



Comparative Study of API Management Solutions

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ABSTRACT

The aim of this paper is to perform a comparative study on Application Programming Interface (API) Management Solutions. API acts as the digital glue that links systems, applications, and services together to create influencing customer experiences. They help one rapidly develop interfaces between back-end systems and applications. Sharing these interfaces with their clients and developers can help one open revenue channels, bring new digital services to market and exceed customer expectations. In this paper solutions from the top 5 vendors were studied deeply with the focus on industry implementations, common widely used features, famous success stories from these vendors. Survey was also conducted on the related subject matter. In the end, contradictions and agreements were highlighted between the literature review and survey results.

Keywords: API, APIM, CA, APIGEE, Axway, IBM, Mashrey.

Introduction

The Application Programming Interface (API) has been around for a considerable length of time with the ascent of Web APIs, driving innovation for creating applications, acquiring information and administrations to portable applications, and incorporating undertakings with cloud administrations and their accomplices. As the present day Web APIs are becoming significantly, and their high accessibility over the Internet, dynamically expanding business values, and turning out to be increasingly vital as the application scene of endeavors. Along these lines, API administration is turning into a basic center segment in current administration base [1]. In other words, API acts as the digital glue that links systems, applications, and services together to create influencing customer experiences. They help one rapidly develop interfaces between back-end systems and applications. Sharing these interfaces with their clients and developers can help one open revenue channels, bring new digital services to market and exceed customer expectations [2]. From an architectural standpoint, APIs represent an extension of SOA (Service-Oriented Architecture). Just as SOA created interfaces to open up legacy systems for reuse in new services that might span organizational boundaries, APIs are used to open the enterprise backend to developers building applications for mobile devices and the public Web [3].



This technology is a significant extension and the design requirements for a Web API are likely to be very different from those for an SOA Web service. Whereas SOA programs are driven by the need for IT cost savings; API programs focus on generating new revenue streams. A Web API connects a range of existing business assets to create value in previously unforeseen ways. Therefore, API design and architecture practices must be aligned with the organization's corporate strategy, from the ground up [3].

1 API Economy

APIs have been utilized as a key segment as a part of programming frameworks for saying the way programming frameworks ought to connect with each other. The API Economy has been shaped on both business advancement opportunities and API innovation points of interest. One can see a ton of fruitful stories in Cloud Computing, Social Computing, Mobile Computing, and Traditional eCommerce. Expedia earned more than \$4 billion of income for every year through its API-controlled associate system. PayPal prepared over \$14 billion in installment exchanges in 2012 and came to \$27 billion in 2013 through its API-empowered business system [1]. Figure-1 delineates both API development and API Economy blasting scene [4].

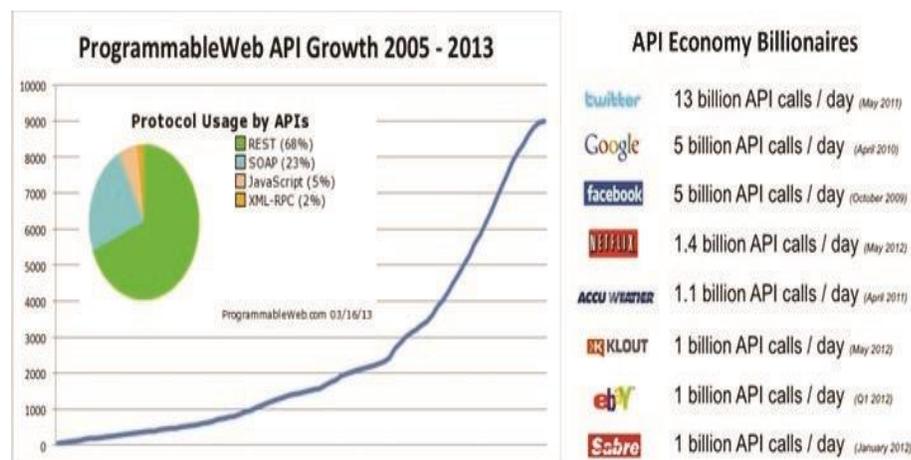


Figure -1: API Growth and API Economy Booming [4]

The API Economy can be characterized as the economy where organizations uncover their (private) business administrations as (over the web) APIs to parties with the objective of getting extra business esteem through the production of new resource classes. The above definition depends on "economy" point of view. The API Economy is developing in both the IT world and business universes. The API Economy is changing the way organizations work together furthermore the way they make their



administration base and incorporate their administrations. To execute business exchanges anyplace and at whatever time through API layer in administration framework and giving portable, the Web and other customer interfaces as a layer on top of APIs. Along these lines, permitting clients to coordinate with center administration framework straightforwardly through very much characterized APIs [1].

2 API Management

The API management is a set of technologies, processes, and tools for governing APIs in a scalable and secure service infrastructure [1]. API management solution consists of the following main components:

- **API Portal** – this is a configuration time API administration device for overseeing API distributed, API control, API profile, and API improvement lifecycle.
- **API Gateway** – this is a runtime API administration apparatus for overseeing API runtime practices, for example, multi-tenure, steering, security (verification, approval and additionally character).
- **API Service Manager** – this is an apparatus for overseeing API lifecycle, for example, dynamic forming, relocation, setup, arrangement, API upgrades, (for example, change, strategy revisions, design)
- **API Monitor** – this is a part of API runtime administration segments for metering the API runtime practices, for example, use, execution.
- **Chargeback or API Billing** – Billing is for utility-arranged open API, for example, Amazon EC2 API, and Chargeback on account of on-reason or private cloud. Both depend on metered use.

Programming interface administration is the way toward distributing, reporting and regulating application programming interfaces (APIs) in a protected, versatile environment. The objective of API administration is to permit an association that distributes an API to screen the interface's lifecycle and ensure the requirements of designers and applications utilizing the API are being met [5]. Programming interface administration programming apparatuses ordinarily give the accompanying functions [6]:

- Automate and control associations between an API and the applications that utilization it.
- Ensure consistency between various API usage and forms.
- Monitor activity from individual applications.
- Provide memory administration and reserving instruments to enhance application execution.
- Protect the API from abuse by wrapping it in security techniques and arrangements.



- API administration programming can be implicit house or obtained as an administration through an outsider supplier. A developing open API development, led by huge name organizations like Facebook, Google and Twitter, has prompted to lessened API reliance upon traditional administration arranged engineering (SOA) for more lightweight JSON and REST administrations. A few API administration instruments are fit for changing over existing SOAP, JMS or MQ interfaces into RESTful APIs or JSON content.

This paper is organized as follows; section 2 will discuss top 5 API management solution; section 3 explore material and methods; section 4 will presents the results and finding and finally discussion and future work will be presented.

3 API Management Solutions

The top 5 selected API Management Solutions [7] [8] [9] [10] were studied and their respective implementations as per their official Website were reviewed. Based upon this study, the industry presence is represented in the Figure-2 below.

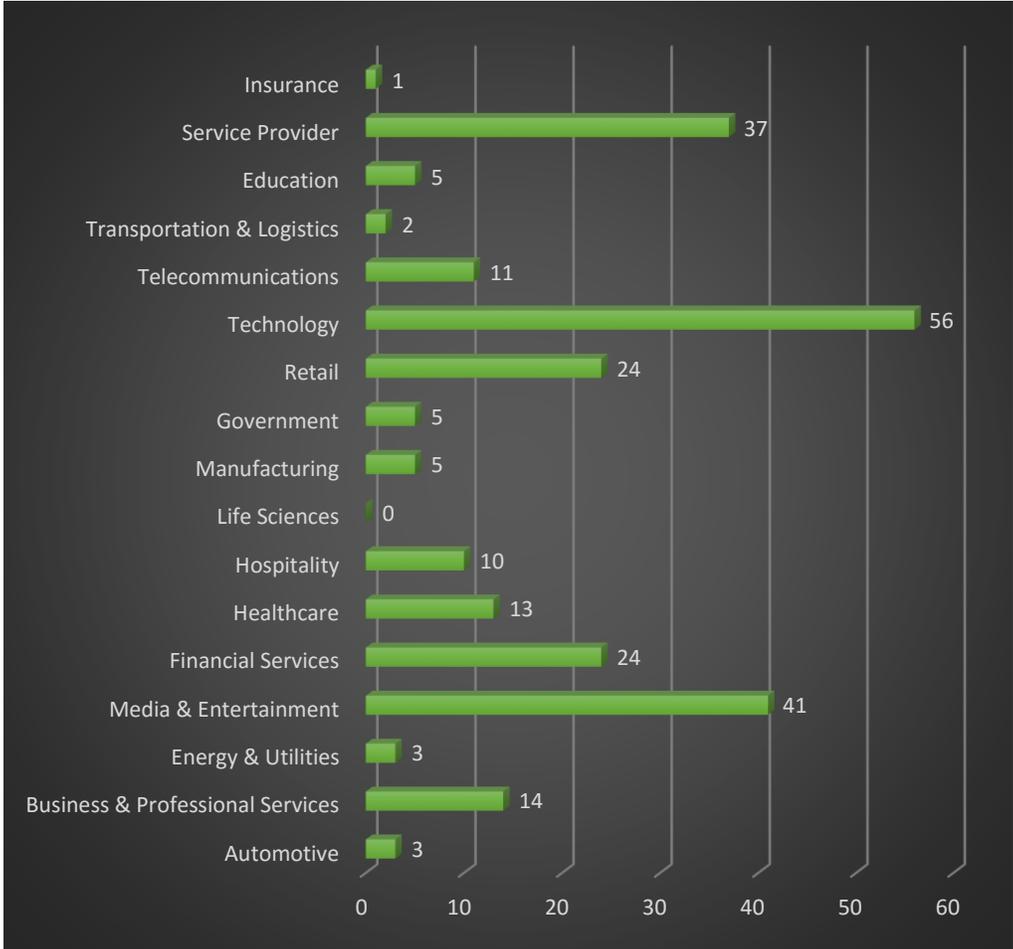


Figure-2: Growing API in different industries [11] [12] [13] [14] [15]

The below Table-1 shows the list of customers, the industry where they belong to and the solution implementation they have opted for.

Table-1: Success stories shared by vendors

Customer	Industry	APIM Solution
Essent	Energy & Utilities	Axway API Gateway
Swiss Post	Public Sector	Axway API Gateway



BBC Worldwide	Media & News	APIGEE
Bugaboo	E-Commerce	APIGEE
Starwood Hotels & Resorts Worldwide, Inc.	Travel & Transportation	IBM API Connect
Citi Bank	Financial	IBM API Connect
Sabre	Travel	Mashrey API Management
Edmunds.com, Inc.	Data Services/Retail	Mashrey API Management
Alaska Airlines	Transportation	CA API Gateway
The Advisory Board Company	Healthcare	CA API Gateway

4 APIM Feature Set Comparison

The features of the selected top 5 APIM Solutions were studied thoroughly and the following comparison chart was drawn. The legend is show in the Table-2.

Table-2: Legend APIM comparison chart

Legend	
Full Capability	●
Limited Capability	●
None or very weak Capability (or must purchase separately)	●

The Table-3 represents the comparison matrix for the widely-used features and their support in the top 5 selected APIM Solutions.

Table-3: APIM comparison chart by features [16] [17] [18] [19] [20]

Feature	CA	APIGEE	Axway	IBM	Mashrey
API Implementation					
API Connectivity	●	●	●	●	●



Drag & Drop API Creation	●	●	●	●	●
Adaptation	●	●	●	●	●
Orchestration	●	●	●	●	●
API Runtime					
Event Processing	●	●	●	●	●
Traffic Management	●	●	●	●	●
Aggregation	●	●	●	●	●
Caching/Compression	●	●	●	●	●
Remote management of APIs	●	●	●	●	●
Centrally update polices	●	●	●	●	●
API Protection					
OWASP Vulnerabilities	●	●	●	●	●
Security SDKs	●	●	●	●	●
Mobile/IoT Security	●	●	●	●	●
API Access Control					
Authorization/SSO	●	●	●	●	●
Risk-based Access	●	●	●	●	●
OAuth/OpenID Connect	●	●	●	●	●
Security Firewalling	●	●	●	●	●
Accelerate Development					
API Discovery/Portal	●	●	●	●	●
Collaboration Tools & Codegen	●	●	●	●	●
Documentation	●	●	●	●	●
API Development					
Mobile/IoT Services	●	●	●	●	●
Mobile Security	●	●	●	●	●
Secure Offline Data Storage	●	●	●	●	●
Messaging/Pub-Sub	●	●	●	●	●
API Intelligence					



Performance Analytics	●	●	●	●	●
Business Analytics	●	●	●	●	●
Mobile App Analytics	●	●	●	●	●
API Monetization					
User Account Management	●	●	●	●	●
Organizational Account Management	●	●	●	●	●
API Key Mgmt. / API Provisioning	●	●	●	●	●
Billing Integration	●	●	●	●	●

5 Materials And Methods

The research methodology of this thesis project was based on both a qualitative literature study and quantitative survey study. Online questionnaire method was used to for this survey. Google Forms used as a tool to conduct it. Survey responses can be found under the following link:

Link: <https://goo.gl/JrmQQh>

Following research items were considered during execution of the survey in order to have a quality research:

- Sampling frame: Linked groups
- Dates survey was conducted: the survey was conducted for 4 weeks.
- Survey method: Online survey
- Resonance: 51 responses

6 Results And Findings

Following are the findings from survey:

6.1 Awareness of API

59.3% users responded with “Yes, already running an API program”, as shown in Figure-3:

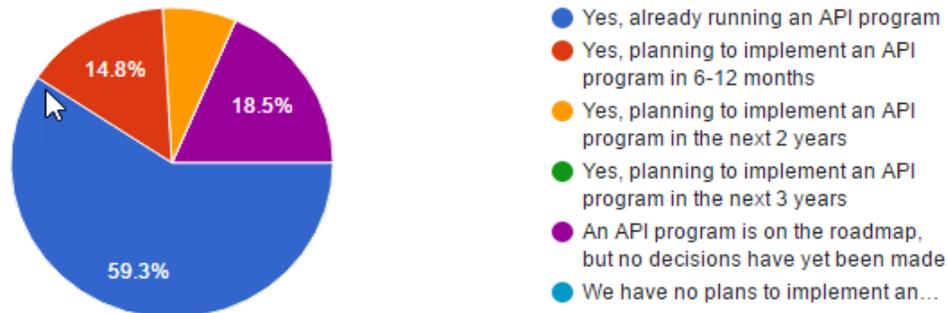


Figure-3: Is your enterprise officially running or wanted to execute an API program

6.2 Drivers for running an API Program

- 48.1% users consider “Develop new partnerships” as “Important”
- 77.8% users consider “Increase Revenue” as “Very Important”
- 55.6% users consider “Exploit new business models” as “Very Important”

6.3 Widely used API Management Solution

- 63% users selected “APIGEE”
- 25.9% users selected “CA”

The same is represented in the Figure-4 below:

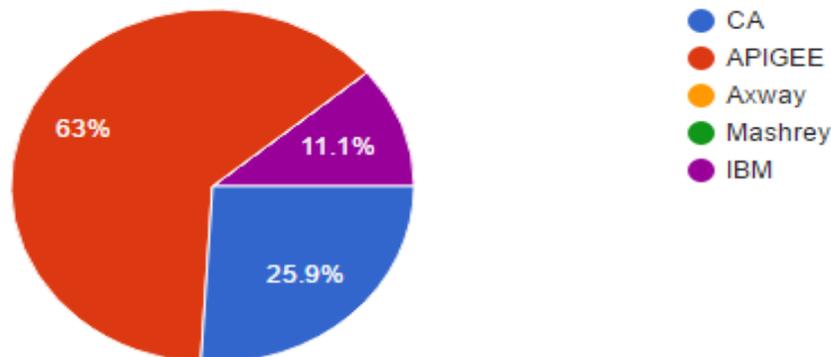


Figure-4: What is your favorite API Management Solution?

From the literature review see Table-3, CA is considered to be the best APIM solution and then comes the APIGEE, whereas in our survey result we discovered that APIGEE is the most favorite APIM solution and then comes the CA. Hence, this shows a contradiction between the literature review and our survey results.

6.4 Preferred deployment model

- 51.9% users opted for “Public Cloud”



6.5 Key features implementation

- 40.7% users selected “Advanced SLA controls”

More details are shown in the Figure-5 below:

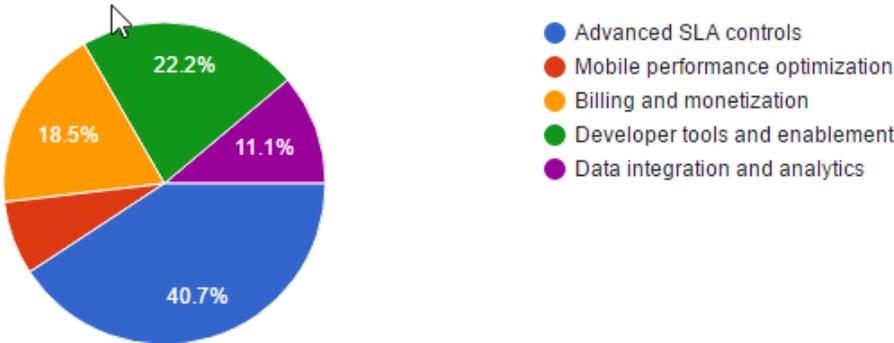


Figure-5: Key features in an API Management Solution

From the literature review see Table-3, features that come under the broad category of SLA are widely considered as the core features of an APIM solution and are mostly supported by the majority APIM solutions. Hence, survey showed the same result.

6.6 Targetted industry having maximum implementations

- 44.4% users choose “Technology”
- 25.9% users choose “Government”

The same is represented in the Figure6 below:

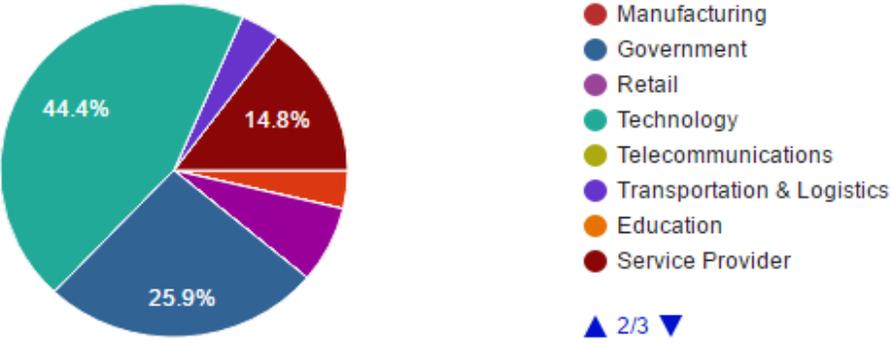


Figure-6: API Management Solution targeted industry

From the literature review see Table 3, “technology” is the industry having the most APIM solution implementations. Indeed, our survey results are aligned on this response.

6.7 Areas where APIM solutions will make most worth of



- 29.6% users selected “Mobile channels and devices”
- 29.6% users selected “Customer-facing applications and systems”

6.8 Areas taking advantage of the exposed data

- 55.6% users consider “Critical”
- 44.4% users consider “Critical”
- 55.6% users consider “Very critical”

6.9 Decision maker for the API program

- 55.6% users selected “Top-level business management”

7 Discussion And Future Work

An APIM solution is maybe a standout amongst the best tools in the cutting-edge API improvement toolbox. Between the load balancing, micro-services partitioning, and security benefits conceded by the framework, some disadvantages do exist in comparison. This shouldn't imply that, obviously, that API portals are magic bullet. If a developer just uses a solely API function, the API Management Solution is a trivial attempt. Yet, for API providers utilizing at least two essential methodologies or capacities in their API, the APIM is a great decision, and should be seriously considered as a design and security highlight [21]. As more APIs come into utilization, the architecture supporting them needs to develop too – associations can't just endeavor to send APIs on top of existing solid frameworks and forms and expect overnight change. Or maybe, the change starts with activities focused at new creative bearings for the association, for example, the grasp of micro-services, versatile applications, and laying the basis for a universe of associated sensors. Most importantly, grasping APIs will guarantee that these associations are made intelligently and productively. Organizations from each industry are utilizing APIs to include extra esteem, from expanded income to expanded readiness to enhanced client encounter. Exceptional changes are occurring in the venture, which require another association and rationality for using innovation. APIM is the main arrangement that permits endeavors to genuinely convey on their computerized change through acknowledging API-led availability. It is an entire answer for API-led availability that makes a consistent application system of applications, information, and gadgets, both on-premises and in the cloud. This mixture incorporation stage incorporates iPaaS, ESB, and a brought together answer for API management, design and distributing. One can design, run, oversee, and break down administrations and APIs, all on a solitary stage [22]. Programming Interface Management framework gives clients a chance to oversee and screen the API program, presenting them to accomplices and customers, while adaptably scaling with approaching burden. The greatest preferred standpoint of



utilizing Azure's API Management framework is that it gives user a chance to interface its back-end administrations with any innovation stack, while giving rich, close ongoing investigation and a powerful designer's entry with auto-produced ridicules, code pieces and API inventories.

This study from literature finds out top 3 industry implementation as "Technology", "Media & Entertainment" and "Service Provider" and find out twp top API Management Solutions as "CA" and "APIGEE". From the survey results, this study finds out top 3 industry implementations as "Technology"; "Government" and "Service Provider" and find out top two API Management Solutions as "APIGEE" and "CA". In future more than 5 API management solution can be consider along with aditional features, for example, licensing model of the vendors etc.

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