours of operation.
Reviews	Get up to three review excerpts for a business.

#### 2.4.3.3. Yelp GraphQL

Yelp GraphQL allows for more specific queries than the fusion API by incorporating the GraphQL query language for APIs<sup>18</sup>. This API allows for more nuanced querying of the Yelp database using a structured query language to input values for multiple relevant fields, such as business name, location, etc. GraphQL has an available Python client, and could therefore be easily used in Python scripts. While the GraphQL API allows for more specific queries than the regular API, the functionality is similar, allowing users to query for very general information about specific businesses.

Yelp GraphQL has rate limits based on a point system, with different query types requiring a set number of points, and each user receiving a daily limit to the amount of points they can use. Every 24 hours, each user has a limit of 250,000 points, with different operations ranging from 1 to 10 points each<sup>19</sup>.

#### 2.4.4. Capabilities

While the Fusions and GraphQL APIs seem too limited for our uses, the Yelp Knowledge tool is promising. Engagement metrics could be aggregated by industry sector or geographic region to get an idea of economic activity. However, very limited information on the tool is publicly available on the website, and a consultation would be required with Yelp staff to gain more information on the tool.

<sup>17</sup> “Yelp Developers,” Yelp. <https://www.yelp.ca/developers> (accessed Jun. 08, 2021).

<sup>18</sup> “GraphQL | A query language for your API.” <https://graphql.org/> (accessed Jun. 08, 2021).

<sup>19</sup> A full list of point values can be found at “Rate Limiting - Yelp GraphQL.” [https://www.yelp.ca/developers/graphql/guides/rate\\_limiting](https://www.yelp.ca/developers/graphql/guides/rate_limiting) (accessed Jun. 08, 2021).

#### **2.4.5. Access**

Yelp Knowledge is only available to enterprise level licensees. The website lists “Social analytics” as an applicable industry, so StatCan would most likely be an accepted partner. Access is not available to individual developers or academic researchers, and a corporate email address is required to book a consultation. There is no information available on pricing, but it is assumed that it is a paid service.

The Fusion and GraphQL APIs use private-key authentication. A private key is associated with each app, and is required to query with the API. There does not appear to be a cost associated with these APIs.

#### **2.4.6. Drawbacks**

The two API tools are very limited. Few functions are available, and none are particularly valuable for our use cases. The Yelp Knowledge tool seems promising, but there is limited information available without a professional consultation, which would require an employee of Statistics Canada, not a contracted student. Furthermore, this tool does not appear to be an API and would likely be an (expensive) paid service.

The main content of Yelp, the reviews, are of limited use. While new reviews could be searched for keywords of interest, such as mask-usage, we don’t have much interest in the specific content of most reviews. Even information about how well an establishment is abiding by Covid regulations is somewhat tangential to our goals.

#### **2.4.7. Conclusion**

The Fusion and GraphQL APIs are too limited for our intended uses. It may be worth booking a consultation with Yelp about the Knowledge tool.

## **2.5. Google**

#### **2.5.1. About**

Google allows to access the infrastructure of its end-user products through Google Cloud, a cloud computing suite of services with over 100 products according to its website<sup>20</sup>. It offers products from a wide array of use cases and applications such as AI and Machine Learning, Healthcare and Life Sciences, and Internet of Things, amongst many others.

#### **2.5.2. Use Case**

We could use the Knowledge Graph Search API to search entities of interest during the COVID-19 pandemic in Canada to get relevant information from Google’s Knowledge Graph, an enhanced Google search service<sup>21</sup>.

Another potential option is Places API, which allows retrieval of data from Google’s Maps database. This API features over 100 million businesses and points of interest worldwide that are updated frequently through owner-verified listings and user-moderated contributions. We could analyze businesses in Canada by getting information about specific places, including user reviews.

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<sup>20</sup> “Products and Services | Google Cloud” <https://cloud.google.com/products/#section-1/> (accessed Jun. 10, 2021).

<sup>21</sup> “Introducing the Knowledge Graph” <https://blog.google/products/search/introducing-knowledge-graph-things-not/> (accessed Jun. 10, 2021).

### 2.5.3. Functionality

Google Cloud has a library of 340 public APIs<sup>22</sup> “to easily add the power of everything from computing to networking to storage to machine-learning-based data analysis...” to the user’s applications. As per Google Cloud documentation, it is possible and encouraged to “mix and match these services into combinations that provide the infrastructure you need, and then add your code to enable the scenarios you want to build.”

### 2.5.4. Access

Google Cloud documentation<sup>23</sup> summarizes the overall access process to use Google APIs in the following steps:

1. Creating a Google account
2. Creating a Google project: This is done in the Google Cloud platform to allocate resources and manage settings, permissions, and metadata of the application being developed.
3. Enabling APIs: It requires to accept the Terms of Service and billing responsibility for the API
4. Enabling billing: Some Cloud APIs charge for usage to the billing account associated with the project.
5. Getting application credentials: Credential types include API keys, OAuth 2.0 clients, and service accounts to associate and report API usage to the right project owning the application.
6. Using application credentials
7. Building applications

### 2.5.5. Pricing

Google Cloud provides a free program with USD 300 in credits and more than 20 free products up to certain monthly usage limits.

<https://cloud.google.com/pricing> provides a tool to estimate the costs associated with a project.

### 2.5.6. Capabilities

There are far too many Google tools available to research without the scope of this report skyrocketing. However, Google APIs are worth further research.

## Part 3: APIs With Limited Potential

### 3.1. TicketMaster

#### 3.1.1. About

Ticketmaster is a platform which allows event planners to sell tickets online. Ticketmaster also has search functionality on its website, allowing users to explore and find events they are

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<sup>22</sup> “API Library | Google Cloud” <https://console.cloud.google.com/apis/library/> (accessed Jun. 10, 2021).

<sup>23</sup> “Getting StarTed | Cloud APIs” <https://cloud.google.com/apis/docs/getting-started/> (accessed Jun. 10, 2021).

interested in. Ticket prices are set by the client, and ticket sales are fulfilled through the ticketmaster website.

### 3.1.2. Use Case

The intended use of the Ticketmaster API would be to examine the types of live events occurring within a city, along with the number of attendees and the popularity of different venues. Live cultural events were hit hard by the pandemic, and may be a strong indicator of economic recovery.

### 3.1.3. Functionality<sup>24</sup>

The Ticketmaster API has varying functionality split across different “tiers”. Fortunately, the functions we are interested in are all contained in the “Discovery API”, which is the lowest tier and easiest to access. Some useful functions the Discovery API includes are as follows:

Function Name	Description
Event Search	Find events and filter your search by location, date, availability, and much more.
Get Event Details	Get details for a specific event using the unique identifier for the event. This includes the venue and location, the attraction(s), and the Ticketmaster Website URL for purchasing tickets for the event.
Attraction Search	Find attractions (artists, sports, packages, plays and so on) and filter your search by name, and much more.
Venue Search	Find venues and filter your search by name, and much more.

### 3.1.4. Capabilities

Through the Ticketmaster API, we would be capable of figuring out how many live events are planned in each city, and within specific venues. Details could be found about particular events to try and gain insight into the specific event types that are popular post-pandemic.

### 3.1.5. Access

Requires registration for a ticketmaster developer account to access the API, although there does not appear to be an associated cost. The rate limit for each API key is 5,000 calls per day

<sup>24</sup> “Getting Started,” The Ticketmaster Developer Portal.  
<https://developer.ticketmaster.com/products-and-docs/apis/getting-started/> (accessed Jun. 08, 2021).

and 5 requests per second. When these limits are surpassed, the API will return an error message.

#### **3.1.6. Drawbacks**

The rate limit seems quite restrictive, especially if we intend to search events within every city in Canada.

#### **3.1.7. Conclusion**

Ticketmaster seems more promising than the similar Eventbrite, although both platforms have limited utility.

## **3.2. Indeed**

### **3.2.1. About**

Indeed is a popular job posting website, where employers can post openings within their companies, and job-seekers can search for jobs in their location which are relevant to them.

### **3.2.2. Use Case**

By searching the number of available jobs within a city on Indeed, we get a good idea of the number of employers who are expanding their operation/ rehiring workers. We can also get a good idea of which types of jobs are in high demand, and determine in which industries workers may be struggling to find work.

### **3.2.3. Functionality<sup>25</sup>**

Indeed has two relevant APIs available, the Job Search API, and the Get Job API. Job Search allows users to query for jobs given a set of parameters, including location and query strings. The Get Job API gives more details about a particular job, specified by a job key which can be found with the Job Search API. This API returns information including company, location, job title, post date, URL, and a snippet of the job description.

### **3.2.4. Capabilities**

Using the Get Jobs and Job Search APIs together, we would be able to search for and count job openings in specific geographic regions. We would then be able to compile based on job title and company into a set of industries and roles in order to determine which career paths have a lot of openings available, and which ones are more competitive. Using this information, we could assess the job market in Canada along multiple dimensions of interest.

### **3.2.5. Access**

These are open source APIs which are managed by Indeeds Engineering team<sup>26</sup>. The documentation does not contain information on costs or rate limits, but since it is open source we assume it is free to use. For applications which do not require user authentication there is a

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<sup>25</sup> "Indeed APIs," Opensource. <https://opensource.indeedeng.io/api-documentation/> (accessed Jun. 08, 2021).

<sup>26</sup> Indeed has a wide variety of open source projects, which can be found and contributed to at "Indeed Engineering," GitHub. <https://github.com/indeedeng> (accessed Jun. 08, 2021).



2-legged OAuth client credential flow. This allows developers to act on behalf of the user who registered the app. The 3-legged OAuth authorization code flow allows the app to act on behalf of other users, given user login credentials. However, for our purposes the 2-legged OAuth is sufficient.

In order to develop an app with the client credential flow, users must apply for access<sup>27</sup> using their Indeed account. Once the app is registered, a client ID and a client secret key are given and associated with the app. The user must then receive an access token associated with their Indeed account, and pass that into application calls as well.

### **3.2.6. Drawbacks**

There is some bias in the types of jobs posted on Indeed. For example, executive-level jobs are often filled with the help of a headhunter and applications are never made public. Using this API to estimate job openings within industries will inevitably be somewhat inaccurate, as certain jobs are far more likely to be posted on job sites than others. Furthermore, some of the most affected industries are less likely to use these sites for hiring, like retail and food service places.

### **3.2.7. Conclusion**

There seems to be some potential with the Indeed API. We would be capable of developing an inventory of job postings within individual Canadian cities, and determine which job types have a lot of openings by using job titles and descriptions. However, we would need to keep in mind the biases in the types of jobs posted on Indeed and other similar sites.

## **3.3. Eventbrite**

### **3.3.1. About**

Eventbrite is an online platform designed to publicise and share events happening within a city. The website hosts information on a wide variety of events, ranging from concerts to cooking classes to charity events. Eventbrite includes live events within cities, as well as online events. While many events are free, the site also allows event planners to charge for tickets, which are processed through the site.

### **3.3.2. Use Case**

The use case for Eventbrite is very similar to Ticketmaster. Live events within a city can be studied to see the number of people who are going out and have the disposable income to spend on these events. Live music and cultural events were perhaps harder hit by the pandemic than any other industries, and could therefore be great indicators of economic activity.

### **3.3.3. Functionality<sup>28</sup>**

The eventbrite API is a REST-based API using OAuth2 authorization. It has wide-ranging functionality for retrieving information about events and event attendees. Unfortunately, the single most useful function, Event Search, has been deprecated and is no longer available. However, events can still be found by venue or organization, and there exist functions to list

<sup>27</sup> "Register API Key | Indeed Accounts," Indeed. <https://secure.indeed.com/account/apikeys/register> (accessed Jun. 08, 2021).

<sup>28</sup> "API Reference | Eventbrite Platform." <https://www.eventbrite.com/platform/api#/introduction/about-our-api> (accessed Jun. 08, 2021).

these. Once we have the ID of an event, there are functions to find details such as description, capacity, and attendees.

#### **3.3.4. Capabilities**

We may be able to find a list of venues associated with each city, and a list of events associated with each venue. Through this, we could model and approximate the amount of money being spent on and attendees to different types of cultural events.

#### **3.3.5. Access**

Eventbrite uses OAuth2 authentication. In order to receive an API token, one is required to create an eventbrite account. Once the account is created, the access token can be found on the users API Keys page. API access appears to be free, and there is no information in the documentation about rate limits. In order to make requests on behalf of other users, OAuth2 authentication is required. However, for our uses this is unnecessary.

#### **3.3.6. Drawbacks**

The depreciation of search functions is a big loss for our potential uses.

#### **3.3.7. Conclusion**

While this API has some potential, Ticketmaster has similar use cases and better API functionality.

## **3.4. Valve API & SteamSpy**

### **3.4.1. About**

Steam is the major PC game vending platform running by Valve Inc. Users could purchase, download, comment, communicate and play on this platform and their playing minutes will be recorded. Since the outbreak of the Covid - 19 and people started staying home for longer, according to the Steam's 2020 year review, video game play time has surged. The number of daily active users reached its new high at 120.4 million<sup>29</sup>.

#### **3.4.1.1. SteamSpy**

A third party API developed by Sergey Galyonkin. Every minute, it synchronizes data from the official valve API.

#### **3.4.1.2. Valve API**

This is the official open API run by Valve Inc, who owns the steam platform.

### **3.4.2. Use Case**

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<sup>29</sup> "Steamworks Development - 2020 Year in Review," Jan. 13, 2021.

<https://store.steampowered.com/news/group/4145017/view/2961646623386540826> (accessed Jun. 16, 2021).

Studying the steam data(game comments, user playing time, daily active users, etc.) might help us to understand how some of the people counter-balance the impact of lockdown and to what extent does PC gaming help these people to get through this difficult time.

### **3.4.3. Functionalities**

#### **3.4.3.1. SteamSpy<sup>30</sup>:**

Retrieves the app ID, developer, publisher and some other useful attributes like average play time in the last two weeks, etc. All requests do not need an API key.

#### **3.4.3.2. Valve API<sup>31</sup>:**

From the various functions it has, the review collecting API might draw some attention. Since we might be able to find out what people's mood is like during the lockdown by analyzing the reviews under games with different topics. Most of the store presence API does not require an API key to access.

### **3.4.4. Access**

#### **3.4.4.1. SteamSpy**

The steamSpy API does not require a secret key.

#### **3.4.4.2. Valve API**

Using the steamworks web API does not require an api key.

### **3.4.5. Drawbacks**

It seems like both the Valve API and the steamSpy API do not provide the geolocation distribution of the players for a game. Therefore, we cannot focus on the Canadians only and we are forced to look at the entire English speaking players.

Most of the Valve API's functions are built to help the game developers and publishers to manage their content, not for data collection.

### **3.4.6. Conclusion**

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<sup>30</sup> "SteamSpy Documentation." <https://steamspy.com/api.php> (accessed Jun. 16, 2021).

<sup>31</sup> "Web API Overview (Steamworks Documentation)." [https://partner.steamgames.com/doc/webapi\\_overview](https://partner.steamgames.com/doc/webapi_overview) (accessed Jun. 16, 2021).

In general, most of the functions described in the valve API document are designed for game developers. However, sentiment analysis could be performed in game reviews.

SteamSpy allows users to collect Steam active users' activity data through time, but selecting a specific period (e.g., from the start of the lockdown until now) is not feasible within the API capabilities. However, this API still has some use. For example, we can examine which games are popular during specific holidays.

## Part 4: Practically Infeasible APIs

### 4.1. Airbnb

#### 4.1.1. About

Airbnb, Inc. is a San Francisco, California based company that operates an online marketplace for lodging, primarily homestays for vacation rentals, and tourism activities. The platform is accessible via website and mobile app.

#### 4.1.2. Use Case

Use Airbnb's total number of listings and occupancy rates to develop an indicator for economic assessment. Airbnb is positively correlated with the development index, the contribution of trade and tourism to GDP, the nominal exchange rate and negatively with GDP per employed person<sup>32</sup>. Airbnb supports many jobs in industries like transportation, entertainment and restaurants and retail that have been hit hard by the pandemic<sup>33</sup>.

#### 4.1.3. Main Limitations

Airbnb doesn't offer an official API for collecting public data on its listings, occupancy rates, reviews nor pricing. The API they do offer is intended for businesses and commercial use, and allows development teams to securely OAuth into new and existing Airbnb accounts. The application users will have the ability to push updates to content, rates, and availability. At this time, Airbnb is currently not accepting new access requests for its API. Instead, Airbnb allows its partners and third-party developers to import listings and synchronize databases.

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<sup>32</sup> Heo, Cindy & Blengini, Isabella. (2019). A macroeconomic perspective on Airbnb's global presence. International Journal of Hospitality Management. 78. 47-49. 10.1016/j.ijhm.2018.11.013.  
[https://www.researchgate.net/publication/329216893\\_A\\_macro-economic\\_perspective\\_on\\_Airbnb's\\_global\\_presence](https://www.researchgate.net/publication/329216893_A_macro-economic_perspective_on_Airbnb's_global_presence)

<sup>33</sup> "Oxford Economics analysis: 2019 Airbnb guests supported 300,000 jobs," Airbnb Newsroom, May 06, 2021.  
<https://news.airbnb.com/oxford-economics-analysis-2019-airbnb-guests-supported-300000-jobs/> (accessed Jun. 08, 2021).  
<https://wtcc.org/Portals/0/Documents/EIR/EIR2021%20Global%20Infographic.pdf?ver=2021-04-06-170951-897>

The focus of Airbnb's partners and third-party developers APIs is in providing short-term rental estate market data, property information, property ownership, investment analysis and rental rates data.

#### 4.1.4. Notes

We could further explore Airbnb's partners and third-party developers APIs to achieve our use case.

## 4.2. Facebook/ Instagram

### 4.2.1. About

Facebook is the world's most popular social media platform, with 2.23 billion monthly active users. Instagram is also one of the top platforms, with over 1 billion monthly active users, and was purchased by Facebook in 2012<sup>34</sup>. Both platforms allow users to post content for their "friends" or "followers" to view. While Facebook allows for general content posts, Instagram is primarily intended for photos.

Facebook also allows users to create or follow pages and groups about any kind of subject. Many businesses set up a Facebook and Instagram page which allows their customers to interact and provide feedback.

### 4.2.2. Use Case

In general, the amount of people interacting with businesses on these platforms could be used as a proxy for the amount of active customers that business has. The growth rate of interactions with a business could be calculated and grouped by industry or geographic location in order to give a rough estimate of which regions and industry sectors are recovering well, and which ones aren't. For example, if new businesses in Montreal have an average monthly growth rate in followers of 5%, and new businesses in Toronto have an average monthly growth rate in followers of 2%, we could conclude that Montreal is recovering better than Toronto.

### 4.2.3. Functionality<sup>35 36</sup>

Both platforms have a similar HTTP-based graph API available.

Graphs are a data type consisting of a collection of vertices and edges used to model connections and networks. In the case of Facebook/Instagram, the nodes are the set of users, and the edges are the "follows"/"friendships". So if Jeff follows John on Instagram, there would be a unidirectional edge from Jeff to John. The Facebook/Instagram graph model also contains a set of "fields" associated with edges and nodes, which is essentially a semi-structured data type (JSON) containing information about that node or edge. For example, the node representing John would have an associated field containing his birthday, workplace, etc.

<sup>34</sup> "21 Top Social Media Sites to Consider for Your Brand -," Buffer Library, Jan. 24, 2019. <https://buffer.com/library/social-media-sites/> (accessed Jun. 08, 2021).

<sup>35</sup> "Graph API - Documentation," Facebook for Developers. <https://developers.facebook.com/docs/graph-api/> (accessed Jun. 08, 2021).

<sup>36</sup> "Instagram Platform - Documentation," Facebook for Developers. <https://developers.facebook.com/docs/instagram/> (accessed Jun. 08, 2021).

#### **4.2.4. Capabilities**

Both APIs are capable of retrieving data on the connections associated with a single node. However, they require a user's authorization to access their information, and connections can only be shown to other users who have authorized the app.

#### **4.2.5. Access**

These APIs require an access token to use, and use the OAuth 2.0 protocol. An app using the graph API will request the user for access to their profile, and will then have access to the specific fields it has requested.

Each app using the Facebook/Instagram API has a rate limit determined by the number of users the app has. An app is allowed to make 200 calls to the API per hour, per user. The rate limits are different for businesses who intend to profit off their app. Within this limit, it doesn't appear there is an associated cost with the use of the API.

#### **4.2.6. Drawbacks**

As permission is required by each and every individual/business for us to access their information, the actual feasibility of these APIs is extremely limited. Even when authorization is given, connections can only be viewed to other users who have granted permission. Plus, it appears that the data given is a "snapshot", and will not be updated real-time. As such, in order to get any insight in change over time, the same businesses would need to grant permission multiple times.

#### **4.2.7. Conclusion**

Facebook and Instagram are not feasible platforms for generating any valuable economic insights, unless an app is developed and widely adopted by users in order to grant us access to many users' data.

### **4.3. Tripadvisor**

#### **4.3.1. About**

Tripadvisor is a website which offers guides and reviews for tourist destinations, as well as offering booking functionality for flights and accommodation.

#### **4.3.2. Use Case**

The intent with Tripadvisor and similar websites would be to estimate the amount of tourists visiting Canadian cities, and track the recovery of the travel and accommodation industries.

#### **4.3.3. Main Limitations**

The Tripadvisor API is for "consumer-facing travel websites and apps only".<sup>37</sup> There are no tools available for our purposes.

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<sup>37</sup> "Content API | Tripadvisor Developer Portal," Tripadvisor. <https://developer-tripadvisor.com/content-api/> (accessed Jun. 08, 2021).

## 4.4. Skyscanner and Similar

### 4.4.1. About

Skyscanner is one of many websites available for finding flights at the cheapest rates possible. These sites allow users to search flights with the origin, destination, and date of the user's choice. The site then aggregates a list of available flights from various airlines, and highlights the least expensive options.

### 4.4.2. Use Case

Similar to Tripadvisor, the intent would be to estimate the amount of travellers in and out of Canadian cities to track the recovery of travel and tourism industries.

### 4.4.3. Main Limitations

Skyscanner and other flight APIs offer information on flights, but not on passengers. For our intended purposes we would at least need access to the number of people on each flight, which is not available.

## 4.5. YouTube

### 4.5.1. About

YouTube is the most popular online video hosting platform in Canada. Youtube was acquired by Google in 2006.

### 4.5.2. Use Case

During the pandemic, people spent more time than ever online. As such, total time spent on YouTube and other online “time waster” platforms is likely negatively correlated with general economic activity. When people aren’t on Youtube, they are more likely to be working or out spending money. Finding live data on watch time within geographic regions would give useful information on the amount of time people are still spending alone at home. Furthermore, the type of content people are watching could also hold useful information. As YouTube is a popular website for learning new skills, we could gain insight into the types of tutorial videos people are watching in order to predict which job markets are likely to have an influx of new interested candidates.

### 4.5.3. Main Limitations

I found information on three different YouTube APIs, the *Data API*, *Analytics API*, and *Reporting API*. The one most relevant to our goals is the *Analytics API*. This API is intended to generate custom analytic reports defined through a set of parameters, queries, and filters. However, this API is intended for the use of individual content creators to generate analytics for their personal channel, and doesn’t appear to be scalable to our goals. It requires user authorization to access data. There are also many unofficial YouTube APIs available on rapidapi.com, but they all seem to be simple search tools, video format converters or similar tools. I could not find any available APIs which could be used for our goals.

## 4.6. Netflix

### 4.6.1. About

Netflix is a popular streaming platform for movies and TV shows.

### 4.6.2. Use Case

Similar to YouTube and Steam, the goal would be to retrieve data on the amount of time Canadians have been spending watching Netflix, and estimate productive time inverse to this.

### 4.6.3. Main Limitations

The official Netflix API was depreciated in 2014<sup>38</sup>. There are a few unofficial Netflix APIs available<sup>39</sup>, but none seem useful for our purposes as they all return information on films, not on viewers.

## 4.7. Uber Eats

### 4.7.1. About

Uber Eat is a famous website that provides food delivery services. Customers can order food on this site, and a uber driver will pick up and deliver the food for the customers. The owner of a restaurant can put his restaurant online and his services can be available to more customers.

### 4.7.2. Use Case

The goal is to collect data for business activities when some provinces(like BC) bans indoor dining. It would be meaningful if we can investigate to what extent these restaurants are affected by the banning policy and to what extent that the food delivery services help these restaurants to stay alive.

### 4.7.3. Main Limitations<sup>40</sup>

In order to use the uber API, the user needs a developer account to apply for an authentication token. We have tried to create a developer account and it says we need to wait for a confirmation message to confirm our phone number. However, we haven't received any.

This API focuses more on the UberEats mobile app's functionality, rather than data collection.

Also, if we want to collect data like the list of orders within a certain period of a restaurant, we need the store ID for that restaurant. However, the store ID is not part of the open data.

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<sup>38</sup> G. Kumarak, "Netflix Kills Off Its Public API, Takes A Few Applications Down With It," TechCrunch, Nov. 16, 2014. <https://social.techcrunch.com/2014/11/16/netflix-api/> (accessed Jun. 08, 2021).

<sup>39</sup> "Top 8 Netflix API Alternatives," RapidAPI. <https://rapidapi.com/collection/netflix-api-alternatives> (accessed Jun. 08, 2021).

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#### 4.7.4. Conclusion

Most of the online food delivery services (like doordash, skipthedishes, etc.) do not have an open data API. Therefore, APIs are not a good source of data for this category.

## 4.8. Fitness APIs

### 4.8.1. About

We looked into the APIs of a number of companies with fitness tracking apps, including Garmin<sup>41</sup>, Fitbit<sup>42</sup>, Runkeeper, Strava<sup>43</sup>, and Under Armour<sup>44</sup>. All of these companies create products or applications which intend to measure a user's fitness through running or cycling distance, heart rate, or step count.

### 4.8.2. Use Case

The intent with these APIs would be to track general fitness before, during, and after the pandemic in order to see what kind of effect working from home and social distancing may have had on fitness and the health industries associated with it. While some people may typically get exercise by commuting to and from work by bike or foot, others may have capitalized on the added free time from not commuting by picking up a fitness hobby. Through aggregate fitness data, we could attempt to estimate the long term effects pandemic lifestyle changes may have on Canada-wide health and fitness.

### 4.8.3. Main Limitations

None of these APIs offer aggregate data, and all require user authentication to access an individual's data.

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<sup>41</sup> "Health API | Garmin Connect Developer Program," Garmin.

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<sup>42</sup> "Fitbit Development: Web API." <https://dev.fitbit.com/build/reference/web-api/> (accessed Jun. 08, 2021).

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