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API 商業模式研究

A Study of the Business Model of Application Programming Interface

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Abstract

Nowadays, there are many studies discussing the advantages of using APIs. But only a few examine what value it holds for an API provider. This study identifies cases from different industry fields, analyzes their APIs to explain why they are willing to provide APIs on the internet. First, the study identified ten enterprises as the target cases from as diverse industry fields as possible. Second, the study chose five representative APIs from each enterprise's website, platform, and developer document. Third, this study applied business model framework to analyze fifty APIs, which revealed the association between the value provided by the API and the provider.

To clarify the differences and similarities among APIs easily, the discussion is based on the API type instead of the function. APIs are categorized into three types: data, service, and development. First, infrastructures of the APIs were examined. Second, the value position of the API was analyzed. Third, API end users were studied to speculate the customer. Finally, the study tried to answer the question of "*what value does the API provider expect to get*" to understand benefits received by API providers. In conclusion, APIs provide five values to the API providers: profit, extended market, enhanced content, user engagement and stimulate consumption. Enterprises which want to engage in the API economy can refer to this study to determine what functions they should encapsulate in the APIs and plan for the benefits.

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Chapter 1: Introduction

1.1 Introduction

The purpose of this study is finding out why the Application Programming Interface (API) providers are willing to provide APIs on internet. What is API ? A presentation which discusses the history of APIs (Bloch, 2018) mentions the key idea is that while "most programs will make use of common operations, library subroutine would reduce amount of new code and error."

The API code is "provided by the OS [operating system] or software library, and provides access to service and data within the application or database" (Encyclopædia Britannica, inc., 2019). The API enables application developers to use a single function, without the prerequisite of knowing the original programming language and principles, or understanding the details of its internal workings. As technology advances, the availability of different and diverse API providers also rises. Some enterprises encapsulate their services into one or more APIs and open them to users on the Internet.

For example, in 1999, Mark Benioff founded Salesforce.com, pioneering the concept of software as a service (SaaS). In 2003, Salesforce launched Sforce, which is the first open enterprise cloud computing API programming language in the world, thus, enabling all developers to use Sforce to access the APIs released by Salesforce (McCarthy, 2020). Another example is the banking industry. To facilitate the development and wider adoption of APIs, the Hong Kong Monetary Authority (HKMA) launched the "Open API Framework for the Hong Kong Banking Sector" in July 2018. The framework adopts a four-phase implementation approach: product information (Phase I); customer acquisition (Phase II); account information (Phase III); and transactions (Phase IV).

This study focuses on famous enterprises from different industry fields and the APIs which they provide. Ten enterprises from different fields were identified and five APIs from each of them were selected for 3W1H analysis. This study is an attempt to find out the value of APIs by examining **how do APIs work, what kinds of API are offered by API providers, who is the API end user and what value does the API provider expect to get.**

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1.2 Motivation

Nowadays, there are many studies discussing the advantages of using APIs. As more interfaces are developed, the more functions the third-party application can adopt. While these functions may not be innovative in themselves, the innovative component is the synergy that arises from the integration of the functions through one simple interface. Using API in applications may create innovative synergy (Fitzpatrick, Kaplan, Mansfield, Arnold & Segall, 2002). The principle of information hiding is one of the most useful approaches to coordinate developers working in the product (Parnas, 1972). One of the features of API is information hiding, wherein the API user does not know how the API works, but uses a set of operations defined by inputs and outputs. The API classifies the function into the public and private module; the public one can be called by every API user through the internet, and the private one can be accessed by the API provider only. An API user uses only the public module to facilitate the coordination of software development projects. (de Souza & Redmiles, 2009; Fowler, 2002). Shortly, when developing the application or service, using API can improve development efficient and create innovation.

While many articles discuss the advantages of using API, only a few examine what value it holds for an API provider. Therefore, this study identifies cases from different industry fields, analyzes their APIs to explain why they are willing to provide APIs on the internet and investigates how they get value through the API economy.

1.3 Research Objectives

Based on Section 1.2, we define the research needs, find out why the API providers are willing to provide APIs on internet. Base on the business model business model canvas, there are nine blocks describing the organization's value position, infrastructure, customer and finance. As the result, this study uses four questions to analyze the APIs' value position, infrastructure, customer and finance. Enterprises which want to engage in the API economy can reference this study to determine what function they should encapsulate as the API, and what value would they get.

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Chapter 2: Literature Review

2.1 Service-Oriented Architecture, Software Development Kit, and Application Programming Interface

This section describes the definition of application programming interface (API), software development kit (SDK), and service-oriented architecture (SOA). The relationship among API, SDK, and SOA is shown in **Figure 1**.

- **SOA**

SOA is not specifically a technology, but a model architecture. SOA is composed of standardized components, such as web services, and can be split into different modules. For developers, building an SOA implies that there is no need to build or own the whole system and service. Instead, developers only need to compose the system and the web service which they need on the Internet. SOA has become an important technology for software development, because it enables system integration and program reuse. SOA enables the service to cross manufacturers, products, and technologies, and achieve true openness (McDaniel, 2019).

SOA services should have the following four characteristics (Market Intelligence & Consulting Institute, [MIC] 2008):

1. Distributed architecture: The components of SOA are composed of many distributed systems and services on the network.
2. Loosely coupled interface: Developers need not know the operating principles or design methods of all components. As long as they meet the interface requirements, components can be replaced if required.
3. Based on open standards: SOA focuses on standards and interactivity, and hence, using open standards can avoid the integration of different platforms (.NET web services and Java web services) and development programs.
4. Process centric: When constructing a system, the purpose of the system and process needs to be understood first, followed by division into service interfaces (including input and output data formats). This is so that developers can develop or select the right components to get the job done based on the service interface.

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- **SDK**

SDK is a collection of software development tools, including frameworks, hardware platforms, and operating systems. It assists developers in developing specific functions in their own application. Thus, the development efficiency could be improved and the cost could be reduced. SDK may only provide some files for the application interface, or may provide some complex hardware that can communicate with other embedded systems. Generally, SDK users can spend less time to develop a specific function and realize the code. The SDK still offers sample code, supporting technical notes and supporting documents that declare doubts for basic reference materials. Developers usually obtain software development kits from target system developers. The SDK is provided free of charge and can often be downloaded directly from the Internet.

- **API**

The presentation which discusses the history of APIs (Bloch, 2018) mentions that the year 1949 witnessed the earliest conceptual formation towards the idea of an API. Maurice Wilkes spearheaded the work on "program libraries." His student, David Wheeler, devised "coordinating orders" which allowed the augmentation of initial orders to allow for complex subroutines (Wilkes, 1951). At the time, this work was not strictly referred to as an API, but this is arguably the first true manifestation of the concept. In 1968, the term, application programming interface, was first used in the dissertation of Ira W. Cotton and Frank S. Greatorex. APIs enable application developers to call a single function without the need to know the original programming language and principles, or understand the details of its internal workings.

As technology advances, API providers become different and various. Some enterprises encapsulate their services into one or more APIs and open them to all users on the Internet. When third-party developers deploy APIs in their application with simple code, APIs enable applications to use some specific functions for which the developers are not aware of the internal principle. Generally, API refers to an interface which enables two entities, such as applications or web services, to communicate with each other.

- **The relationship among API, SDK, and SOA**

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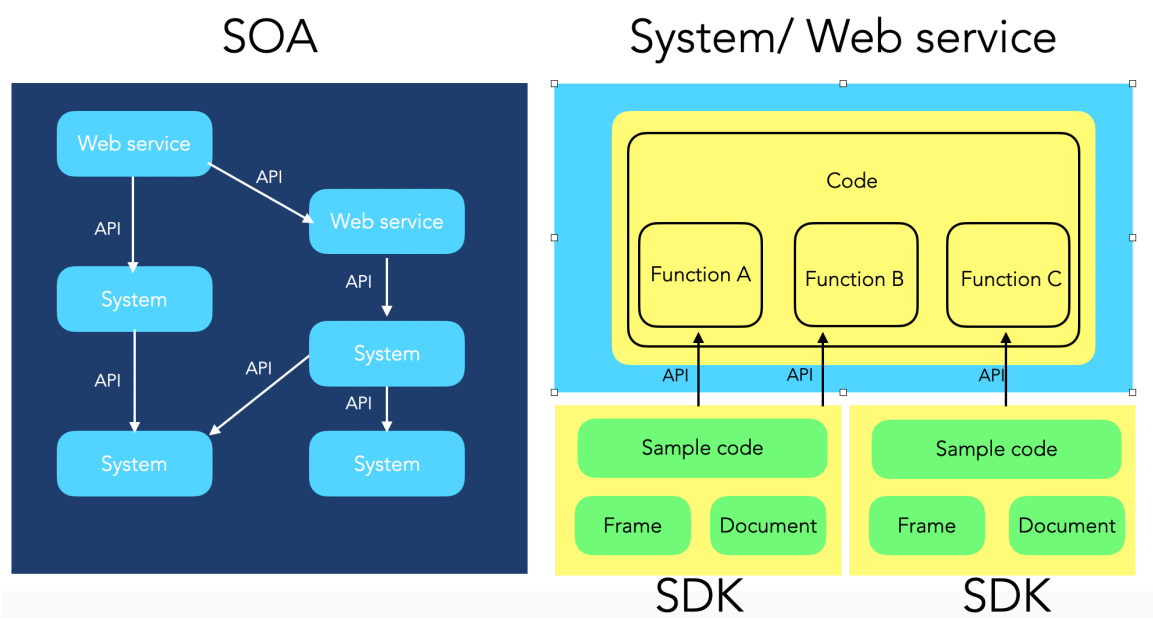
The relationship among API, SDK, and SOA has been depicted in **Figure 1**. The organization establishes an SOA for a specific business purpose, which is composed of many systems and web services, which connect to each other using an API. The SOA service provider does not own the whole system and the web service. The SDK is like a tool box, which helps developers develop a specific function in their system or service. The SDK may not only provide the APIs for the developers to deploy, but also the documentation on doubts, debuggers, and compilers. In programming language, an API is an interface for passing and retrieving the data to/from the API provider, but from a developer perspective, the API provides the data access, service, and the development ability.

Figure 1

The relationship among API, SDK and SOA



2.2 Categories of API

In this study, API has been categorized by three types: data, service, and development. (I) An API in the data category enables the application to create, read, update, and delete the data from/to the API provider's database. For example, Development Bank of Singapore (DBS) provides data access through API for private and general information, such as account status, current exchange rate, and DBS ATM.

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(II) An API in the service category enables the application to access services from the API provider. The services include those which the common users can easily access on the network, such as translation, sending and receiving email, and reserving an event or room. For example, Amadeus provides an API that enables third-party applications to book hotels and plane tickets, rate the hotels, and manage the orders. The common users and enterprises can easily use these functions on the Internet. (III) An API in the development category enables applications to access the development ability from the API provider, such as image recognition, natural language processing, and controlling the device setting. Generally, common users rarely demand access to the development ability. For example, Salesforce largely provides APIs of this type. Because of their business model, they want more products launched on the platform. To lower the development threshold, Salesforce encapsulates their development as the API, such as sandbox environment, prediction, and natural language processing. These functions are not used by the common users and enterprises on the Internet.

2.3 Stakeholders of API

There are three stakeholders in the API economy: API provider, developer, and end user. The API provider operates their own service and/or application and encapsulates data, service, or development ability into APIs, opening it to everyone who needs. The API provider usually operates a platform where developers can call an API to use from. Also, some platforms operate like markets where an end user can purchase a product or a solution when needed.

The developer may call different APIs from different platforms to develop an application. Some developers publish their product independently, while some publish on the platform operated by the API provider, such as Salesforce and Play Store (Google). Not every API is free; some of them need to be paid for by flow or call times, and some are charged monthly. The developer earns revenue from selling the application which they have developed, or through a sales commission when users purchase the application from the platform.

While the end users are similar to a buyer, not every business model includes a cash flow. The end user uses or purchases the final product, which calls the API. Users usually

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also provide their own data to the API provider when they use the final product. Consequently, some enterprises can enrich their content by providing APIs.

2.4 Business Model

According to the dissertation (Osterwalder, Pigneur & Tucci, 2005), the term "business model" appeared for the first time in an academic article in 1957, but became popular towards the end of the 1990s. In this study, we use the definition of a business model from Osterwalder, A., Pigneur, Y. and Tucci, C. L. (2005):

A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams.

The reason why we use this definition is because they use nine blocks to describe a business model, including value proposition, target customer, distribution channel, relationship, value configuration, core competency, partner network, cost structure, and revenue model. It provides a relatively comprehensive analysis for the study. Furthermore, Osterwalder and Pigneur developed a business model canvas (BMC) in 2010. BMC uses nine elements to define enterprises' business models. It uses key partners, key activities and key resources to describe the infrastructure of the business model, value proposition to describe what the organization offers, customer relationship, channels and customer segments to describe the customer, cost structure and revenue to describe the finance structure. Every element provides different points of a business model and combines all of them to present the business strategy of an enterprise.

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Chapter 3: Research Methodology

3.1 Research Approach and Process

This study adopts content analysis to analyze the API technical documents on the internet and examine the differences and similarities among the cases. Content analysis refers to a research methodology for the objective, systematic, and quantitative description of communication content (Berelson, 1952).

First, we identified ten enterprises as the target cases from as diverse industry fields as possible. Second, we chose five representative API from each enterprise's website, platform, and developer document. Third, we used 3W1H to analyze fifty APIs, which revealed the association between the value provided by the API and the provider.

3.2 Data Selection

Ten enterprises were selected as the analysis target for the purpose of investigating why are they willing to encapsulate their data access, service, and development ability as the API. There were three selection criteria:

1. First, the enterprise must be an API provider, regardless of whether it provides data API, development API, or services API.
2. Second, the API provider must have a large number of API user. As an API provider, it is important to have huge user base, which means that the APIs they provided are workable, useful, and valuable for API users.
3. Third, the enterprise must have already operated for years, which implies that its core business functions are relatively stable. Thus, the analysis results can be used as a long-term reference for new enterprises that seek to be API providers.

After determining the ten enterprises, We select five popular and representative APIs we speculate from each enterprises. The enterprise and APIs which meets the criteria were selected as the target cases and are shown in **Table 1**

3.3 Selected Cases

Based on the selection criteria, ten enterprises were selected from different fields, including software, social media, website establishment, communication, traveling, bank,

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entertainment, live streaming, and healthcare. The table presents the enterprises' name, field, date of establishment, and the five APIs which will be analyzed in Chapter 4.

Table 1

The list of cases

Name	Field	Date of founded	API
Salesforce	Customer-relation management (CRM) software solution	1999	B2C Commerce Developer Sandbox
			Einstein Prediction Service Scoring
			Einstein Vision and Einstein Language
			IoT API
			Marketing Cloud REST API
Reference	https://developer.salesforce.com/docs/api-explorer		
Google	technology	1998	MAP
			Cloud Translation API
			Gmail
			YouTubePlayer
			People API
Reference	https://developers.google.com/drive/api/v2/reference		
Facebook	Social media	2004	Live video
			Group
			Pages
			Marketing
			Instagram Basic Display API
Reference	https://developers.facebook.com/docs		
Amadeus	Traveling	1987	Points Of Interest
			Flight Inspiration Search
			Hotel Booking

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			Trip parser
			Trip Purpose Prediction
Reference	https://developers.amadeus.com/self-service/apis-docs		
Wix	Website establishment	2006	Data query
			Secret-backend
			Chat-backend
			Emailuser
			Subscribe
Reference	https://www.wix.com/corvid/reference		
WhatsAPP	Communication	2009	Contacts
			Messages
			Media
			Account
			Application setting
Reference	https://developers.facebook.com/docs/whatsapp?locale=en_US		
Revolut	Bank	2015	Account
			Counterparties
			transfer
			Exchange
			Payment
Reference	https://developer.revolut.com/docs/business-api/#getting-started-useful-links		
Ticketmaster	Entertainment	1976	Discovery
			Top pick
			Payment Initialization
			Presence
			3rd party integration API
Reference	https://developer.ticketmaster.com/products-and-docs/apis/discovery-api/v2/		
Twitch	Stream	2011	PubSub

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			Get top game
			Redeem Code
			Create Entitlement Grants Upload URL
			Get Users
Reference	https://dev.twitch.tv/docs/api/reference		
PokitDok	Healthcare	2011	Activity
			Claim
			Eligibility
			Insurance Prices
			Medical Procedure Code
Reference	https://platform.pokitdok.com/documentation/v4/?python#overview		

3.4 Data Analysis

Based on business model canvas (Osterwalder, 2004), we expect to describe the business model of every API for enterprises. Therefore, we use 3W1H to analyze every API and describe their infrastructure, offer, customer and finance.

First, we start analyzing APIs from “How do APIs work” to describe the “infrastructure” and research the principle of the API. Second, the answer to “What kinds of APIs do API providers provide” denotes “offer” and the value position of the API. Third, basing on the first two answer, speculate the answer to “Who is the API user” which denotes the “customer”. Finally, the answer to “What value does the API provider expect to get” denotes the “finance” and the value provided from customer. In this study, “finance” contain not only earning profit, but also many other value components, which could increase opportunities to earn profit and have been shown in Section 3.4. Finally, this study reviews these values and finds out what aspect of the business model they leverage. Enterprises can reference the results to determine what API they should provide and what value they might get.

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Chapter 4: Case Analysis

4.1 Analyzed Results

This section briefly introduces ten cases: Salesforce, Google, Facebook, Amadeus, Wix, WhatsApp, Revolut, twitch, and PokitDok. The results of the analysis of APIs of each of the enterprises are presented below.

4.1.1 Salesforce

Salesforce was founded by Marc Benioff in 1999. It is a customer relationship management (CRM) software solution provider, and a Software as a Service (SaaS) company. Salesforce provides customized solutions and charges on demand. Customers can access Salesforce's service through the Internet by renting, without the need to build and maintain a server or software. Developers can launch their products on AppExchange, which is a platform for third-party applications that either connects to Salesforce or runs on the Salesforce platform. As the product is used, the developer would earn revenues, and Salesforce would have more products to enhance the marketplace.

The table below is the result of analyzing five APIs: B2C Commerce Developer Sandbox API, Einstein Prediction Service Scoring API, Einstein Vision and Einstein Language, IoT API, and Marketing Cloud REST API.

Table 2

The analysis result of Salesforce's APIs

API	B2C Commerce Developer Sandbox API	Einstein Prediction Service Scoring API	Einstein Vision and Einstein Language	IoT API	Marketing Cloud REST API
Type	Development	Development	Development	Development	Service

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What kinds of API are offered by API providers.	The API allows application to create, manage, and delete developer sandboxes.	The API enables the application to run predictions, manage prediction definitions and models.	The API enables application to do image recognition and natural language processing.	The API enables application to create and manage orchestrations and contexts, and retrieve usage data.	The API enable app to manage and create marketing campaign
Who is the API end user.	Developer	Developer	Developer	Developer	Digital marketing
What value does the API provider expect to get	Enhance content	Enhance content	Enhance content	Enhance content	Enhance content
How do APIs work.	The API passes the quest parameter to the server, then returns the user, sandbox and realm data.	The developer should deploy the prediction model on the platform first. The API passes the ID of model and metadata to server, then returns the result.	The API can passes the dataset to the server for training model. Also, can passes the image or text, then return result and probability.	The developer should create events and orchestration on the platform first. The API passes request to the server, then, acceding to the parameter, activate, delete or managed the events and orchestration or returns the information about it.	The developer can access marketing processes, including Contacts, Content Builder, Journey Builder, Mobile Connect, MobilePush, Campaigns, Triggered sends, Tracking, Subscribers and lists, Automations, Content,Most other email activities

4.1.2 Google

Google was founded by Larry Page and Sergey Brin in September 1998. Initially, Google only provided online search engine service, but it now offers more than fifty Internet services and products, such as Gmail, Google document, YouTube, and even the mobile operation system, Android. Google generates most of its revenues from advertising (Hosch & Hall, 2020).

The table below presents the results of analyzing five APIs: map, cloud translation API, Gmail, YouTubePlayer, and people API.

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Table 3

The analysis result of Google's APIs

API	Map	Cloud Translation API	Gmail	YouTubePlayer	People API
Type	Data	Service	Service	Service	Data
What kinds of API are offered by API providers.	The API provides the context user need, including static, street view, interactive maps and high resolution satellite imagery	The API integrates text translation into the website or application.	The API enables application to read and send messages, manage drafts and attachments, search threads and messages, work with labels, setup push notifications, and manage Gmail settings.	The API provides application access to YouTube data, such as videos, playlists, and channels.	The API enables application to list and manage the authenticated user's contacts and retrieve profile information for authenticated users and their contacts.
Who is the API end user.	Every user	Every user	Member	Member	Member
What value does the API provider expect to get	Profit Enhance content	Profit Enhance content	Extend market User engagement	Extend market Enhance content User engagement	Extend market Enhance content User engagement
How do APIs work.	Access to Google Maps servers, data downloading, map display, and response to map gestures	The input text, which can be plain text or HTML, is send to the corpus server, then application will receive the output text in target language.	Create the content, then pass back to the server through API. Depending on the API methods user uses, the content can be send to receiver directly or saved as the draft	Enable application to load or cue videos into a player view embedded in application's UI. User can play, pause, or seek to a specific point in the video.	The API passes the query parameter to the server, then returns the user's contacts, also, can crate, update and delete contact data.

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4.1.3 **Facebook**

Facebook was founded by Mark Zuckerberg, Eduardo Saverin, Dustin Moskovitz, and Chris Hughes in 2004. Everyone who has a valid email address and are 13 years or older can register an account to access Facebook for free. Facebook provides users an online environment where content is created, distributed, or shared among communities for the purpose of social activities and not related to task-oriented objectives. Facebook earns most of its revenue from advertisements on the website (Hall, 2019).

The table below presents the results of the analysis of five APIs: Live video, group, pages, marketing, and Instagram basic display API.

Table 4

The analysis result of Facebook's APIs

API	Live video	Group	Pages	Marketing	Instagram Basic Display API
Type	service	data	Data	Service	Data
What kinds of API are offered by API providers.	The API enables application video encoders and cameras to stream live video directly to Facebook user profiles, pages, and groups.	The API enables application to read and create Facebook Group data on behalf of group members.	The API enables application to access and update a Facebook page's settings and content, create and get posts, get comments, page insights, and update actions that Users are able to perform on a Page.	The API enables application to build marketing automation with Facebook's advertising platform.	The API enables application to get an Instagram user's profile, images, videos, and albums.
Who is the API end user.	Streamer	Member	Member	Digital marketing	Member

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What value does the API provider expect to get	Extend market Enhance content User engagement	Extend market Enhance content User engagement	Extend market Enhance content User engagement	Extend market	Extend market Enhance content User engagement
How do APIs work.	The API passes the request to the server, then returns the stream secure URL and ID. Pass the secure stream URL value to the encoding device and stream live video data to it. Once the Facebook detects streaming data, the broadcast will go live on the user profile.	The app user authenticates their identity and authorizes the app to access their data. Once authenticated, you can query any data the user has permitted the app to access.	The app user authenticates their identity and authorizes the app to access their data. Once authenticated, you can query any data the user has permitted the app to access.	Through calling API, user can create ad campaign on the app, including define targeting and define budget, billing, optimization, and duration. Finally, book the ad.	The app user authenticates their identity and authorizes the app to access their data. Once authenticated, you can query any data the user has permitted the app to access.

4.1.4 Amadeus

The Amadeus official website (https://corporate.amadeus.com) shows that it was founded by 4 airlines: Air France, Iberia, Lufthansa, and Scandinavian Airlines in 1987 October. Amadeus is a global distribution system (GBS) provider, which connects travel providers with travel agencies. Thus, they extend travel providers' sales distribution to countries and markets where they could not sell, which is the value they provide to travel providers. According to their annual report of 2019, they primarily earn revenue from distribution and IT solutions.

The table below presents the results of analyzing five APIs: points of interest, flight inspiration search, hotel booking, trip parser, and trip purpose prediction.

Table 5

The analysis result of Amadeus's APIs

API	Points of interest	Flight inspiration search	Hotel booking	Trip parser	Trip purpose prediction

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Type	service	Data	Service	Development	Development
What kinds of API are offered by API providers.	The API return a ranked list of popular points of interest.	The API returns a list of the cheapest flight destinations from a given city or airport of departure.	The API enables application to complete bookings at over hotels and accommodations around the world.	The API parses information from various booking confirmation emails and returns a standardized, structured travel itinerary.	The API enables application to forecast traveler purpose, business or leisure, together with the probability
Who is the API end user.	Traveling agent Market analyst Every user	Traveling agent Every user	Traveling agent Member	Traveling agent	Traveling agent
What value does the API provider expect to get	Profit stimulate consumption	Profit stimulate consumption	Profit Extend market	Profit	Profit
How do APIs work.	For each place, the underlying algorithm analyzes feedback from different online media sources into a human understandable number to measure the popularity of that place.	The API returns cached prices from a large cache database which is continually updated with a large number of routes.	The API sends the booking and payment information to the hotel server, then returns confirmation to the user.	The API sends the context of booking confirmation emails, then returns the unique ID and the state of the parsing work first. After finishing the parsing work, the API returns the result of the email parsing	The API sends the origin location, the destination location and duration to the server. Then, according to the historical search and shopping data, the API returns prediction result and probability.

4.1.5 Wix

Wix was founded by Israeli developers Avishai Abrahami, Nadav Abrahami, and Giora Kaplan in 2006 (https://www.wix.com/about/us). Wix provides cloud-based web development services, which helps users to create their own website through the online tool for free, including registration of domain name, front-end design, and website management. Wix is on the “freemium” business model. They earn revenues when a user upgrades to the premium level.

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The table below presents the result of analyzing five APIs: DataQuery, secrets-backend, chat-backend, emailUser, and subscribe.

Table 6

The analysis result of Wix's APIs

API	Dataquery	Secrets-backend	Chat-backend	Emailuser	Subscribe
Type	Data	Development	Service	Service	Service
What kinds of API are offered by API providers.	The API enables app to run, sort, filter, and control which results a query returns.	The API enables app to store and encrypt API keys and other secrets on the site.	The API enables site owners and contributors to exchange chat messages with site members, contacts, and visitors	The API enable app to send a triggered email to the currently logged-in site member.	The API enables application to subscribes to a channel or channel resource. Site visitors can subscribe to a channel to receive the messages that are published on
Who is the API end user.	Member	Developer	Member Every user	Member	Member Every user
What value does the API provider expect to get	Extend market	Enhance content	Extend market User engagement	Extend market	Extend market User engagement
How do APIs work.	The API passes the query conditions, then returns the result.	Wix provides "Secrets Manager" in the dashboard, which can store some private information from 3rd-party service as secret. The API can return the secret.	The API passes the message to the business channel, whether the message is from visitor or owner.	First, the developer have to create at least one triggered email. The API passes the triggered email ID, receiver who must be a member to the server.	The API passes the the channel ID, subscriber ID to the server.

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4.1.6 WhatsApp

WhatsApp was founded by Brian Acton and Jan Koum in 2009 and was acquired by Facebook in 2014. In the beginning, WhatsApp did not want advertising to bother users, and thus, WhatsApp charged users a $1 annual subscription fee for survival. After 2016, WhatsApp no longer charged its users in any way. In January 2018, WhatsApp launched WhatsApp Business application, which allows small business users to create their own businesses and establish their presence for free. However, WhatsApp API is payable; it is the way WhatsApp earns revenue(Pahwa, 2020; Qadri, 2020) .

The table below presents the result of analyzing five APIs: contacts, messages, media, account, and application settings.

Table 7

The analysis result of WhatsApp's APIs

API	Contacts	Messages	Media	Account	Application Settings
Type	Data	Service	Service	Service	Service
What kinds of API are offered by API providers.	Verify customer phone numbers to generate WhatsApp IDs	Send text, media, Message Templates, and group messages	Upload, delete, and retrieve media	Register developer's WhatsApp account	Update, retrieve, or reset application settings
Who is the API end user.	Developer	Member	Member	Every user	Member
What value does the API provider expect to get	Profit	Profit Extend market User engagement	Profit Extend market User engagement	Profit Extend market	Profit Extend market

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How do APIs work.	The API passes the phone number to the server. If the phone number is valid, the API will return the user state and their WhatsApp ID	The API passes the message context and the target recipient type to the server. If success, The API will return message ID	The API passes the media to the server, then gives it an ID and returns it. When user delivers media message, the app passes corresponding ID to show the media in chat.	The API passes the certificate phone number, the certificate string, and the receive method(voice or SMS). If success, developer will receive the the registration code by voice or SMS	The API passes setting parameters to the server. If success, returns OK message and specific content.

4.1.7 Revolut

According to the official website (https://www.revolut.com), Revolut was founded by Nikolay Storonsky and Vlad Yatsenko in 2015. Revolut provides mobile app-based banking service. Revolut earns revenue in many ways, providing different subscription plans (standard: free; premium: £9.99 per month), offering business accounts with added options for businesses, charging transaction fees or fees for international money transfers when the amount exceeds the limit. It charges users 0.5-1.5% exchange rate fee between currencies on weekends, providing value-added services such as trading, insurance, cryptocurrency trade, and P2P loans (Matthew, N.D.)

The table below presents the result of analyzing five APIs: account, counterparty, transfer, exchange, and payment.

Table 8

The analysis result of Revolut's APIs

API	Account	Counterparties	Transfer	Exchange	Payment
Type	Data	Development	Service	Service	Service

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What kinds of API are offered by API providers.	The API enables application to show the account information	The API enables application to create, delete and get counterparty information, so that the user have the object to interact.	The API enables application to process transfers between accounts of the business with the same currency.	The API enables application to process exchange	The API enables application to process transaction.
Who is the API end user.	Member	Developer	Member	Member	Member
What value does the API provider expect to get	Extend market User engagement	Extend market	Extend market User engagement	Extend market User engagement	Extend market User engagement
How do APIs work.	The API passes the access token to the server, then returns the account information, including ID, name, balance, currency state, state, create and update data	The API passes profile types name, phone and email to the server and query the database, then returns the corresponding data	The API passes source and target ID, amount, currency to the server, then returns the transaction completed or not and complete time.	The API passes the source and target account ID, fixed amount which user wants to sell or bought and two kind of currency, then returns the state of the transaction.	The API passes the transaction data to the server, then new a transaction which in pending state. Once the transaction has been processed, the state could be completed, failed, reverted or declined.

4.1.8 Ticketmaster

According to the official website (https://www.ticketmaster.com), Ticketmaster was founded by Albert Leffler, Peter Gadwa and Gordon Gunn in 1976. In 2010, Ticketmaster and Live Nation merged to create Live Nation Entertainment. Initially, Ticketmaster earns revenue from selling ticket reservation system (TRS), which helps venues to manage ticket selling information. It also earns a commission when a ticket is sold through their system. In 1982, Ticketmaster switched its revenue stream as it transitioned to computerized ticketing and started selling tickets by itself. To obtain 100% right of sale, Ticketmaster charges a service fee from the consumer instead of the host (Shoe, 2020).

The table below presents the result of analyzing five APIs: discovery, top pick, payment initialization, presence, and 3rd party integration API.

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Table 9

The analysis result of Ticketmaster's APIs

API	Discovery	Top pick	Payment Initialization	Presence	3rd party integration API
Type	Data	Data	Service	Development	Development
What kinds of API are offered by API providers.	The API allows application to search for events, attractions, or venues, which from various platform, including Ticketmaster, Universe, FrontGate Tickets and Ticketmaster Resale.	The API provides seat recommendations based on current availability, sampling across various areas of a venue and available price points.	The API enables application to integrate with Braintree for payments.	The API enables the application to validate tickets and manage scanning devices for Ticketmaster events.	Through this API, partners can provide allocations to the Ticketmaster ticketing platform in order to sell their inventory through the broad reach of Ticketmaster sales channels.
Who is the API end user.	Every user	Every user	Member	Developer	Ticket seller
What value does the API provider expect to get	Stimulate consumption	Stimulate consumption	Extend market	Extend market	Enhance content
How do APIs work.	The API passes the query conditions to the server, then returns corresponding event detail.	The API passes the query conditions to the server, then returns the corresponding result, including available seats, price, quality score and so on.	The API generates the client token and sends it to Braintree for generating payment token as the method of payment for the order.	The API passes the data of the ticket including ticket type, token, venue ID and so on, then returns the status of the ticket	The API passes the event ID and other query conditions, and the returns the response from the partner's system.

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4.1.9 Twitch

In 2011, Twitch was formed from Justin.tv and was launched by Justin Kan and Emmett Shear in 2007. It was subsequently acquired by Amazon in 2014 (Wilhelm, 2011). Twitch is a platform that allows users to be streamers, viewers, and participants of gaming communities. Users without registering can watch stream, but they cannot be a streamer and chat in the channel. Twitch earns revenues in three ways: advertisements, subscription fee (through which the audience subscribes to streamers with different tier), and selling "bits," which is used to cheer a streamer in the chatroom (Nawal, 2018).

The table below presents the result of analyzing five APIs: PubSub, get TOP game, redeem code, create entitlement grant upload URL, and get user.

Table 10

The analysis result of Twitch's APIs

API	PubSub	Get TOP game	Redeem Code	Create Entitlement Grants Upload URL	Get Users
Type	Service	Data	Service	Development	data
What kinds of API are offered by API providers.	The API enables application to subscribe to a topic, such as bits, new subscription and moderator's action.	The API enables application to get games sorted by number of current viewers on Twitch.	The API enables application to redeems one or more provided codes to the authenticated Twitch user.	The API enables application to create a URL where you can upload a manifest file and notify users that they have an entitlement.	The API enables application to get information about one or more specified Twitch users. Users are identified by optional user IDs and/or login name.
Who is the API end user.	Streamer Member	Every user Market analyst	Member	Developer	Member
What value does the API provider expect to get	Enhance content User engagement	Extend market	Extend market User engagement	Extend market User engagement	Extend market User engagement

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How do APIs work.	The API passes the request to the server, then returns the content of the corresponding topic.	The API passes the query parameters to the server, then returns the games' box art, name and ID	The API passes the code and user ID which would receive the entitlement associated with the code to the server, then return the state of each code.	The API passes the manifest id and the entitlement type to the server, then generate and returns the URL	The API passes the query parameter, user ID or login ID, to the server, then returns the information about the user.

4.1.10 **PokitDok**

According to the official website (https://pokitdok.com), PokitDok was founded in 2011 by Lisa Maki and Ted Tanner. PokitDok provides platform-as-a-service (PaaS) which provides APIs to enable users to plug directly into over 700 trading partners and integrate member-specific insurance information into applications and services. Some of APIs are free, but some are payable. One of its ways of earning revenue is charging individual developers and startups by API call times. Another revenue source is the monthly fee from enterprises which deploy the PokitDok solution.

The table below presents the result of analyzing five APIs: activity, claim, eligibility, insurance price, and medical procedure code.

Table 11

The analysis result of PokitDok's APIs

API	Activity	Claim	Eligibility	Insurance prices	Medical procedure code
Type	Data	Service	Data	Data	Service

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What kinds of API are offered by API providers.	Tracks the life cycle of a transaction.	The API enables the application to submit claims to designated trading partners.	The API enables the application to verify a member's insurance information in real-time.	The API enables the application to access to collection of insurance pricing data.	The API enables the application to access to clinical and consumer information related to medical procedures.
Who is the API end user.	Member Hospital	Member Hospital	Member Hospital	Member Hospital	Member Hospital Insurance
What value does the API provider expect to get	Extend market	Extend market	Extend market	Profit Extend market	Extend market
How do APIs work.	The API passes the activity ID as query parameter, then returns the information of the activity.	The API passes the claim data to the server, then returns the submitter and trading partner's data.	The API passes the insured member and insure provider's data as query data to the server, then returns the member's insurance information.	The API passes the CPT code which presents the procedure and zip code to the server, then returns the information of the procedure.	The API passes the consumer friendly name of medical procedure and/or description which can be used to located medical procedure information to the server, then returns the procedure code, name and description.

4.2 Content analysis

Based on Section 3.4, we can find out the overall result of using 3W1H analysis among the ten cases: what kinds of API do API providers offer, who is the API user, what value does the API provider expect to get, and how do APIs work. This section discusses the answer to each question below.

4.2.1 How do APIs work?

Although some APIs pass the character or the image or the dataset, they are all some form of data. The API user will retrieve another data, which might be based on the result they queried or the result of accessing the service. No matter what the type of API is, the principle of API's work is to pass and retrieve data. Therefore, we can say that the

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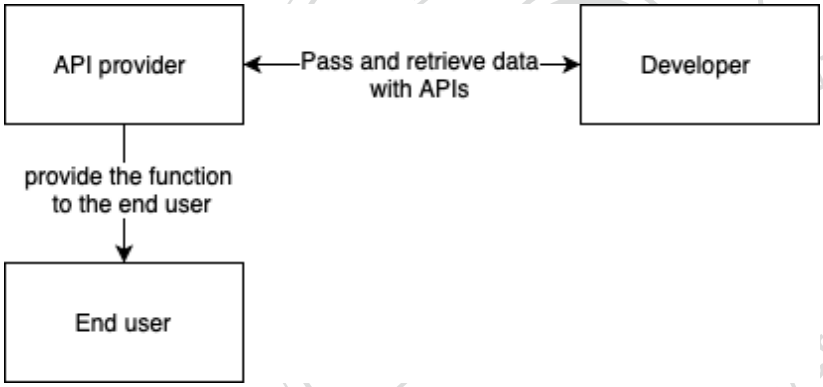
process or how an API works would not affect whether the API is successful or not. Fast and smooth information transfer is the foundation of an API. But the information flow of each API still has something different. We categorize different information flow into three types.

As **Figure 2** show, the developer passes and retrieves data to/from the API provider with APIs, and the end user accesses the function from the API provider only. Such as Salesforce and Google (paly store), after the developer deploys APIs in the application and launches it on the platform which is operated by the API provider, the end user purchases and downloads the application from the platform.

Figure 2

Type 1, one of the information flow process



Another type of the information flow is shown in **Figure 3**. Like type1, the developer passes and retrieves data with APIs as well, but the end user can accesses the function from the API provider and the developer. Such as Facebook , the end user can manage posts in Facebook App, they can also manage posts in third-party application.

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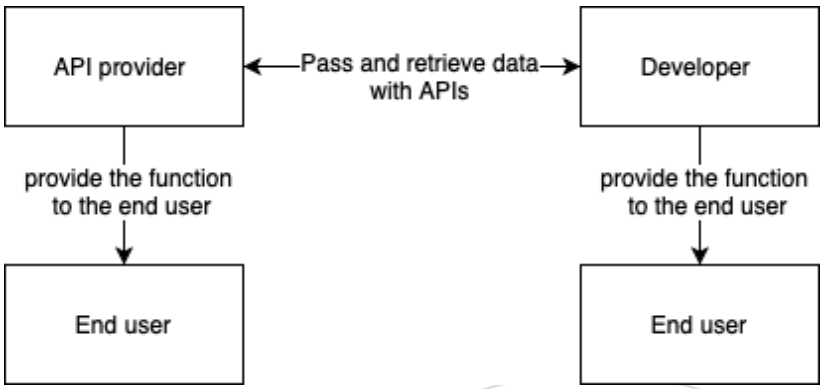
Figure 3

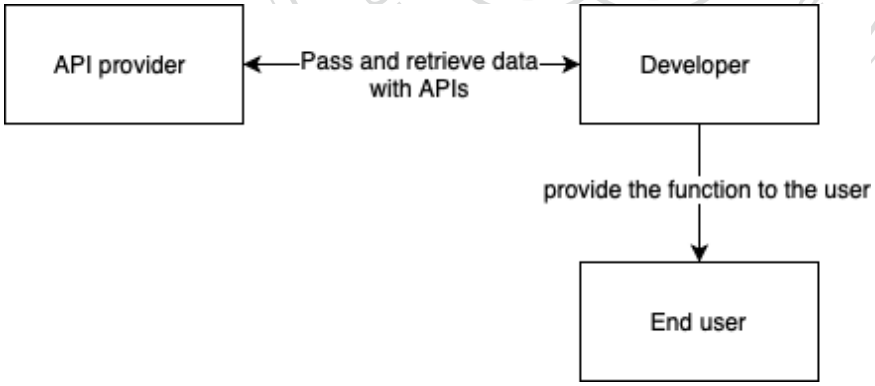
Type 2, one of the information flow process



Final type of the information flow is shown in **Figure 4.** Like above, the developer passes and retrieves data with APIs as well, but the end user can accesses the function from the developer. Such as counterparty API provided by Revolut ,the end user couldn't access this function from the API provider directly, but they will access the API when they use the third-party application.

Figure 4

Type 3, one of the information flow process



4.2.2 What kinds of API are offered by API providers

Because every function of API is different and unique, it is hard to clarify the differences and similarities. Thus, this discussion is based on the API type instead of the function. **Table 12** shows that the most common API type is of service, followed closely by the number of data- and development-type APIs.

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Table 12

The number of the three types

API type	Data	Service	Development
Number	15	22	13

The differences in data-type APIs depend on the industry of the API providers. If the API provider has a platform enabled for users to interact with each other (such as Facebook, Google, Wix and so on), the provided APIs are used to access user data. If the API provider sells through a merchandise, such as Amadeus and Ticketmaster, the provided APIs are used to show merchandise data.

The service-type APIs are used to access the core function from API providers. The end user can access these functions on the internet as well. We argue that the reason why the number of service-type API is high is because it can directly add value to third-party applications and provide service to end users. Due to this, the third-party application prefers to use service-type APIs rather than others, and thus, the number of service-type APIs increases accordingly.

For a third party, using development APIs provides more flexibility than the other types. The development-type APIs are more like a component, which completes the function of the application. On the other hand, using development APIs to create value has a higher technical threshold. Because the development-type API would not provide value to a consumer directly, they need to be extended to a service. In the case of Salesforce, its five APIs are of the development category. Given its business model, Salesforce wants more developers to launch products and services on the platform to attract more customers. Salesforce provides APIs to reduce the threshold and improve the efficiency.

After we find out the answer to first two questions, we can speculate who will be end users of each API.

4.2.3 Who is the API end user?

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We can classify the end users by four types: every user, member, developer, and enterprise. “Every user” refers to people who can access the function of APIs without registering. This kind of end user usually form the target audience for promotion and enhance the data of services, such as Google’s Map API and Amadeus’ Points of interest API. “Member” refers to only those people who register to access the function of APIs. If an API’s end user type is “member,” the API must help the API provider “extend market,” because it directly or indirectly attracts new users to use their service, register account, and join the ecosystem. The third type of end user is “developer,” which is the target user for development-type APIs. The final type of end user is “enterprise,” which refers to other enterprises from the same or different field. There are two choices: first, the API provider operates B2B business model, or the API is used to cooperate with each other, such as Amadeus’ Hotel booking API; second, it enhances and increases the products, such as Ticketmaster’s 3rd party integration API.

After we determine the end users of each API, we can start to find out what value would they provide to the API providers and find out the research need, why the API providers are willing to provide APIs on internet

4.2.4 What value does the API provider expect to get?

There are five reasons which will be explained in this section. Because of the differences in the fields of the API providers, we can understand the trend in the reasons why companies from different fields provide APIs.

Table 13

The number of value which the API providers provide

	Profit	Extend market	Enhance content	User engagement	Stimulate consumption
Salesforce	0	0	5	0	0
Google	2	3	4	3	0
Facebook	0	5	4	4	0
Amadeus	5	1	0	0	2

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Wix		4	0	2	0
WhatsApp	5	4	0	2	0
Revolut	0	5	0	4	0
Ticketmaster	0	2	1	0	2
Twitch	0	4	1	4	0
PokitDok	1	5	0	0	0

- **Profit**

The first value is "profit"; the decision of charging API users and the pricing policy depends on the API providers' strategies. API providers earn profit in many ways, such as buyout, charging by flow or calling times, monthly fee, or quota. Google cloud API, for example, charges third-party users depending on the number of API calls. If the number of API calls per month per billing account is below 2 million, Google will not charge the developer; If the number of API calls per month per billing account is between 2 million to 1 billion, every call will cost $3.00; if the number of calls every month is above 1 billion, every call will cost $1.50.

- **Extend market**

The second value is "extend market." Most APIs can generate this value for the API provider. The APIs can directly or indirectly attract new users to use their service, register an account, and join the ecosystem. According to **Table 13**, we find that almost every enterprise provides APIs which can help them to extend market. Usually, the user must be a member of the provider's platform, enabling them to use or access the function provided by the API provider in the third-party application. If there is a user who is not a member but wants to use the function in third-party applications, then the user needs to register for an account on the provider's platform in advance. Additionally, third-party developers and the API provider are not in the same field sometimes, due to which the API provider may reach the users who never use their services and applications and collect different data which the provider does not usually collect.

Overall, as long as a user wants to access the function through the API, he or she has to join the API provider's platform. Therefore, if an enterprise wants to extend market

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through providing APIs, it could open their service, data, and development tools, which can only be accessed by the members to third-party developers and enterprises.

- **Enhance content**

The third value is "enhance content." The API provides this value to the API provider through which the providers can increase their product amount, enrich their data, and attract other users to stay in the ecosystem. Take Salesforce for example, they provide different APIs to the developer for helping them to develop products and launching them on the Salesforce platform. In this manner, they own more and more products on their own platform. The more products they have, the more enterprises tend to become their customer. Another example is Facebook's live video. The developer deploys it on the third-party application, and therefore, the user can start streaming on Facebook from third-party applications. In Facebook's opinion, the API provides the user with another way to stream on Facebook, and thus, the content in Facebook is enhanced and the stream may attract other users to stay in Facebook for watching it.

This study examined five enterprises that provide APIs which can help them to enhance content. The purpose of Salesforce and Ticketmaster is to increase the number of their products. Developers and other ticket sellers can launch their product on the API provider's platform through API. The purpose of Google, Facebook, and Twitch is to enrich the data and diversity on their platform or service.

Table 14

The different purposes of the API provided by enterprises

Enterprise	API	Purpose
Salesforce	B2C Commerce Developer Sandbox API's	Increase number of product
	Einstein Prediction Service Scoring API	Increase number of product
	Einstein Vision and Einstein Language	Increase number of product

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	IoT API	Increase number of product
	Marketing Cloud REST API	Increase number of product
Google	Map	Enrich the data in service
	Cloud Translation API	Enrich the data in service
	YouTubePlayer	Enrich the data in service
	People API	Enrich the data in service
Facebook	Live video	Enrich the data in service
	Group	Enrich the data in service
	Pages	Enrich the data in service
	Instagram Basic Display API	Enrich the data in service
Ticketmaster	3rd party integration API	Increase number of product
Twitch	PubSub	Enrich the data in service

- **User engagement**

The fourth value is "user engagement." The API which generates this value encourages users to keep using or switch back to the API provider's platform or application. For example, many of Revolut's APIs enable third-party applications to complete a transaction. As the third-party developers deploy APIs in their application, the users can transfer and exchange currency in the application with their Revolut account. In Revlout's opinion, providing API to third-party developers can not only attract new users to register accounts, but also encourage old users to keep using their service.

If the API can bring this value to the API provider, it must help the provider to extend the market as well. There are three features of the API providers' primary service. First, the third-party application user knows which enterprise provides the service or data through the API. Second, the user can interact with other users, even form a community. Lastly, comparing to other service, the account represents the user more. Because users provide more information about themselves when they register or operate their accounts.

- **Stimulate consumption**

The fifth value is "stimulate consumption." The APIs which generate this value can increase products' exposure, so that the API provider can increase the number of sales. It

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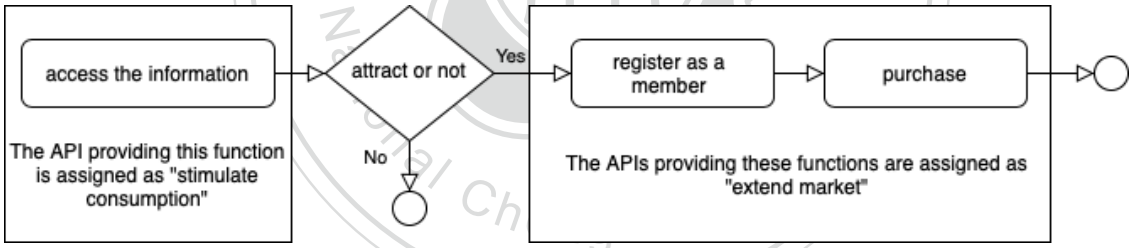
is regarded as promotion as well. For example, Ticketmaster provides many APIs which enable third-party applications to show information about events. attractions, or venues; the information includes the price range, location, seatmap, and so on. In Ticketmaster's opinion, the APIs help them to show merchandise information on different platforms, and may attract customers to buy tickets.

The enterprises which provide the API with this value usually sell merchandise whatever is solid or digital, such as Amadeus and Ticketmaster. The biggest difference between "stimulate consumption" and "extend market" is the API user. As **Figure 5** shows, the core idea of "stimulate consumption" is to make visible certain information to the audience (the more the better), so that the end user of the API providing "stimulate consumption" value is every user on the Internet. After end users receive the information, if they are willing to purchase merchandise, they will access the API providing "extend market" to register and process transaction.

Figure 5

The difference between "stimulate consumption API" and "extend market API"



After we find out what value does the API provider expect to get, we categorize values into five types. Different APIs provide different values, so that there are may some value which doesn't be found out in this study. Four of the values in this study, "extend market", "enhance content", "user engagement" and "stimulate consumption", couldn't help API providers earn profit directly, but they help API providers increase opportunities to earn profit. As the result, we can say that the main reason why API providers are willing to provide APIs on internet is increasing income.

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Chapter 5: Conclusion

5.1 Summary

In this study, we find that API plays different roles for three types of stakeholders. From an API provider's perspective, they earn value through providing API, not only through profits, but also through extending markets, enhancing content, facilitating user engagement, and stimulating consumption.

From developers' perspective, the trends of the API economy bring advantages to them. The more the APIs are provided on the internet, the less functions they need to develop. In other words, the developers have more time to develop the core function of their own product. To utilize the advantages of an API, besides development ability, the ability which the new developer must have involves establishing business models, dividing functions, assessing the API's quality and stability, choosing suitable APIs, and most importantly, ensuring integration capability. From an end user's perspective, APIs boost the powerful applications and services that are launched. They can access different functions in an application or service, and make daily life more convenient. Take Moneybook for example, which is an accounting software in Taiwan. It deploys many APIs from different banks. The application can retrieve expense data from banks, but not from users providing the information manually. (https://moneybook.com.tw)

As seen in Section 4.1, many APIs enable applications to access data. This means that using an API becomes another way of easily collecting data. Previously, only big enterprises had enough data for analysis, but now even small enterprises and third-party developers can collect enough data for analysis by retrieving API data. Using these data, the enterprises and developers can predict demand, create new products, and ensure precise marketing.

The API economy is more and more popular nowadays, and the API provider and the third-party API user can both get value from APIs. However, they still need to assess what API they should provide and use. They should not develop APIs for chasing trends, as it may lead to unexpected expenditures and even failure.

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5.2 Implications

We find that the functions of APIs all access the enterprises' core service, data, or development, because enterprises have to make their APIs unique and irreplaceable for third-party developers and enterprises. The more the third-party developers and enterprises deploy APIs in their projects, the more complete the API provider's crowdsourcing ecosystem will be. In the future, if there are any new enterprises that seek to build the API economy in their business model, they can refer to the process as follows: First, the new enterprise needs to review and declare the business model and find the core capabilities. Second, they should refer to the case in this study which is similar to their field and determine what value the core ability may provide to an API user. Finally, they need to decide what is the function of the APIs, who is the end user, and what is the expected value they would get. They should remember the most important concept—open the core business functions to attract and keep API users.

5.3 Research Limitation and Future Research

The purpose of this study is to determine why the API providers are willing to provide APIs on the internet and how they get value through the API economy. To do so, we identified ten enterprises from different industry fields and analyzed fifty APIs from each of them. The research limitation is that we do not have solid data of API usage, such as call time per month, revenue, and the number reached. Therefore, we could not determine the specific figure of how much value the API provider might get, or the relationship between usage data and the API type. Another limitation is that the cases in this dissertation are from different industry fields. Therefore, we could not analyze the preference among the enterprises in the same industry field. For instance, they may all provide some kinds of API and the difference of the provided APIs between the big and small enterprises needs to be examined as well. Future research can focus on a specific field, and collect cases from the same field to analyze.

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