SecureIQlab®

Public Test Report

Cloud WAAP CyberRisk Validation Report – Google

Product Version: Google Cloud Armor and Apigee API Management
Language: English
Published: 13 May, 2024

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1. Executive Summary

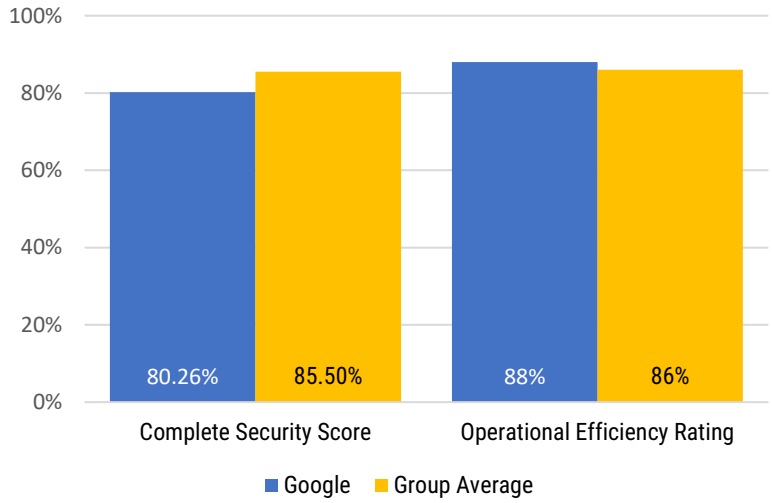


Figure 1. Overall Validation Results for Google Cloud Armor and Apigee API Management and API Security

This report discusses the test results for the Software as a Service (SaaS) Google Cloud Armor and Apigee API Management and API Security (WAAP). SecureIQLab completed testing for 12[1] of the leading enterprise-class WAAP solutions to determine their security efficacy and operational efficiency. The higher the security efficacy and operational efficiency scores, the better. Google Cloud Armor and Apigee API Management was slightly below average in the *Complete Security Score* but above average in the *Operational Efficiency Rating* of 88%.

WAAP solutions need to provide outstanding security and control that is easy to implement and efficient to use. This cloud WAAP test evaluated these products' effectiveness in mitigating attacks while minimizing operational burden.

SecureIQLab measured security efficacy for the cloud WAAP solutions by subjecting applications and APIs protected by these products under test to more than 3500 diverse attacks. These attacks were selected based upon industry frameworks such as the OWASP Top 10[2], MITRE ATT&CK, and Lockheed Martin Kill Chain[3]. Roughly 80 features and functions were validated in the evaluation of the WAAPs' operational efficiency. Key operational efficiency validation areas include ease of deployment, management, risk management, scalability, IAM control, visibility & analytics, and logging & auditing capabilities. This comprehensive validation of features and functions further raises the bar in cyber security industry and is unparalleled in contemporary validation and analysis as it exists in the marketplace. Testing was conducted in accordance with the standards of the Anti-Malware Testing Standards Organization[4] (AMTSO). The test used version 3.0 of the SecureIQLab Cloud Web Application Firewall and Application Programming Interface CyberRisk Validation Methodology (AMTSO Test ID: AMTSO-LS1-TP097).

Because thousands of attacks were simulated during the test, test results have necessarily been simplified and presented for review in a summary format. Figure 1 provides a summary of the Google Cloud Armor and Apigee API Management and API Security overall validation results. Google *Complete Security Score* was 80.26% and the *Operational Efficiency Score* of 88%. Google excelled at API security and operational efficiency.

This report covers testing for just 1 of the 12 products. An overview comparative report is also available. Reports are also available for the other 11 products tested.

[1] Testing was attempted on a total of 15 cloud WAF solutions. See vendor list for details.
[2] Open Web Application Security Project®.
[3] https://www.lockheedmartin.com/en-us/capabilities/cyber/cyber-kill-chain.html.
[4] https://www.amtso.org/

2. Introduction

Cloud-based WAAPs should accurately detect, prevent, and log attack attempts while avoiding false positives. The majority of the attacks conducted against the cloud WAAP product under test were tactics and techniques identified by OWASP for the exploitation of applications and APIs.

Tests were performed utilizing black-box and gray-box testing. Black-box testing assumes that the internal code structure of the product being tested is unknown to the tester. For this testing approach, testers are not required to know a system's implementation details. Gray-box testing assumes that part of the product's internal code structure is known to the tester.

Default configurations and rule sets were used for the majority of the products in this test. However, any "Detect Only" mode settings that were part of default configurations were modified to "Block" mode, with default rulesets used as applicable.

Tuning was based on industry and marketplace expectations that these solutions will require minimal to no tuning during the provisioning, deployment, and management phases. This translates to lower operational expenses and increased revenue for the targeted audience, i.e., SMBs, managed service providers (MSPs), and managed security service providers (MSSPs). To align with the customer experience, any required tuning was performed according to publicly available vendor recommendations.

WAAP-protected applications and APIs were used during testing by performing standard user transactions that included form submissions, comment writing, ecommerce transactions, authentication and authorization, data additional and retrieval, and other transactions. See the Appendix for additional information on the configurations. More detailed information about our testing methods is contained in version 3.0 of the Cloud Web Application Firewall and Application Programming Interface CyberRisk Validation Methodology (AMTSO Test ID: AMTSO-LS1-TP097).

3. Security Efficacy

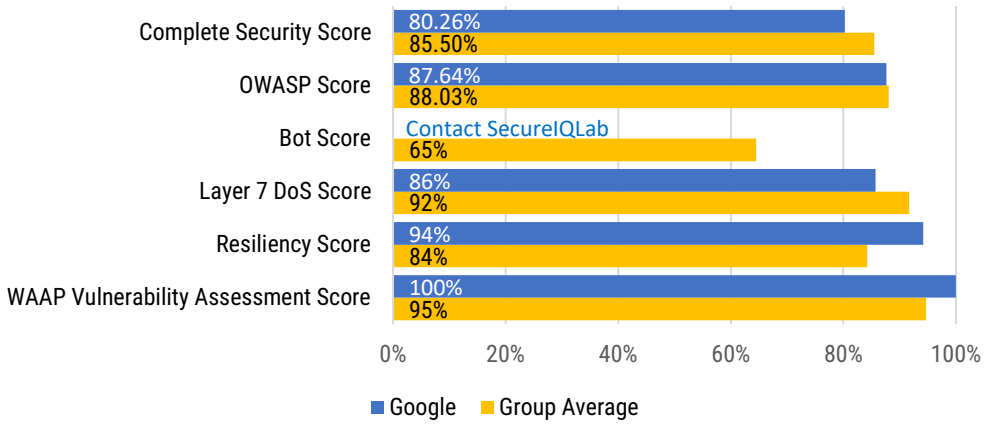


Figure 2. Security Validation Results for Google WAAP

Figure 2 above provides an overview of the SecureIQLab findings during the security validation of the Google Cloud Armor and Apigee API Management WAAP. To summarize, SecureIQLab's testing demonstrates the efficacy of the Google Cloud Armor and Apigee API Management in this area.

The *Complete Security Score* depicts the average of all security categories tested. Equation 1 below depicts the *Complete Security Score* calculation.

$$\text{Complete Security Score} = \frac{\text{A01 Score} + \text{A03 Score} + \text{A04 Score} + \text{A05 Score} + \text{A06 Score} + \text{A07 Score} + \text{A10 Score} + \text{Bot Score} + \text{Layer 7 DoS Score} + \text{Resiliency Score} + \text{WAAP Vulnerability Assesment Score}}{11}$$

Equation 1. Calculation of Complete Security Score

Every cloud WAAP evaluated in this test was subjected to 11 different categories of more than 30 real world-based operational scenarios targeting small-to-medium businesses and enterprises alike. Over 3500 validated attacks were used encompassing these scenarios and categories. The testing performed by SecureIQLab carries on our tradition of innovation and improvement. The complete security score consists of Web Application Firewall specific attacks; API attacks were not factored in on this inaugural WAAP test. SecureIQLab will continue to add attack libraries and other relevant operational metrics in future iterations of this test as attacks continue to evolve.

3.1. OWASP Top 10 Validation

The OWASP Top 10[5] lists are assembled by security experts from across the globe and describe the most critical web application and application programming interface vulnerabilities[6]. The order of these lists is based on vulnerability frequency, severity, exploitability, and detectability. SecureIQLab testing is based on the most recent iterations of the OWASP Top 10 Web Application Security Risks—2021 and OWASP Top 10 API Security Risks—2023.

3.1.1. OWASP Web Application Firewall Score

OWASP WAF	Test Case	Google %Blocked/Score	Group Test Average
A01:2021-Broken Access Control	Path Traversal	99.0%	99.5%
	CSRF	83.3%	52.8%
A02:2021-Cryptographic Failures	Cryptographic Failures	100.0%	100.0%
A03:2021-Injection	XPath Injection	70.0%	83.8%
	Host Header Injection	66.7%	88.9%
	HTML Injection	100.0%	94.4%
	SQL Injection (SQLi)	100.0%	98.2%
	OS Command Injection (OSi)	74.5%	73.3%
	Cross Site Scripting (XSS)	100.0%	99.7%
	LDAPi	100.0%	79.5%
	SSTI	93.1%	83.1%
	PHP Code Injection	100.0%	96.9%
A04:2021-Insecure Design	Web Scraping(Parse Hub)	0.0%	50.0%
	LFI	30.5%	71.1%
	RFI	100.0%	87.8%
A05:2021-Security Misconfiguration	Unrestricted File Upload (UFU)	100.0%	82.2%
	XXE	100.0%	83.3%
A06:2021-Vulnerable and Outdated Components	Vulnerable Web Environment	81.3%	88.0%
A07:2021-Identification and Authentication Failures	Bruteforce Attack	100.0%	91.7%
A09:2021-Security Logging and Monitoring Failures	Logging and Monitoring	86.0%	87.1%
A10:2021-Server-Side Request Forgery (SSRF)	SSRF	91.7%	76.4%
OWASP WAF Score		**87.64%**	**88.03%**

Table 1. OWASP WAF Vulnerability Testing

[5] https://owasp.org/www-project-top-ten/

[6] SecureIQLab is not affiliated with OWASP.

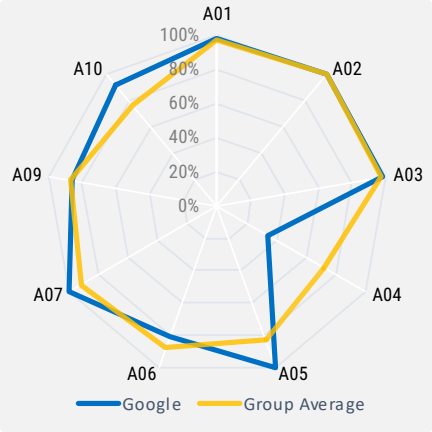


Figure 3. Comparative OWASP WAF Coverage for Google vs Group Average

Google Cloud Armor and Apigee API Management was tested against 9 of the OWASP Top 10 vulnerabilities. The OWASP A08:2021–Software and Data Integrity Failures vulnerability was not included in testing because it relates to coding and infrastructure practices that are outside the scope of WAAP security. The Figure 3 radar plot shows the relative OWASP coverage area for Google versus the group test average. In the radar plot, more area means better performance.

For detailed explanations of each of these attacks, please reference the OWASP Top 10. Table 1 below provides the results from these tests.

Test case averages are calculated by determining the percentage of the total attacks blocked to the total attacks used in the test case. Category averages are determined by calculating the percentage of the total number of blocked attacks divided by the total number of attacks for all the test cases within each category. As an example, Equation 2 below provides the formula for calculating the average for the *A01 Broken Access Control* vulnerabilities category.

$$A01\ Broken\ Access\ Control = \frac{Total\ \#\ CSRF\ Attacks\ Blocked + Total\ \#\ Path\ Traversal\ Attacks\ Blocked}{Total\ \#\ CSRF\ Attacks + Total\ \#\ Path\ Traversal\ Attacks} \times 100\%$$

Equation 2. Formula for Calculating the Average for A01 Broken Access Control Vulnerabilities OWASP Category

The OWASP score is calculated by averaging the nine test categories within the OWASP top 10 that were validated during testing. Equation 3 below demonstrates the calculation for the OWASP Score.

$$OWASP\ Score = \frac{A01\ Score + A02\ Score + A03\ Score + A04\ Score + A05\ Score + A06\ Score + A07\ Score + A09\ Score + A10\ Score}{9}$$

Equation 3. OWASP Score Calculation

Please see the Appendix for information regarding mapping the OWASP test cases to the MITRE ATT&CK Enterprise Framework.[7]

From the above, Google's *OWASP WAF Score* was slightly below average but scored 100% in 10 out of 21 validated test cases. Google excelled in 7 of the 9 tested OWASP WAF categories.

3.1.2. OWASP Application Programming Interface Security Rating

Application Programming Interface (API) security is critical for organizations from a security or regulatory standpoint. An effective WAAP solution must help organizations prevent unauthorized access to sensitive data or functionalities while maintaining reliable operations over multiple protocols.

This inaugural test of API Security was executed to understand the current state of API security as it exists in the marketplace. No relevant dataset exists, and these API security results serve as a baseline of the WAAP industry. Security Testing was performed over six API protocols. These protocols represent the majority of the API deployment as it exists today. More than 70 attacks were used in the testing of the WAAP's API Security efficacy. Attacks were selected based on the OWASP API Security Top 10 2023.

[7] SecureIQLab is not affiliated with The MITRE Corporation.

OWASP API	Google Rating (1-5)	Group Average (1-5)
API1:2023 - Broken Object Level Authorization	5	2.7
API2:2023 - Broken Authentication	5	2.3
API3:2023 - Broken Object Property Level Authorization	5	2.8
API4:2023 - Unrestricted Resource Consumption	4	2.7
API5:2023 - Broken Function Level Authorization	2	2.3
API6:2023 - Unrestricted Access to Sensitive Business Flows	5	3.7
API7:2023 - Server Side Request Forgery	3	2.3
API8:2023 - Security Misconfiguration	3	2.0
API9:2023 - Improper Inventory Management	3	2.8
API10:2023 - Unsafe Consumption of APIs	5	5.0
OWASP API Rating	**4.0**	**2.9**

Table 2. OWASP API Security Rating Results

Protocols Tested	Google Rating (1-5)	Group Average (1-5)
REST-API	5	3.2
GraphQL	4	3.2
SOAP	5	3.4
Kubernetes	5	3.5
WebSockets	1	1.9
gRPC	5	2.3
API Security Rating	**4.2**	**2.9**

Table 3. API Security Results for Tested Protocols

Table 2 highlights the results of testing against the OWASP API framework. Table 3 highlights the results from this testing for the API Security Rating for each protocol tested. Ratings are between 1 and 5 where 5 represents the highest security efficacy. The rating system is as follows:

Rating of 5: Security Efficacy ≥ 90%
Rating of 4: 90% > Security Efficacy ≥ 70%
Rating of 3: 70% > Security Efficacy ≥ 45%
Rating of 2: 45% > Security Efficacy ≥ 20%
Rating of 1: 20% > Security Efficacy

The above data showcases Google's significantly better-than-average OWASP API Security protection and significantly better-than-average security coverage over various protocols. Currently, API security testing is not part of the *Complete Security Score*. Future iterations of this test will see the results included in the *Complete Security Score*.

3.2. Advanced Threat Coverage

The results of advanced threat coverage represent threats that are not covered by OWASP Top 10 but are sophisticated and relevant enough for every WAAP solution to provide coverage. This section consists of Bot Attacks, Layer 7 DoS Attacks, Resiliency, and WAAP Vulnerability assessment.

3.2.1. Bot Attacks

For purposes of this test, a bot is defined as an automated tool that is used by a remote attacker to carry out automated attacks. The bot tool can exist on the attacker's computer or a compromised endpoint. Google Cloud Armor and Apigee API Management was tested against five types of bot attacks. Two of these bot attacks are part of the OWASP security validation. The remaining three attacks are scored within this category. These attacks were initiated from Asian and North American locations to determine whether the geolocation of an attack source impacts the product's security effectiveness. Results show that geolocation does not impact the product's security effectiveness. The *Bot Score* is calculated by averaging the three contributing scores. The maximum *Bot Attack Score* for the tested vendors was 100%. The minimum *Bot Attack Score* for the tested vendors was 0%.

Bot Attacks	Google Results	Group Average
Web Crawler	Contact SecureIQLab	67%
Broken Link Checker	Contact SecureIQLab	67%
User Agent Manipulation	Contact SecureIQLab	50%
Bot Score	**Contact SecureIQLab**	**65%**

Table 4. Bot Attack Results

Table 4 shows Google's bot protection performance. Contact SecureIQLab for details.

3.2.2. Layer 7 DoS Attacks

Layer 7 Distributed Denial-of-Service (DDoS) and Layer 7 Denial-of-Service (DoS) attacks are more difficult to detect than other DDoS and DoS layer attacks because they use a valid TCP connection. Below, Table 5 presents the results of testing Google's Cloud WAAP against two Layer 7 DDoS attacks and five Layer DoS attacks. These attacks to the MITRE ATT&CK framework, as far as possible. The product's *Layer 7 DDoS and DoS Score* was determined by taking the average of its scores against the seven attacks. The highest Layer 7 DDoS Score of the group of tested vendors in this category was 100% and the lowest rating was 57%.

Layer 7 DoS	Google Results	Group Average
DDoS - LOIC	Blocked	83%
Slowhttptest Slow Header (-H)	Blocked	92%
Slowhttptest Slow Body (-B)	Blocked	83%
Slowhttptest Slow Read (-X)	Blocked	100%
Torshammer		92%
MHDDoS	Blocked	92%
Slowloris	Blocked	100%
Layer 7 Dos Score	**86%**	**92%**

Table 5. Layer 7 DoS Results

Google blocked one of the two Layer 7 DDoS attacks and four of the five Layer 7 DoS attacks.

3.2.3. Resiliency Score

Security products must demonstrate resiliency. The prevailing definition of operational resilience is provided by the Department of Defense (DoD), and states it is: "The ability of systems to resist, absorb, and recover from or adapt to an adverse occurrence during operation that may cause harm, destruction, or loss of ability to perform mission-related functions."[8]

To test its operational resilience, Google Cloud Armor and Apigee API Management was tested against 103 resiliency test cases using 3 unique attack vectors. These attacks were employed to determine whether it could successfully block attacks that would otherwise go unseen. A higher resiliency score indicates a product is more capable of withstanding and absorbing different variations of attacks while a lower resiliency score indicates the opposite.

Table 6 below provides the Google Cloud Armor and Apigee API Management and API Security results for the test cases. The *Resiliency Score* is the percentage of attacks blocked out of the total 103 attacks. The maximum *Resiliency Score* for the tested vendors was 99.3%, and the minimum *Resiliency Score* for the tested vendors was 54.9%.

Resiliency	Google Results	Group Average
Cross Site Scripting	83%	89%
OS Command Injection	100%	73%
SQL Injection	100%	92%
Resiliency Score	**94.2%**	**84.3%**

Table 6. Resiliency Validation Results

3.2.4. WAAP Vulnerability Assessment

Google performed notably better than the group average *Resiliency Score*.

WAAP Vulnerability Assesment	Google Results	Group Average
Configuration & Deployment Management	Pass	92%
Identity Management Testing	Pass	100%
Authentication Testing	Pass	92%
Authorization Testing	Pass	92%
Session Management Testing	Pass	92%
Input Validation Testing	Pass	92%
Testing for Error Handling	Pass	100%
Testing for Weak Cryptography	Pass	100%
Business Logic Testing	Pass	100%
Client-side Testing	Pass	83%
API Security testing	Pass	100%
WAAP Vulnerability Assessment Score	**100%**	**95%**

Table 7. WAAP Vulnerability Assessment Results

[8] https://csrc.nist.gov/glossary/term/operational_resilience

Security solutions, regardless of their deployment method, should not increase the attack surface of the environments that they are designed to protect. Additionally, privileges granted to security solutions should not be exploitable by threat actors. SecureIQLab has assessed the security of the cloud WAAP product itself.

Google was tested against 11 vulnerability assessment techniques that are commonly used to assess the hardness of WAAP systems. Furthermore, this assessment also represents secure design outcomes. Table 7 provides the details of our findings. Seven out of the 12 WAAP solutions tested passed the WAAP Vulnerability Assessment with a score of 100%.

Google performed better than average in the WAAP vulnerability assessment and earned a perfect score. For earning a 100% WAAP Vulnerability Assessment Score, SecureIQLab rates Google as "Secure by Design".

4. Operational Efficiency

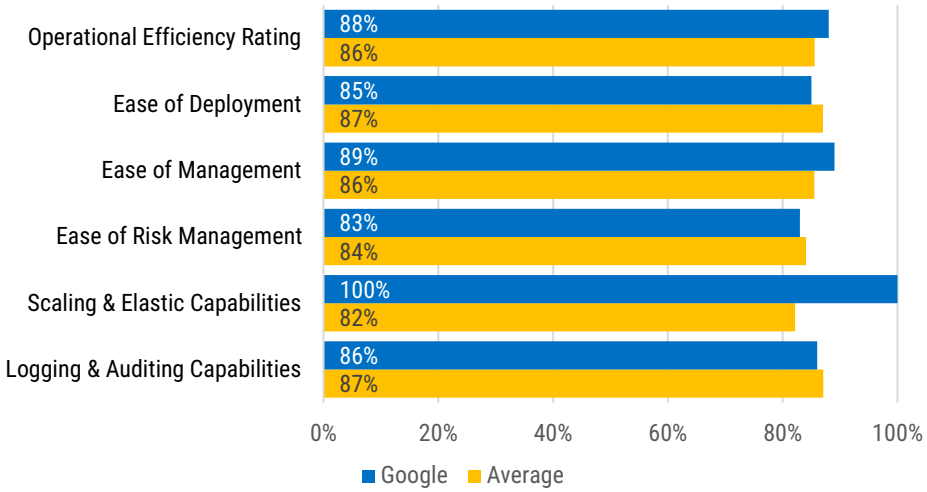


Figure 4. Overview of Operational Efficiency Results for Google Cloud Armor and Apigee API Management

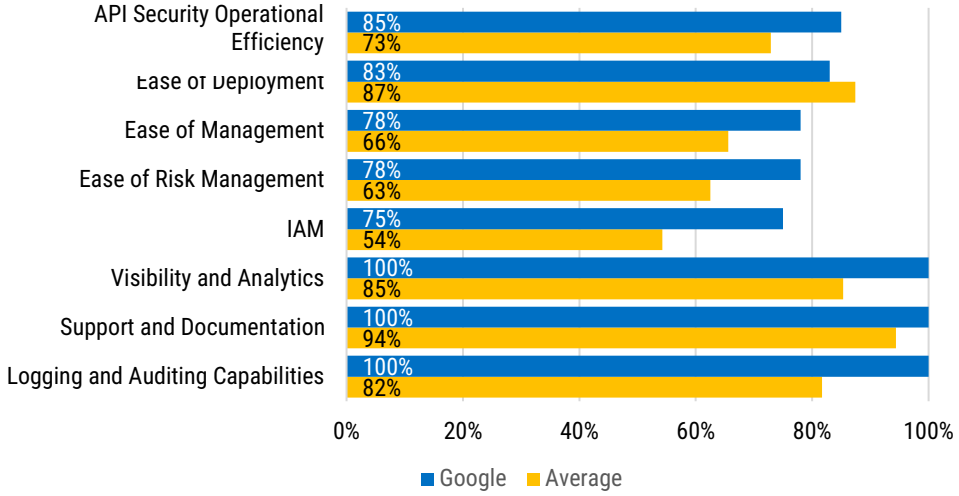


Figure 5. Overview of Operational Efficiency Results for Google Cloud Armor and Apigee API Management

Operational efficiency in deploying, managing, and utilizing WAAP solutions is critical for modern enterprises. WAAP solutions that provide WAF and API security with a high operational efficiency optimize resource allocation, minimize the burden on infrastructure, and reduce operational costs.

As to the first, SecureIQLab already validated WAF operational efficiency in five areas of validation with a total of 39 features and functions validated. These five areas include Ease of Deployment, Ease of Management, Ease of Risk Management, Scalable & Elastic Capabilities, and Logging & Auditing Capabilities. Figure 4 above provides an overview of the operational efficiency results for the Google Cloud Armor and Apigee API Management.

As to the second, in SecureIQLab's premiere validation of API security operational efficiency, seven categories are reviewed, within which a total of 37 features and functions are validated. These seven categories include Ease of Deployment, Ease of Management, Ease of Risk Management, Identity Access Management Control, Visibility & Analytics, Support and Documentation, and Logging & Auditing Capabilities. Figure 5 provides an overview of the operational efficiency findings for the API Security Platform.

The features and functions within each category are awarded scores based on their capabilities. These scores are then tallied together to form a rating of high, med, or low. The *Operational Efficiency Rating* is equal to the total number of points scored respectively by the WAAP operational efficiency validation over the total number of points. Category scores were calculated by aggregating earned points and then dividing this number by the total number of possible points to find a percentage. Points (integers 0 – 3) are earned for each feature within a category as follows:

- High or Yes (Green) = 3 Points
- Med (Yellow) = 2 Points
- Low (Orange) = 1 Point
- NA/No (Red) = 0 Points

The *Operational Efficiency Rating* was calculated by adding together the total points for each category, then dividing this number by the maximum potential points (117) and multiplying that number by 100%. Equation 4 states the *Operational Efficiency Rating* calculation. The *API Security Operational Efficiency Rating* is calculated in a similar manner to the *Operational Efficiency* Rating using the percentage of the total points earned from the seven areas of validation to the 111 total points possible.

$$\text{Operational Efficiency Rating} = \frac{\left(\begin{array}{c}\text{Ease of Deployment Points} + \text{Ease of Management Points} + \text{Ease of Risk Management Points} + \\ \text{Scalable and Elastic Points} + \text{Logging and Auditing Points}\end{array}\right)}{117 \text{ points}} \times 100\%$$

Equation 4. Operational Efficiency Rating Calculation

The average result for each feature validated is used to calculate the test group feature results. Group test averages were then calculated by adding the average score for each feature and then dividing this number by the total number of possible points to find a percentage.

4.1. Web Application Firewall Operational Efficiency Details

The detailed results for SecureIQLab's validation of Google's operational efficiency are found below in Table 8. Google scored higher than the group average and achieved a 100% in Scaling and Elastic Capabilities.

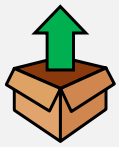
	WAF Operational Efficiency Test Case	Google Rating	Group Average
	Simplicity of Provisioning	Medium	High
	Ease of Setting Up WAF Service	High	High
	Ease of Certificate creations and management	High	High
	Application Load Balancing and Monitoring	High	High
	Deployment Autonomy/customer support experience	High	High
	Integration with Multi-Cloud WAF	Yes	Yes
	Plug and Play Integration with On-prem Firewall	No	No
	Plug and Play Integration for SIEM/S3 Bucket	Yes	Yes
	Plug and Play Integration for API Gateway	Yes	Yes
	Ease of Deployment Rating	**85%**	**87%**
	Simplicity of Tuning WAF	High	High
	False Positive Resistant Pre-Canned Security Profile	Medium	High
	Intuitiveness of Security Policy	High	High
	Ease of Managing Security Policy	High	High
	Customization of Dashboard	High	High
	Capability of Asset Management	Low	Medium
	Facilitation of PCI Compliance	High	Medium
	Facilitation of Data Sovereignty (GDPR)	High	High
	WAF Update Automation	Medium	Medium
	Simplicity of Managing Web ACL	High	High
	Single Sign On Support	Yes	Yes
	Efficient User Management	High	Medium
	Ease of Management Rating	**89%**	**86%**
	Risk Assessment & Mitigation	Low	Medium
	Security Metrics Reporting	High	High
	Threat Analytics Dashboard	High	High
	Alert and Rule Management	High	High
	Automated Alert and Rule Management	High	Medium
	Incident Management	Medium	Medium
	Ease of Risk Management Rating	**83%**	**84%**
	Load Balancing and Failover Capability	High	High
	Auto-Scaling Capability	Yes	Yes
	Manual Scaling Capability	Yes	No
	Designed for Static and Dynamic Sites	Yes	Yes
	Multi-tenancy Support	Yes	Yes
	Scaling and Elastic Capabiites Rating	**100%**	**82%**
	Log Configuration Simplicity	Medium	High
	Log Storage Capability	High	High
	Web Request Inspection	Medium	High
	Application Monitoring	High	Medium
	Infrastructure Monitoring	High	High
	Auditing Capability	Medium	Medium
	Multi-Factor Authentication	Yes	Yes
	Logging & Auditing Capabilites Rating	**86%**	**87%**
	WAF Operational Efficiency Rating	**88%**	**86%**

Table 8. Operational Efficiency Detailed Results

4.2. Application Programming Interface Security Operational Efficiency Details

API Security Operational Efficiency Validation Case	Google Rating	Group Average
API Technology Supported	High	High
Speed for API Deployment	Medium	Medium
Speed to Push the Policy	Medium	High
Support for Multiple Deployments	High	High
Ease of Deployment Rating	**83%**	**88%**
API Endpoint Addition Support	Medium	Medium
API Endpoint Visibility	High	Medium
API Endpoint Discovery	NA	Low
Default Template for Policy Management Support	High	Medium
Speed to Discover All API Endpoints	High	Low
Violation ratings support	Medium	High
Managing policies for API groups	High	High
Capability of dashboard to filter and export data	Medium	Medium
Intuitiveness of security policy	High	High
Ease of tuning API security policies	High	High
API Endpoint Classification Capability	Low	Low
Visibility into different API versions	Yes	No
Ease of Management Rating	**78%**	**66%**
Alert on Implementation Malpractice	Medium	Low
Coverage for Top 10 OWASP List	Medium	Medium
Rate Limiting Strategies to Manage Risks	High	High
Speed to Patch API Security Signature	Low	Low
False Positive Mitigation Strategy Support	Yes	Yes
Access Token Theft/Leakage Strategies	High	Low
Ease of Risk Management Rating	**78%**	**63%**
MFA Integration Support	No	No
Role-Based Access Control Support	Yes	No
SSO Integration Support	Yes	Yes
Authentication and Authorization Mechanisms Support.	High	Medium
Identity Management and Access Control	**75%**	**54%**
Security Metrics Reporting	High	High
Dashboard Customization	High	Medium
Exporting of Security Metrics	High	High
Visibility and Analytics	**100%**	**85%**
Documentation for Installation in Public Domain	High	High
Documentation for Best Practices Deployment	High	High
Support for Knowledge Base	High	High
Vendor Moderated Support Forum	High	High
Private Channel for Communication with Support	High	High
Support and Documentation	**100%**	**94%**
API Application Monitoring Capabilities	High	Medium
Logs Retention	High	Medium
Log Export Capabilities	High	High
Logging & Auditing Capabilities Rating	**100%**	**81%**
API Operational Efficiency Rating	**85%**	**73%**

Table 9. API Operational Efficiency Results

As Table 9 demonstrates, Google's API operational efficiency is notably higher than average and scored perfect ratings in three of the seven categories.

5. False Positive Avoidance

WAAPs need to allow business-related transactions while blocking malicious activity. Blocking legitimate user activity constitutes a false positive, increases the operational burden for the enterprise and requires additional tuning to correct.

Properly tuned security devices will not detect benign traffic as malicious. More than 6,500 false positive test cases were used to validate that the product under test (PUT) would not block simulated consumer purchases. These test cases simulated users that would browse the web application normally while being protected by the cloud WAAP. The results for the *False Positive Avoidance* testing are found below in Table 10. The higher the *False Positive Avoidance Score*, the less impact on the operational efficiency.

Google's *False Positive Avoidance Score* is the percentage of the total allowed legitimate activity test cases to the total test cases. Google's score was 100%.

False Positives	Google Results	Group Average
False Positive Avoidance Score	100.0%	99.98%

Table 10. False Positive Avoidance Score

The highest *False Positive Avoidance Score* of the group of tested vendors in this category was 100.0%, and the lowest score was 99.90%. Google performed better-than-average with a score of 100%.

6. Differentiators

Google provides the following information to highlight their market differentiators:

> APIs are the doors to various digital assets--and every door needs a lock to keep what's behind it safe and protected from unauthorized access. Therefore, to help organizations secure APIs to the highest level, Google Cloud has brought together Apigee and Cloud Armor, combining industry-leading API management and web application firewall technologies. With Apigee X, the latest release of Google Cloud's full lifecycle API management platform, customers can easily and seamlessly apply Cloud Armor web application firewall (WAF) to APIs, adding another layer of security to ensure that corporate digital assets are accessed only by authorized users.
>
> For companies such as AccuWeather, a global leader in weather data and forecasting, APIs have been essential to both building new applications and monetizing data and functionality for outside developers, so those communities can innovate with AccuWeather assets as well. With this new expanded surface area from their APIs, AccuWeather needed robust security to manage and secure its digital assets.
>
> "Over the last decade, AccuWeather has continued to transform as a digital solution for serving business customers with the most accurate and useful weather information using APIs. With Apigee's strategic partnership and comprehensive API management platform, we were able to design, develop, and launch our industry-leading APIs in a few short weeks." said Chris Patti, Chief Technology Officer at AccuWeather. "Today, we serve over 50 billion API calls per day. As many organizations embrace their own digital solutions, they are increasingly adopting

API-first strategies for accelerated transformation. With the new Apigee X release, we can foresee furthering our API programs with the best of Google capabilities like reCaptcha, Cloud Armor, and Content Delivery Network (CDN) for global scale, performance and security."

7. Conclusion

Google's performance throughout this testing has helped showcase why they are one of the leaders in this field. Although they were slightly below average on the *Complete Security Score*, their *Operational Efficiency Rating* was above average with 88%. In the OWASP Web Application Firewall test, they blocked 100% in 10 of the 21 areas. The *OWASP API Rating* and the *API Protocols Tested* both received the highest scores of the tested vendors. Google also received above-average ratings on WAF Operational Efficiency Test Cases and API Security Operational Efficiency Validation Cases. It is also important to note that Google passed the WAAP Vulnerability Assessment with a 100% score and received the "Secure by Design".

8. Appendix

Please see the linked appendix here.

9. Contact Information

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SecureIQLab (May 2024)