SafeKeep

GCP AUDIT REPORT

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EXECUTIVE SUMMARY

A vulnerability assessment and cloud audit was conducted in accordance with the organization [redacted] regards to their Google Cloud Platform (GCP).

Efforts were based on analyzing nodes on the internal segment of the environment of organization [redacted] and to analyze for improved security posture and configuration.

After assessing the internal environment, we found several vulnerabilities that should be remediated in order to create better defensive posture and a more secure set of systems. Our findings, which will be outlined in this report, include the following areas of vulnerabilities:

- Cross Site Scripting (XSS)
- Outdated Library (JQuery)
- Unencrypted Loaded Resources (HTTP)
- Privilege Escalation (Google Bucket)
- Misconfigured Service Account
- Excess Permissions
- Instance Misconfiguration
- Low Password Complexity
- SSH Using Password
- Password Optimization
- Open Ports, filtering & logging off on Firewall

We have included remediation steps for the vulnerabilities in this report.

In conclusion, [redacted] should look to remediate these findings in order to increase the effectiveness of security within the organization.

SCOPE OF TESTING

The scope of testing discussed and agreed upon with organization AAAAA AAAAAA included assessment of the AWS RDS and associated backend services including the S3, EC2, and the hosted WordPress web application. The test would cover vulnerabilities associated with the web application, associated services and the MySQL server hosting the application of organization AAAAAA AAAAA.

The testing was done utilizing a gray box approach. Some credentials were provided in order to speed up the process of testing and vulnerability finding.

The test included the EC2, S3 buckets, associated backend services and the server hosting the web application. There were three (3) external public facing Ips provided in scope for organization AAAAAA AAAAA of the server hosting the web application, MySQL and its associated services. Furthermore, A minimalistic privileged user account for the SSH service on the Linux environment, and of the web server was provided so a deep internal assessment of the SSH environment could be completed, in which we did find significant warnings needing to be addressed.

VULNERABILITY RATING (CRITICALITY)

A criticality score, between 0 to 49, is calculated by adding individual scores from “Time”, “Expertise”, “Knowledge required”, “Access to product by attacker”, “Type of equipment”. A following example is shown:

Factor	Value	Points
Time	< 1 week	1
Expertise	Expert	6
Knowledge required	Restricted information	3
Access from Attacker	Moderate	4
Type of equipment	Standard	0

Criticality: Medium (14)

Scores are also labeled based on three levels of criticality:

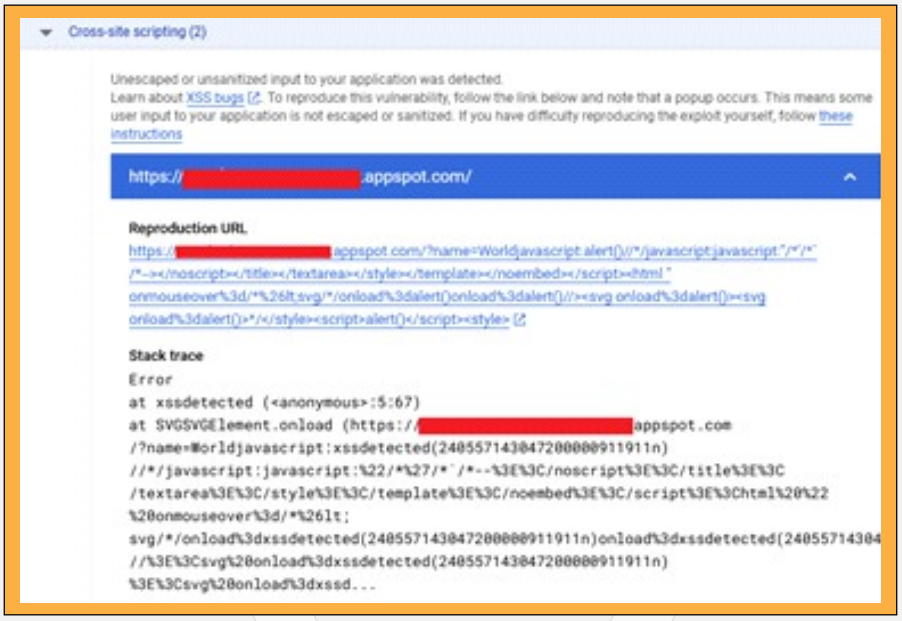
- **Critical - Score between >=25**
- **Very High - Score Between 20-24**
- **High - Score between 14-19**
- **Medium - Score between 10-13**
- **Low - Score between 0-9**

Please refer to the criticality matrix in the appendix for more information.

SUMMARY OF VULNERABILITIES

VULNERABILITY #1	CRITICALITY: CRITICAL (33)
CROSS SITE SCRIPTING (XSS)	LOCATION: WEB SERVER GCP CLOUD

With utilization of the Google Web Security scanner, Cross Site Scripting (XSS) was detected in the deployed NodeJS app. Cross Site Scripting (XSS) allows attackers to inject their own script onto the application, alter the behavior of the application, and ultimately create an attack that will execute the malicious script to any and all other legitimate visitors of the application.



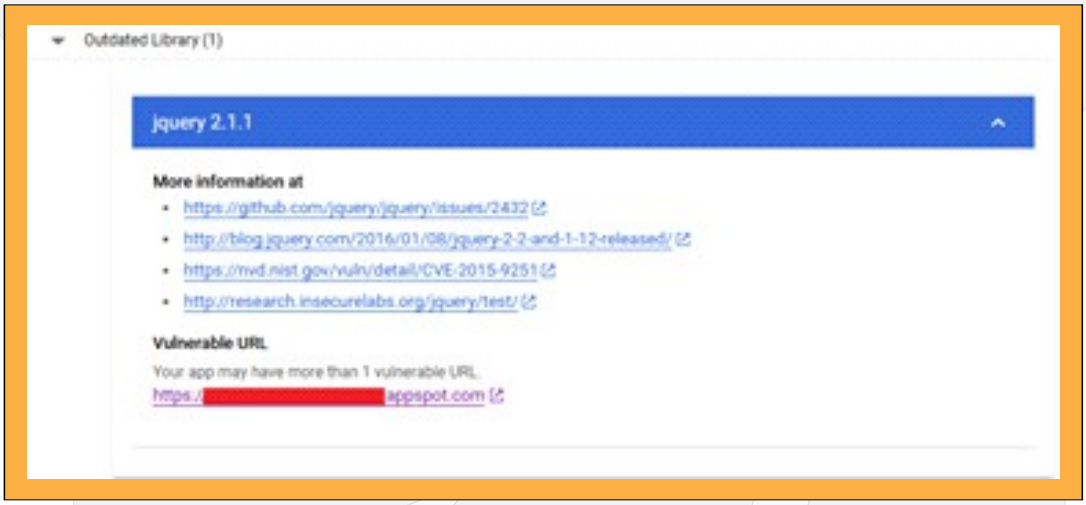
RECOMMENDED REMEDIATION #1	CRITICALITY: CRITICAL (33)
CROSS SITE SCRIPTING (XSS)	LOCATION: WEB SERVER GCP CLOUD

We recommend, if possible, to change the underlying code, to better sanitize inputs and not allow inserting of scripts. If changing the underlying code is not possible at this point in production, a robustly configured Web Application Firewall (WAF) would also provide the additional level of security.

VULNERABILITY #2	CRITICALITY: CRITICAL (34)
OUTDATED LIBRARY	LOCATION: WEB SERVER GCP CLOUD

With utilization of the Google Web Security scanner, an outdated library of jquery 2.1.1 has been found. This library has known and detailed vulnerabilities associated with it and more information regarding the vulnerability can be found on, for example, https://nvd.nist.gov/vuln/detail/CVE-2015-9251

Based on the CVE above a quick description of the vulnerability is as follows: jQuery before 3.0.0 is vulnerable to Cross-site Scripting (XSS) attacks when a cross-domain Ajax request is performed without the dataType option, causing text/javascript responses to be executed.

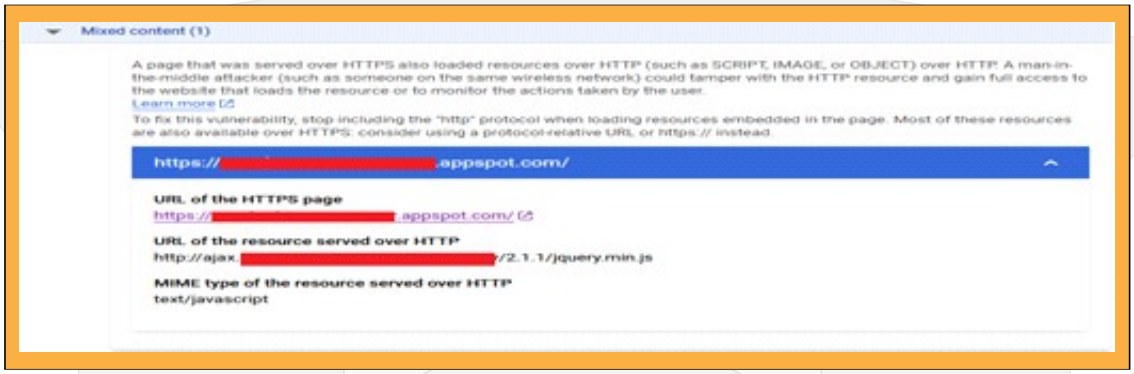


RECOMMENDED REMEDIATION #2	CRITICALITY: CRITICAL (34)
OUTDATED LIBRARY	LOCATION: WEB SERVER GCP CLOUD

It is recommended to upgrade to at least jquery version 3.0.0

VULNERABILITY #3	CRITICALITY: MEDIUM (13)
UNENCRYPTED LOADED RESOURCES	LOCATION: WEB SERVER GCP CLOUD

With utilization of the Google Web Security scanner, it was found that the application served as HTTPS has some loaded resources that are served over HTTP. HTTP is an unencrypted and unsecure protocol, hence we need to analyze the loaded resources to determine if an encrypted protocol would be the better option, which is most often the case.

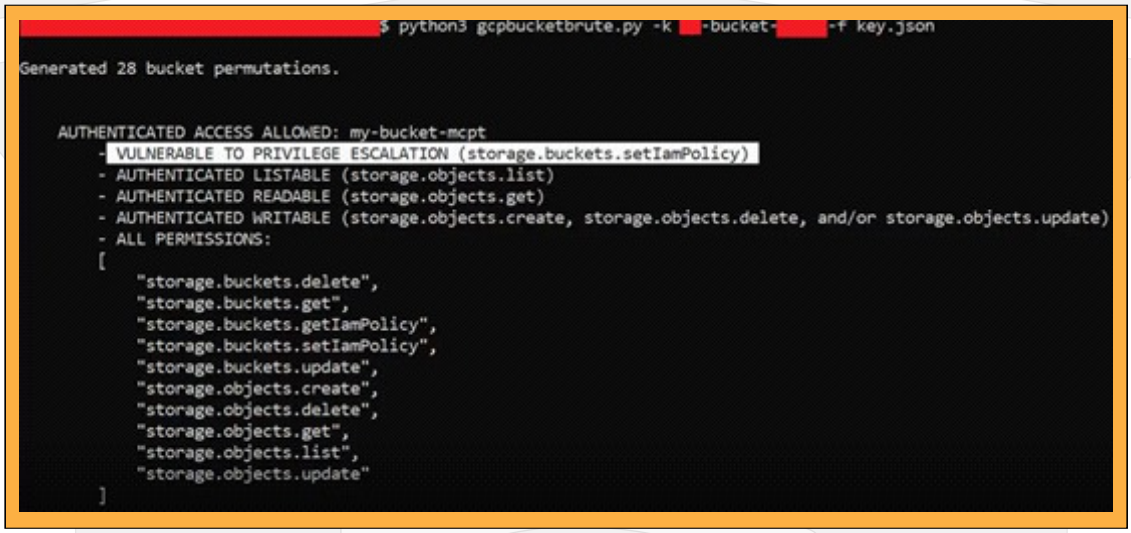


RECOMMENDED REMEDIATION #3	CRITICALITY: MEDIUM (33)
UNENCRYPTED LOADED RESOURCES	LOCATION: WEB SERVER GCP CLOUD

Do not utilize HTTP, even for the loaded resources, utilize HTTPS instead.

VULNERABILITY #4	CRITICALITY: CRITICAL (25)
PRIVILEGE ESCALATION	LOCATION: GCP BUCKET

With utilization of the GCPBucketBrute script, we have found that the bucket utilized in the environment is vulnerable to privilege escalation.

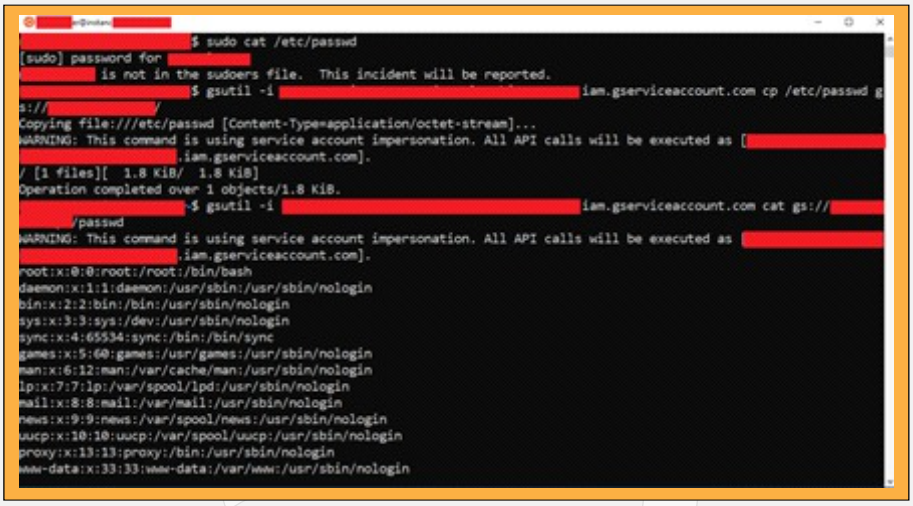


RECOMMENDED REMEDIATION #4	CRITICALITY: CRITICAL (25)
PRIVILEGE ESCALATION	LOCATION: GCP BUCKET

Configure the permissions of the bucket to not allow service accounts to escalate privileges. Having *storage.buckets.setIamPolicy* may allow a user to modify the IAM policy of the specified resource to grant himself/herself a role on it, thus granting him/her additional privileges at the resource level.

VULNERABILITY #5	CRITICALITY: CRITICAL (27)
MISCONFIGURED SERVICE ACCOUNT	LOCATION: SESSION MANAGEMENT

We were able to extract a credentials file (/etc/passwd) through a misconfigured service account. As can be shown in the following screenshot, we first try to read the /etc/passwd file using sudo, which then tells us that the user does not have the required permissions. Next, we utilize gsutil to copy the credentials file (/etc/passwd) to a bucket. The passwd file can then be read from the bucket as shown:

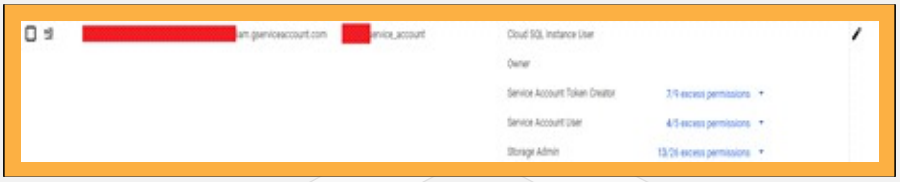


RECOMMENDED REMEDIATION #5	CRITICALITY: CRITICAL (27)
MISCONFIGURED SERVICE ACCOUNT	LOCATION: SESSION MANAGEMENT

Review and remove the bucket storage permission from the service account.

VULNERABILITY #6	CRITICALITY: VERY HIGH (24)
MORE THAN REQUIRED PERMISSIONS	LOCATION: GCP IAM

Authorization vulnerability and principles of least privilege are violated here. This service account is given more roles than it is required for its function, and these roles can lead to perform impersonation, letting users access files and folder without having permission to do so at the instance level.

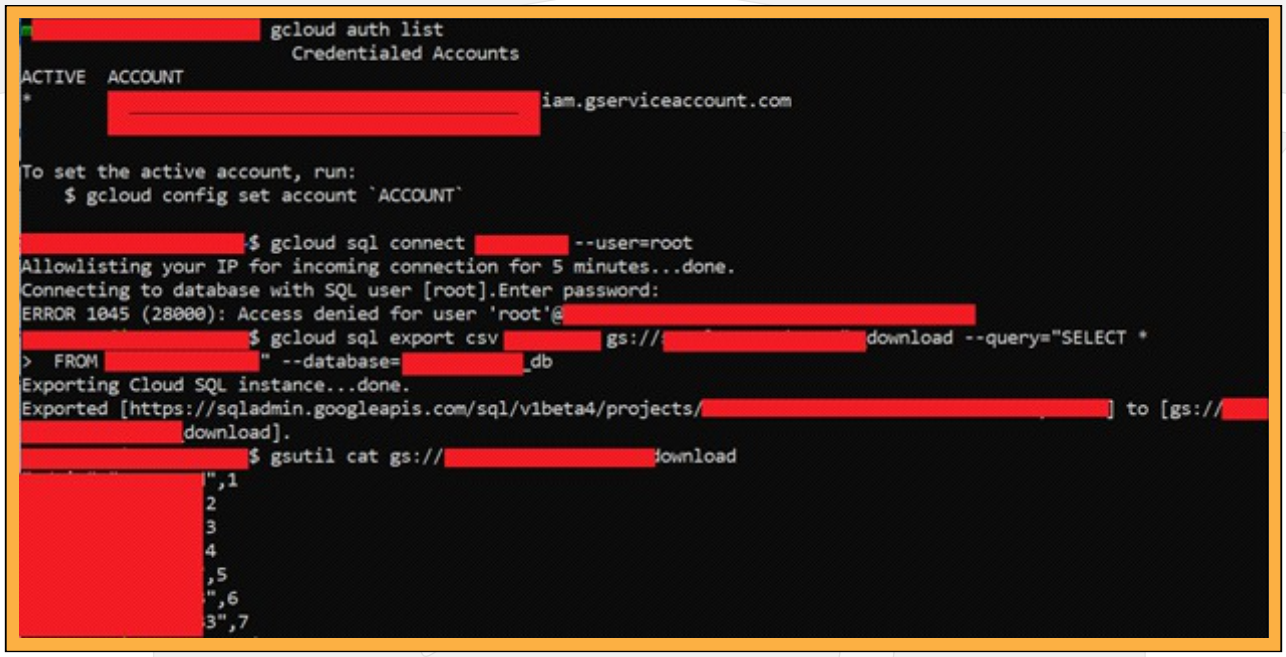


RECOMMENDED REMEDIATION #6	CRITICALITY: VERY HIGH (24)
MORE THAN REQUIRED PERMISSIONS	LOCATION: GCP IAM

Follow the principles of least privilege and only allow required permissions on this service account. Do not permit additional permissions that are not required by the role.

VULNERABILITY #7	CRITICALITY: CRITICAL (27)
INSTANCE MISCONFIGURATION	LOCATION: SQL INSTANCE

Here the permissions given to the SQL instance are not limited and access to bucket storage can lead users who do not have permissions to access SQL to export the entire SQL database:

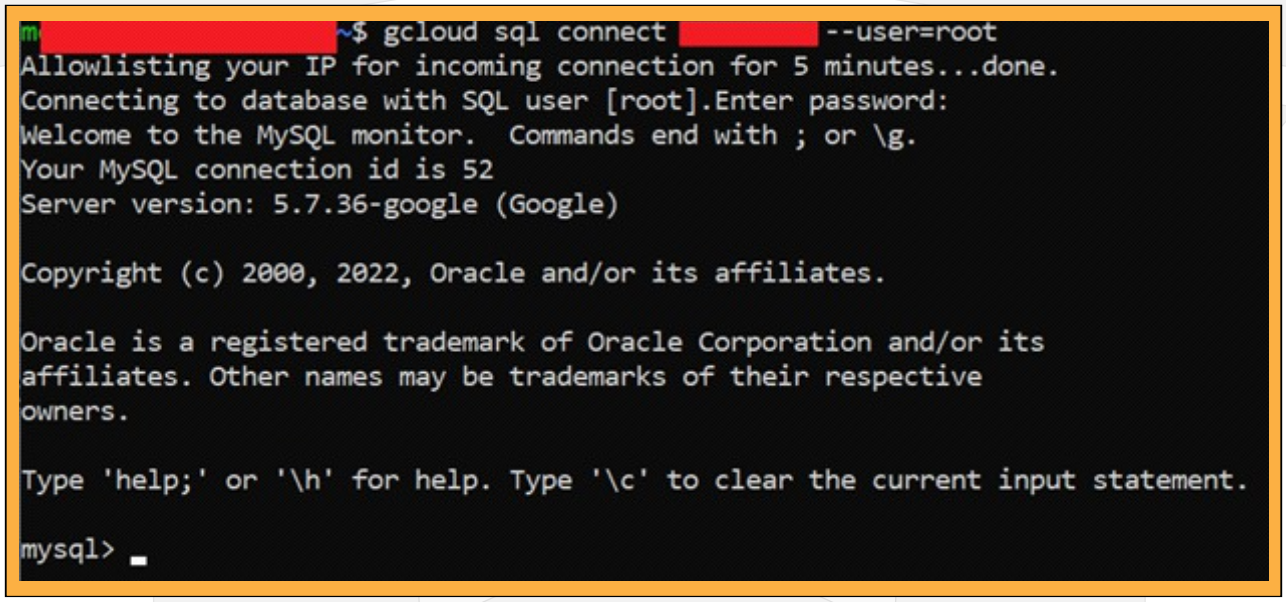


RECOMMENDED REMEDIATION #7	CRITICALITY: CRITICAL (27)
INSTANCE MISCONFIGURATION	LOCATION: SQL INSTANCE

Remove the permission of SQL instance to access the storage buckets.

VULNERABILITY #8	CRITICALITY: VERY HIGH (24)
PASSWORD COMPLEXITY	LOCATION: GCP SQL SERVER

Root access to the SQL server is enabled and password used is less than 6 characters containing only lower-case alphabets.

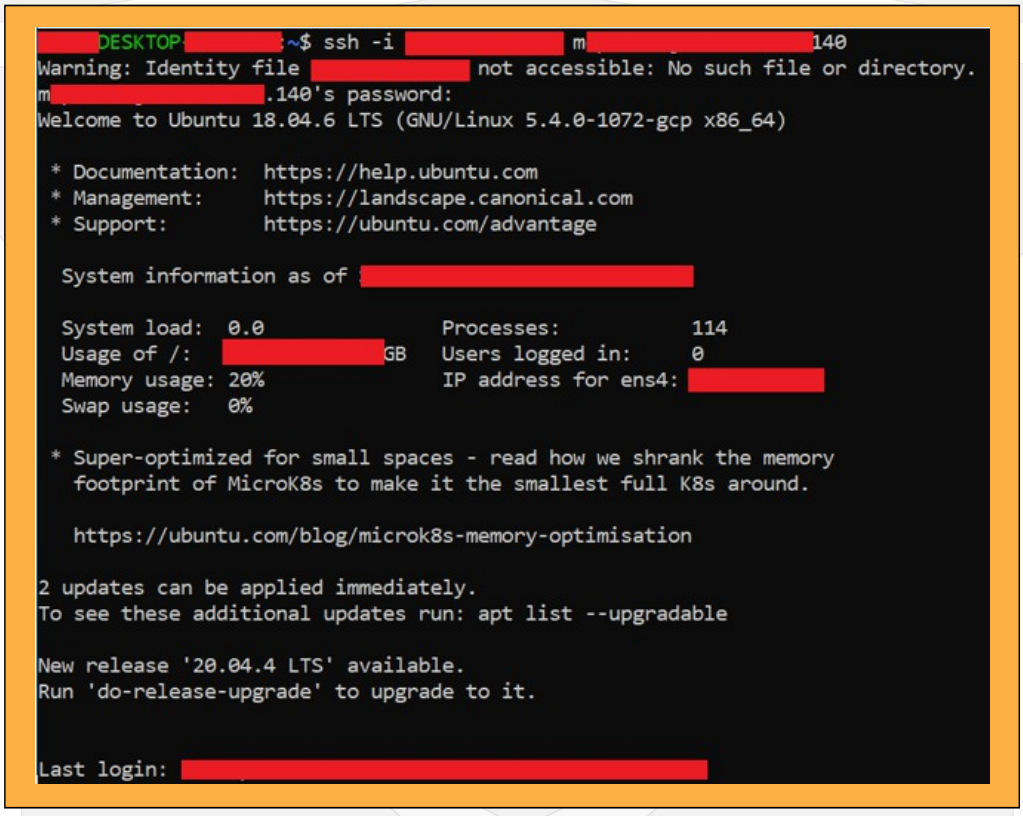


RECOMMENDED REMEDIATION #8	CRITICALITY: VERY HIGH (24)
PASSWORD COMPLEXITY	LOCATION: GCP SQL SERVER

Remove the root access via MySQL until absolutely necessary. Also, put in place a strong password policy.

VULNERABILITY #10	CRITICALITY: HIGH (14)
PUBLIC KEY CRYPTOGRAPHY VS PASSWORD	LOCATION: APPLICATION INSTANCE

SSH to the instance is possible via password. Since the instance is of critical sensitivity and importance to the environment, it should not utilize a password authentication mechanism, but instead public key cryptography.



RECOMMENDED REMEDIATION #10	CRITICALITY: HIGH (14)
PUBLIC KEY CRYPTOGRAPHY VS PASSWORD	LOCATION: APPLICATION INSTANCE

Public/Private keys and public key cryptography infrastructure should replace password authentication.

VULNERABILITY #11	CRITICALITY: HIGH (14)
PASSWORD POLICY OPTIMIZATION	LOCATION: APPLICATION INSTANCE

The password policy for users of the instance is not optimized. Passwords with less than 6 characters and only alphabets are allowed. Furthermore, password expiration days are set to default, 99999, and should be shortened to allow for password rotation.

```
[redacted]$ sudo cat /etc/pam.d/common-password | grep password
# /etc/pam.d/common-password - password-related modules common to all services
# used to change user passwords.  The default is pam_unix.
# The "sha512" option enables salted SHA512 passwords.  Without this option,
password        [success=1 default=ignore]      pam_unix.so obscure sha512
password        requisite                       pam_deny.so
password        required                        pam_permit.so
```

```
[redacted]$ sudo cat /etc/login.defs | grep PASS_
#       PASS_MAX_DAYS   Maximum number of days a password may be used.
#       PASS_MIN_DAYS   Minimum number of days allowed between password changes.
#       PASS_WARN_AGE   Number of days warning given before a password expires.
PASS_MAX_DAYS   99999
PASS_MIN_DAYS   0
PASS_WARN_AGE   7
#PASS_CHANGE_TRIES
#PASS_ALWAYS_WARN
#PASS_MIN_LEN
#PASS_MAX_LEN
```

RECOMMENDED REMEDIATION #11	CRITICALITY: HIGH (14)
PASSWORD POLICY OPTIMIZATION	LOCATION: APPLICATION INSTANCE

Make password policy strong for example set minimum length to 12 while using upper case, lower case, numbers and special characters wtihin.

VULNERABILITY #11	CRITICALITY: HIGH (14)
OPEN PORTS AND LOGGING OFF	LOCATION: GCP FIREWALL

There present several default ports and other ports maybe opened during pre-production environment which are still present for example testservices which lets TCP ports 1111 and 1234 publicly accessible. On top of this only secure protocols are marked with logs “On”. It is not a good practice to turn logging off for ingress ports especially when they are publicly accessible.

Filter Enter property name or value

Name	Type	Targets	Filters	Protocols / ports	Action	Priority	Network	Logs
default-allow-http	Ingress	http-server	IP ranges: 0.0.0.0/0	tcp:80	Allow	1000	default	Off
default-allow-https	Ingress	https-server	IP ranges: 0.0.0.0/0	tcp:443	Allow	1000	default	On
httppython	Ingress	Apply to all	IP ranges: 0.0.0.0/0	tcp:1234	Allow	1000	default	Off
testservices	Ingress	testservice	IP ranges: 0.0.0.0	tcp:1111, 1234	Allow	1000	default	Off
default-allow-icmp	Ingress	Apply to all	IP ranges: 0.0.0.0/0	icmp	Allow	65534	default	Off
default-allow-internal	Ingress	Apply to all	IP ranges: 10.128.0.0/9	tcp:0-65535 udp:0-65535 icmp	Allow	65534	default	Off
default-allow-rdp	Ingress	Apply to all	IP ranges: 0.0.0.0/0	tcp:3389	Allow	65534	default	Off
default-allow-ssh	Ingress	Apply to all	IP ranges: 0.0.0.0/0	tcp:22	Allow	65534	default	On

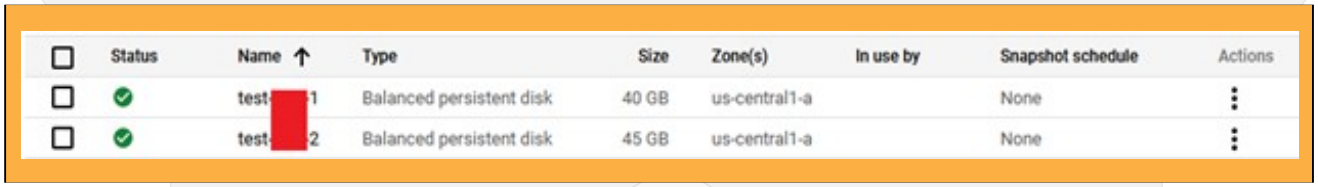
RECOMMENDED REMEDIATION #11	CRITICALITY: HIGH (14)
OPEN PORTS AND LOGGING OFF	LOCATION: GCP FIREWALL

Turn off all nonsecure ports such as HTTP (80) and ports meant for pre-production. Turn on filtering logging on those ports which are open.

RECOMMENDATIONS FOR BEST PRACTICES

RECOMMENDATION [1] UNATTACHED STORAGE BUCKET	CRITICALITY: (N.A.)

There are unattached disks with prefix “test” found. These unattached disks are currently participating in a significant amount of monthly billing, consider backing them up and removing them if they are no longer in utilization.



Status	Name	Type	Size	Zone(s)	In use by	Snapshot schedule	Actions
✓	test[redacted]1	Balanced persistent disk	40 GB	us-central1-a		None	⋮
✓	test[redacted]2	Balanced persistent disk	45 GB	us-central1-a		None	⋮

RECOMMENDATIONS FOR BEST PRACTICES

RECOMMENDATION [2] NO AUTOMATIC SNAPSHOTS	CRITICALITY: (N.A.)

Schedule periodic snapshots of the instances which would assist in data recovery or rolling back to previous versions.

Status	Name ↑	Type	Size	Zone(s)	In use by	Snapshot schedule	Actions
✓	[redacted]	Balanced persistent disk	[redacted]GB	europe-west3-c	[redacted]	None	⋮
✓		Balanced persistent disk	[redacted]GB	europe-west3-c		None	⋮

SECURITY MATRIX

No.	Interface	Attack Path	Result
1.	GCP Bucket	Misconfigured permissions on Google bucket can lead to privilege escalation.	Exploitable
2.	Google Instance	Miconfigured service let a user export sensitive data and read which he or she can't normally.	Exploitable
3.	GCP IAM	Service account is giving some storage and admin permissions which is not a good practice.	N.A.
4.	SQL Server	Misconfigured permission to storage handling liked to SQL can let a user to export data and read it wehich he or she can't normally.	Exploitable
5.	IAM	Password complexity is very low, have demostrated accessing services like SQL server by burteforcing the password easily.	Exploitable
6.	SSH	SSH allows connection via password when key is not provided. Since password complexity is low it is not advicable.	N.A.
7.	GCP Firewall	There are unsued open ports and services like filtering and logging is off for a number of ports.	N.A.

KNOWN VULNERABILITIES / END OF LIFE

No.	CVE	Affected	CVE - Details	CVSS	Result
1.	CVE-2015-9251	Jquery 2.1.1	jQuery before 3.0.0 is vulnerable to Cross-site Scripting (XSS) attacks when a cross-domain Ajax request is performed without the dataType option, causing text/javascript responses to be executed.	6.1	Exploitable

RECOMMENDATIONS

Recommendations	Description	Required immediate remediation
REC [1]: Unattached google storage buckets.	There are unattached disks with prefix “test” found. These unattached disks are currently participating in a significant amount of monthly billing, consider backing them up and removing them if they are no longer in utilization.	NO
REC [2]: No automatic snapshots.	Schedule periodic snapshots of the instances which would assist in data recovery or rolling back to previous versions.	NO

APPENDIX

1. CRITICALITY RATING:

Listed below are the vulnerability ratings for the first two vulnerabilities. This section has been redacted, please refer to the full report for criticality ratings for all the vulnerabilities found.

1.A VULN [1]:

Factor	Value	Points
Time	<= 1 week	15
Expertise	Layman	8
Knowledge required	Restricted information	7
Access to product by	Moderate	1
Type of equipment	Standard	2
Total	33	

1.B VULN [2]:

Factor	Value	Points
Time	<= 1 week	15
Expertise	Competent	6
Knowledge required	Restricted information	7
Access to product by	Easy	4
Type of equipment	Standard	2
Total	34	

2. CRITICALITY REFERENCE TABLE:

Factor	Value	
Time taken for the exploitation	<= 1 day	18
	<= 1 week	15
	<= 2 weeks	13
	<= 1 month	10
	<= 2 months	7
	<= 3 months	4
	<= 4 months	2
	<= 5 months	1
	>5 months	0
Attacker skills	Layman	8
	Competent	6
	Expert	3
	Multiple experts	0
Knowledge required by the attacker	None	11
	Restricted information	7
	Sensitive information	3
	Critical information	0

Factor	Value	
Access to the product by the attacker	Not necessary/unlimited	10
	Easy	4
	Moderate	1
	Difficult	0
	None	N.A.
Type of equipment needed	None/ standard	2
	Specialised software	0

3. TOOLS REFERENCED:

Tool	Version
Burp Suite professional	2021.4
Nmap	7.4p
Firefox browser	21
GCPBucketBrute	N.A.
gcloud	N.A

4. ACRONYMS:

Acronyms	Full Form
SSH	Secure Shell
HTTP	HyperText Transfer Protocol
HTTPS	Secure HyperText Transfer Protocol
GCP	Google Coud Platform