tcs | TATA CONSULTANCY SERVICES

InfraMind

Discovering the next in IT

Season IV

Autonomous IT

Name	Shubham Deepakrao Kondekar
Reg No.	CT20182513257
Contact No.	+91-9960595451
Email-ID	kondekarshubham123@gmail.com
College Name	Walchand Institute of Technology, Solapur.

GitHub link

https://github.com/kondekarshubham123/TCS-inframind-season-iv.git

Presentation link

https://youtu.be/hfi0gEG_gu0

Index

1. Introduction

Autonomous Infrastructure is designed to **automate the Infrastructure Life-Cycle management from build to decommission**. It leverages Machine Learning functionality which helps to assimilate the information that it needs to take care of itself. It monitors the overall utilization of the ecosystem in various aspects i.e. CPU, Memory, Disk, Network and create the pattern of utilization[1].

Based on trends it will recommend and automate the sizing of the infrastructure in an effort to avoid performance problems. Autonomous Infrastructure **helps to reduce the manual intervention and also minimize human error**. An Autonomous Infrastructure can help organizations minimize that spend and boost service assurance, resulting in broad business benefits[1].

In this project we are going to **deploy a wordpress application on Google Cloud Platform** using various automation technologies like Terraform, Ansible, Deployment Manager and etc. also we will be continuously monitoring the Infrastructure.

Lets begin ...

2. Problem Statement

One of the Retail customers is looking to **automate various phases of Infrastructure Lifecycle** i.e., Design, Build, Operate & Optimize. Overall objectives of the Autonomous Infrastructure are to improve agility of the business requirement and reduce manual intervention while managing the overall lifecycle of application[2].

Overall Solution consist of

1. Create the WordPress application stack – 2 Servers, 1 ELB (1-LB, 1-Apache PHP, 1-MySql).
2. Patch the system to the latest kernel and security updates.
3. Create the test Blog site.
4. Create self-healing automation which will monitor the Apache-PHP and MySQL process and in case it is not running/hung it will stop/start the daemon/process.
5. Add Apache-PHP server in case of increase in CPU utilization above 70-80%.

Consideration[2] :
https://github.com/kondekarshubham123/TCS-inframind-season-iv/wiki/Consideration

Approach[2]:

https://github.com/kondekarshubham123/TCS-inframind-season-iv/wiki/APPROACH

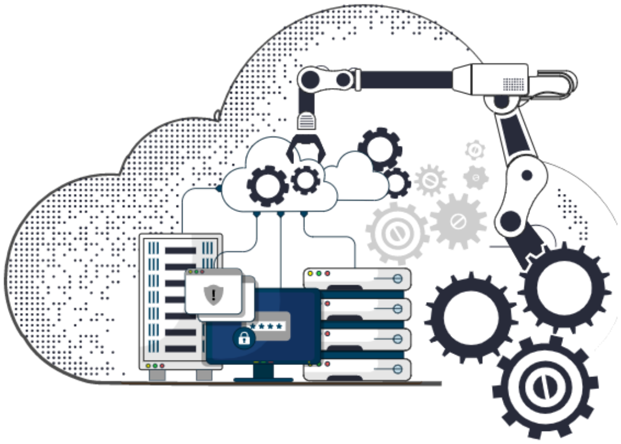


Image Credit: inedo.com

3 . Details of technology used

1. Google Cloud Platform

Google Cloud Platform is a suite of cloud computing services that runs on the same infrastructure that Google uses internally for its end-user products, such as Google Search, Gmail, file storage, and YouTube.[3]

- For this project we are going to use GCP's following services:
    1. Compute Engine
    2. Cloud SQL
    3. Google Storage
    4. VPC network
    5. HTTP load balancer
    6. Deployment Manager

The following figure shows all the features and services provided by GCP.

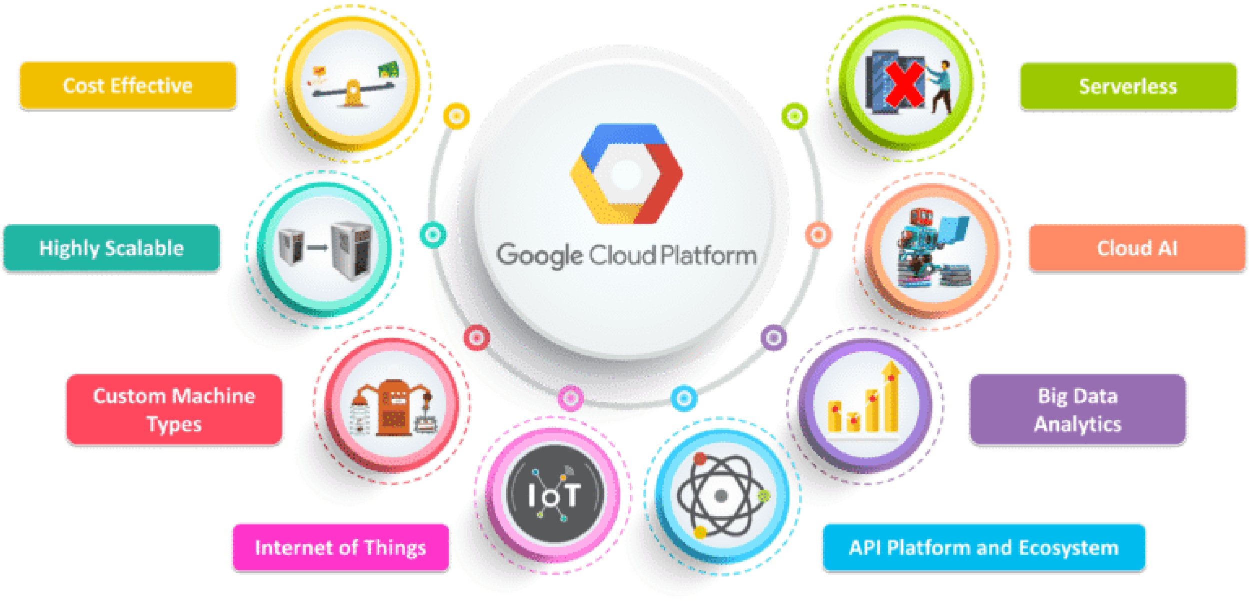


Fig. Cloud Benefits Image Credit: edureka.co

2. Deployment Manager

Google Cloud Deployment Manager is an **infrastructure deployment service that automates the creation and management** of Google Cloud resources. With a flexible template and configuration files and use them to create deployments that have a variety of Google Cloud services, such as Cloud Storage, Compute Engine, and Cloud SQL, configured to work together.[4]

Fig. Deployment Manager

3. Terraform

Terraform is an open-source infrastructure as code software tool **that provides a consistent CLI workflow to manage hundreds of cloud services.** Terraform codifies cloud APIs into declarative configuration files.[5]

Fig. Terraform

4. Stackdriver

Stackdriver Monitoring **measures the health of cloud resources and applications by providing visibility into metrics such as CPU usage, disk I/O, memory, network traffic and uptime**. It is based on collectd, an open source daemon that collects system and application performance metrics.[6]

Fig. Stackdriver

4. Required Software and Infrastructure Design

- This project consists of following softwares on GCP.

a. Operating System : Debian GNU/Linux 9 (Stretch)
b. Database : Cloud SQL (MySQL 5.7)
c. Other Binaries : Wordpress app (Version 5.6 “Simone”)
d. Automation tools :
   1. Deployment Manager
   2. Terraform

Base softwares:

Automation tools:

Infrastructure Design:

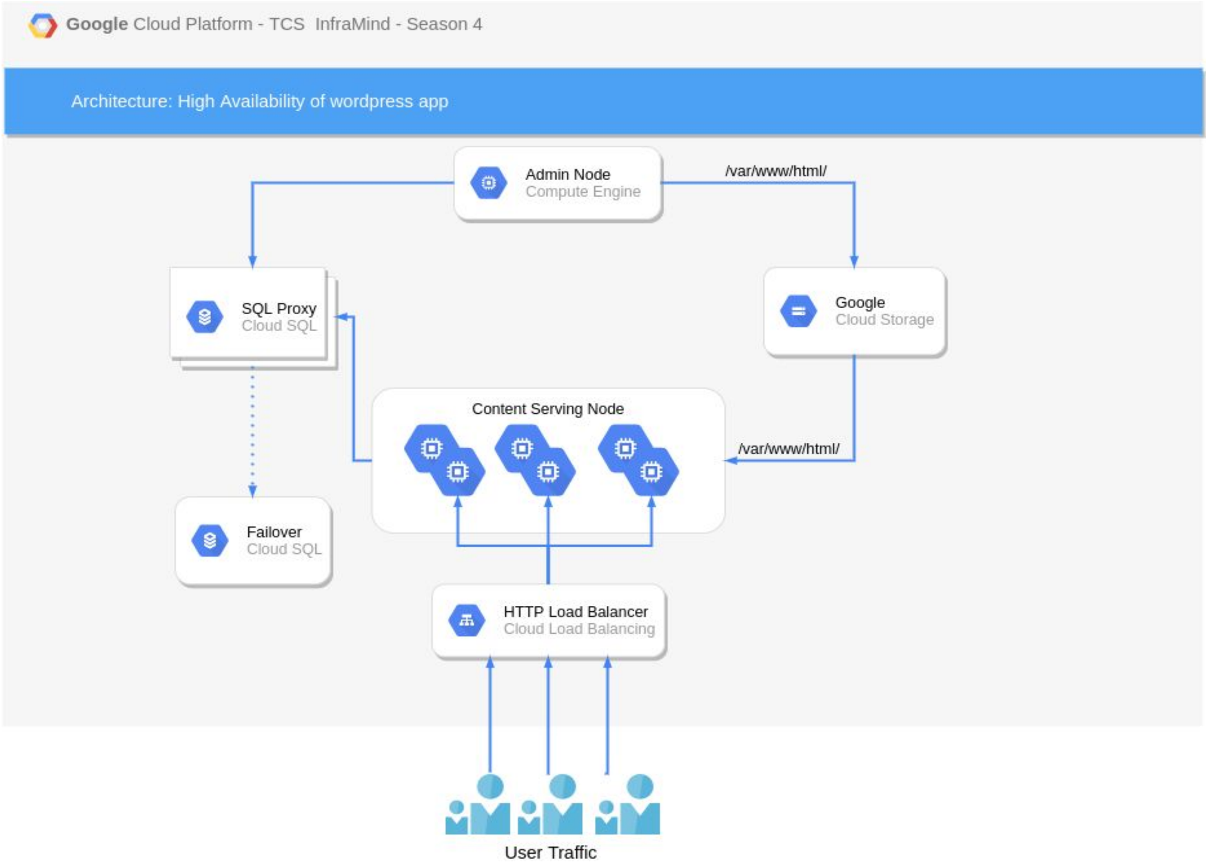


Fig: Infrastructure Design

From the above figure, there are **two sections** in infrastructure design.

1. **Project section:**
    - Admin node have all the administration power, admin can change permissions for gcps services like Cloud storage,Cloud SQL,Nodes and Load Balancer too.
    - Load balancer splits external traffic and helps to reduce cpu utilization.

2. **Client section :**
    - User traffic comes from the client section.

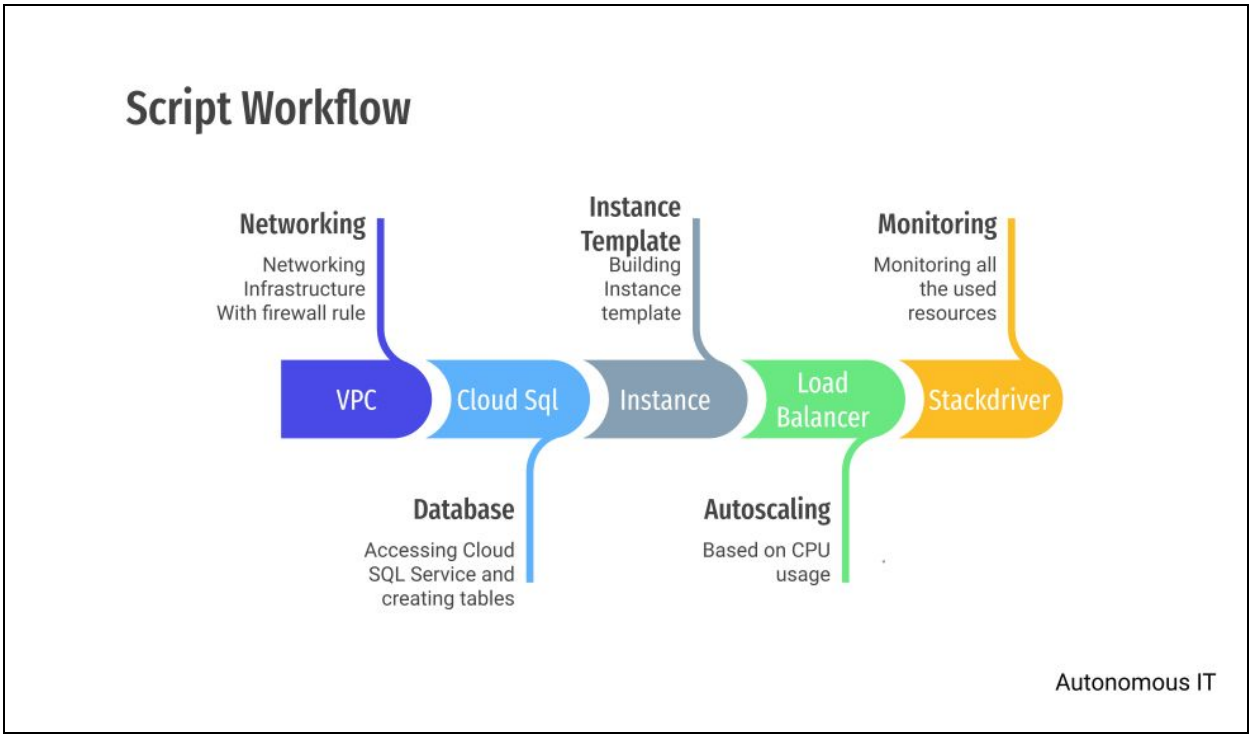
5. Solution and workflow

Automation is the process of **building infrastructure in automated fashion and reducing manual efforts and errors**. The solution uses the same strategy.

Overall **solution is template driven**, just we have to run the script. It will **automatically create VPN networks, managing databases, deploying template ,etc**. Without manual work which reduces a lot of time and manpower.

The overall solution consist of **5 stages** which are:

1. **Networking**
2. **Database**
3. **Template**
4. **Autoscaling**
5. **Monitoring**


Script Workflow
Networking
Networking Infrastructure With firewall rule
Instance Template
Building Instance template
Monitoring
Monitoring all the used resources
VPC
Cloud Sql
Instance
Load Balancer
Stackdriver
Database
Accessing Cloud SQL Service and creating tables
Autoscaling
Based on CPU usage
Autonomous IT

The **five stages** are as follows:

1. **Networking:**

   On cloud **every service is virtually available so to manage all the compute instances we need a proper network planning** so this is the first and most important stage to deploy apps in an automated way.

   Feel free to **check all the configuration of network and firewall rules** used in this project here:

   VPC Network and Firewall rule configuration

2. **Database:**

   Database creation is also an important stage while deployment. As **all the required data like blog page details,posts are stored in it.** Here cloud sql service is used for data storing purposes. Internally **it uses MySQL service.**

   Feel free to **check all the configuration of database and tables** used in this project here:

   Database configuration

3. **Instance template:**

   Instance template is **blueprint of compute engine instance**. Defining instance template will **help for launching more compute engine instances with the same configuration** as per requirement.

   Feel free to **check all the configuration of instance templates and instance groups** used in this project here:

   Instance template and Instance groups configuration

4. **Autoscaling:**

   Stackdriver keeps track of cpu usage. **As soon as CPU usage capacity hits its defined threshold it will automatically launch new instances** with all the configurations provided in the instance template.

   Feel free to **check all the configuration of load balancer** used in this project here:

   Load Balancer configuration

5. **Monitoring:**

   Monitoring is the last step in Automation IT. it **keeps tracing and logging of all the services and apis used for deployment.** If any error found it will trigger cloud functions which automatically restart the service.

   Feel free to **check all the configurations of stackdriver tools** used in this project here:

   Stackdriver configuration

6. Security aspects and Deployment steps

Security Aspects:

Implementing information security in an organisation **can protect the technology and information assets it uses by preventing, detecting and responding to threats,** both internal and external.

On any **cloud security is shared responsibility of both cloud provider and client.** Cloud providers should maintain security physical infrastructure and clients should check security issues at deployed applications.

Google cloud platform gives guarantee of trust and security. Documentation of the privacy and security statements from google is here

Being an application administrator, [fig. Infrastructure Design] our infrastructure is designed by looking towards secure wordpress deployment i.e. only the admin node should configure the database.

Deployment Steps:

There are tons of automation technologies available in the market for building given infrastructure automatically. From that I'm **providing a script for deploying a high availability wordpress app using two technologies.**

1. **Using Deployment Manager**

   Please feel free to check deployment steps for Deployment manager here or

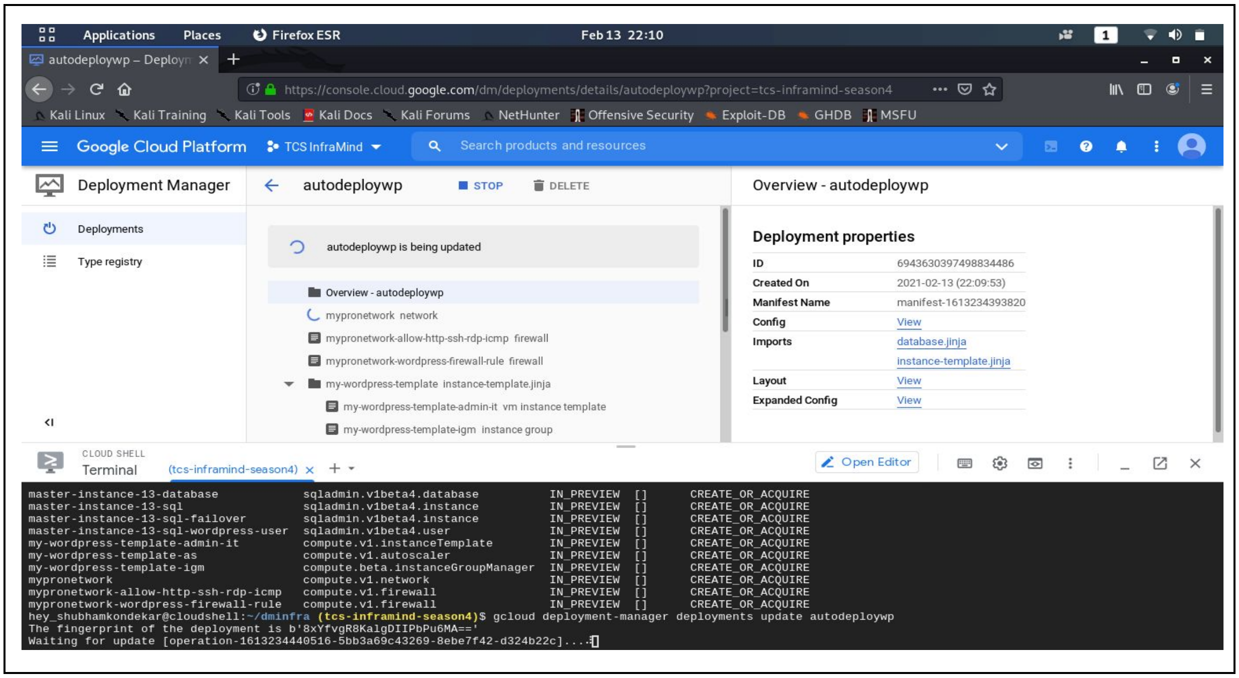
   Link : https://github.com/kondekarshubham123/TCS-inframind-season-iv/wiki/Deployment-Steps#using-deployment-manager

2. **Using Terraform**

   Please feel free to check deployment steps for Terraform here or

   Link: https://github.com/kondekarshubham123/TCS-inframind-season-iv/wiki/Deployment-Steps#using-terraform

7. Application Interface



autodeploywp is being updated

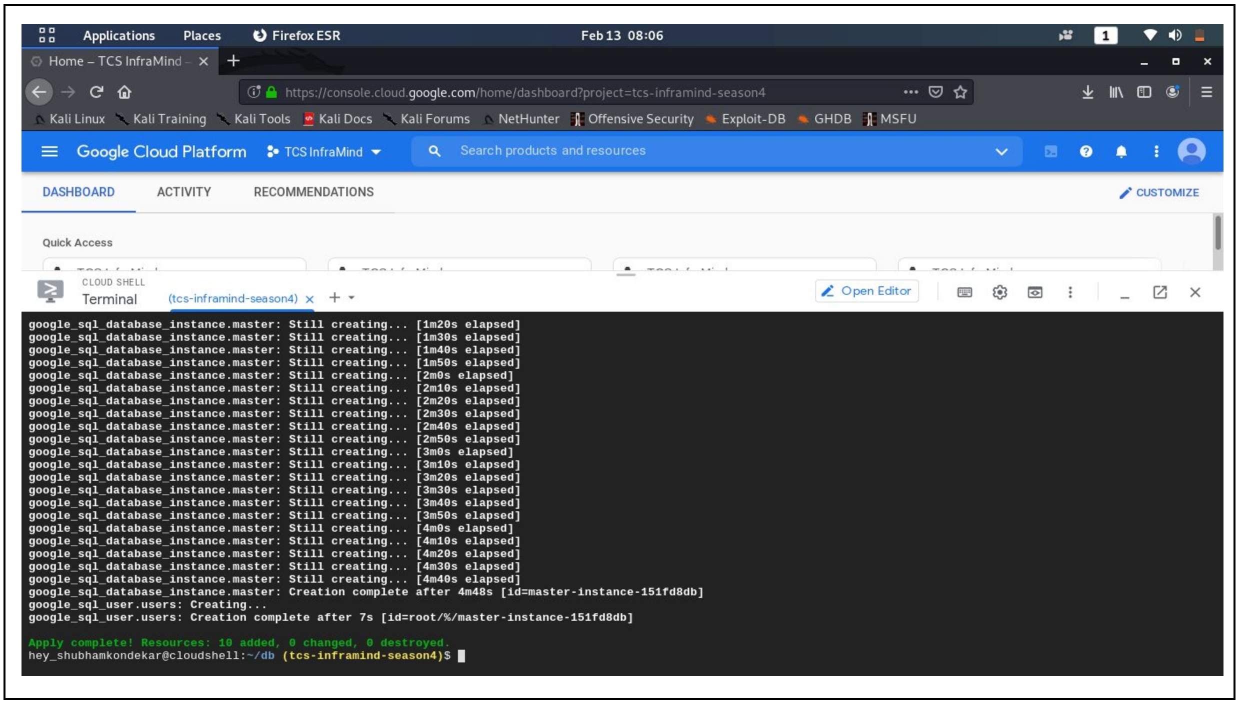
- Overview - autodeploywp
- mypronetwork network
- mypronetwork-allow-http-ssh-rdp-icmp firewall
- mypronetwork-wordpress-firewall-rule firewall
- my-wordpress-template instance-template.jinja
  - my-wordpress-template-admin-it vm instance template
  - my-wordpress-template-igm instance group

Deployment properties

ID	6943630397498834486
Created On	2021-02-13 (22:09:53)
Manifest Name	manifest-1613234393820
Config	View
Imports	database.jinja instance-template.jinja
Layout	View
Expanded Config	View

```
master-instance-13-database              sqladmin.v1beta4.database           IN_PREVIEW  []      CREATE_OR_ACQUIRE
master-instance-13-sql                   sqladmin.v1beta4.instance           IN_PREVIEW  []      CREATE_OR_ACQUIRE
master-instance-13-sql-failover          sqladmin.v1beta4.instance           IN_PREVIEW  []      CREATE_OR_ACQUIRE
master-instance-13-sql-wordpress-user    sqladmin.v1beta4.user               IN_PREVIEW  []      CREATE_OR_ACQUIRE
my-wordpress-template-admin-it           compute.v1.instanceTemplate         IN_PREVIEW  []      CREATE_OR_ACQUIRE
my-wordpress-template-as                 compute.v1.autoscaler               IN_PREVIEW  []      CREATE_OR_ACQUIRE
my-wordpress-template-igm                compute.beta.instanceGroupManager   IN_PREVIEW  []      CREATE_OR_ACQUIRE
mypronetwork                             compute.v1.network                  IN_PREVIEW  []      CREATE_OR_ACQUIRE
mypronetwork-allow-http-ssh-rdp-icmp     compute.v1.firewall                 IN_PREVIEW  []      CREATE_OR_ACQUIRE
mypronetwork-wordpress-firewall-rule     compute.v1.firewall                 IN_PREVIEW  []      CREATE_OR_ACQUIRE
hey_shubhamkondekar@cloudshell:~/dminfra (tcs-inframind-season4)$ gcloud deployment-manager deployments update autodeploywp
The fingerprint of the deployment is b'8xYfvgR8KalgDIIPbPu6MA=='
Waiting for update [operation-1613234440516-5bb3a69c43269-8ebe7f42-d324b22c]....
```

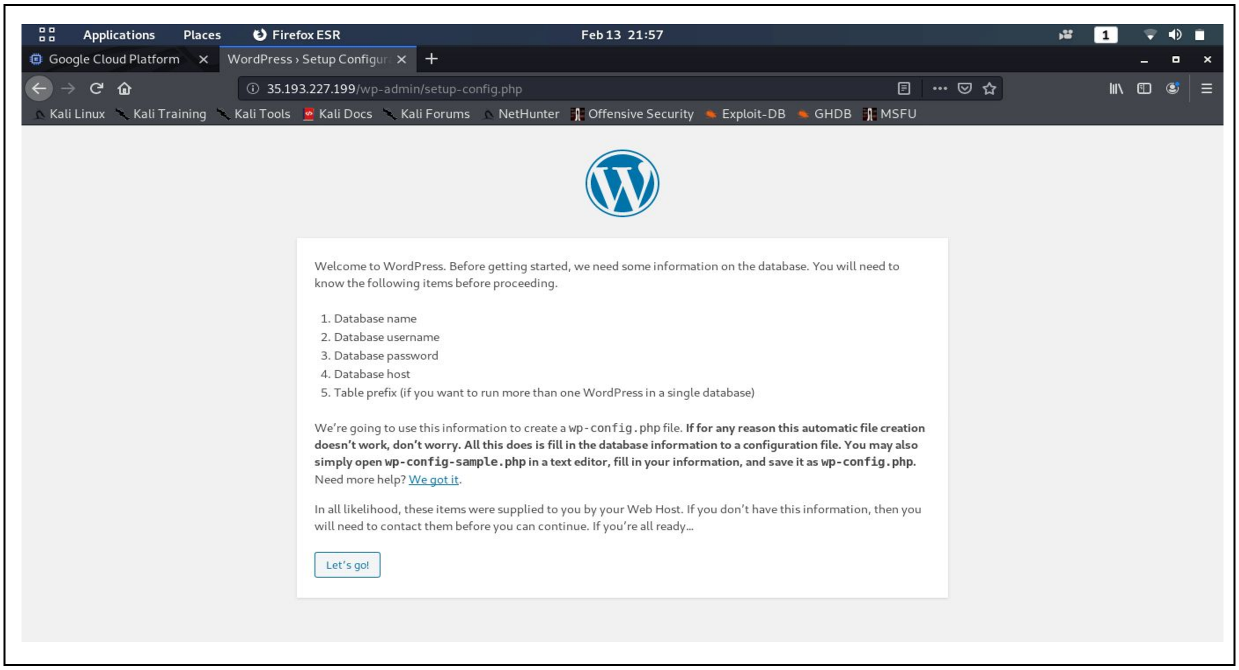
Fig: Automatic Deployment of wordpress app deployment using gcp's **Deployment Manager** tool.



```
google_sql_database_instance.master: Still creating... [1m20s elapsed]
google_sql_database_instance.master: Still creating... [1m30s elapsed]
google_sql_database_instance.master: Still creating... [1m40s elapsed]
google_sql_database_instance.master: Still creating... [1m50s elapsed]
google_sql_database_instance.master: Still creating... [2m0s elapsed]
google_sql_database_instance.master: Still creating... [2m10s elapsed]
google_sql_database_instance.master: Still creating... [2m20s elapsed]
google_sql_database_instance.master: Still creating... [2m30s elapsed]
google_sql_database_instance.master: Still creating... [2m40s elapsed]
google_sql_database_instance.master: Still creating... [2m50s elapsed]
google_sql_database_instance.master: Still creating... [3m0s elapsed]
google_sql_database_instance.master: Still creating... [3m10s elapsed]
google_sql_database_instance.master: Still creating... [3m20s elapsed]
google_sql_database_instance.master: Still creating... [3m30s elapsed]
google_sql_database_instance.master: Still creating... [3m40s elapsed]
google_sql_database_instance.master: Still creating... [3m50s elapsed]
google_sql_database_instance.master: Still creating... [4m0s elapsed]
google_sql_database_instance.master: Still creating... [4m10s elapsed]
google_sql_database_instance.master: Still creating... [4m20s elapsed]
google_sql_database_instance.master: Still creating... [4m30s elapsed]
google_sql_database_instance.master: Still creating... [4m40s elapsed]
google_sql_database_instance.master: Creation complete after 4m48s [id=master-instance-151fd8db]
google_sql_user.users: Creating...
google_sql_user.users: Creation complete after 7s [id=root/%/master-instance-151fd8db]

Apply complete! Resources: 10 added, 0 changed, 0 destroyed.
hey_shubhamkondekar@cloudshell:~/db (tcs-inframind-season4)$
```

Fig: Automatic Deployment of wordpress app deployment using **Terraform** tool.



Welcome to WordPress. Before getting started, we need some information on the database. You will need to know the following items before proceeding.

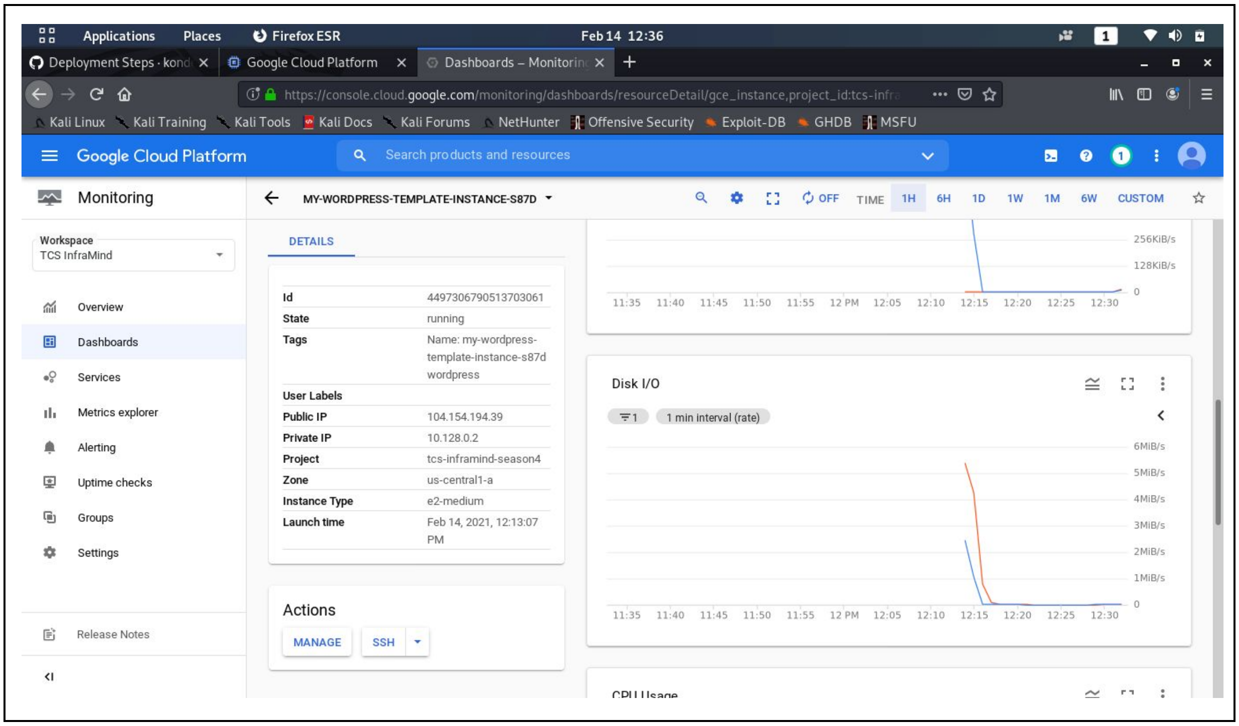
1. Database name
2. Database username
3. Database password
4. Database host
5. Table prefix (if you want to run more than one WordPress in a single database)

We're going to use this information to create a `wp-config.php` file. **If for any reason this automatic file creation doesn't work, don't worry. All this does is fill in the database information to a configuration file. You may also simply open `wp-config-sample.php` in a text editor, fill in your information, and save it as `wp-config.php`.** Need more help? We got it.

In all likelihood, these items were supplied to you by your Web Host. If you don't have this information, then you will need to contact them before you can continue. If you're all ready…

Let's go!

Fig: **Wordpress app** {First time setup view}.



Id	4497306790513703061
State	running
Tags	Name: my-wordpress-template-instance-s87d wordpress
User Labels	
Public IP	104.154.194.39
Private IP	10.128.0.2
Project	tcs-inframind-season4
Zone	us-central1-a
Instance Type	e2-medium
Launch time	Feb 14, 2021, 12:13:07 PM

Fig: Stackdriver **Monitoring Dashboard**

Feel free to check more images from Image-Gallery.

8. Conclusion

"The rule of the cloud is to ruthlessly automate everything"
- Pat Gelsinger

Image Credit: benmeadowcroft

Automation is "The creation and application of technology to deploy, monitor and control the production and delivery of products and services."

This project of Autonomous IT helps **building applications by eliminating many of the manual tasks**. At the same time, **increased levels of automation will serve to reduce the cost** of labor associated with managing IT.

9. References

[1] Campus Commune introduction to Autonomous Infrastructure

https://campuscommune.tcs.com/contests/tcs-inframind-season-4

[2] Problem Statement

https://cc-uploads.s3.amazonaws.com/open_links/INFRAMIND_Season4_Round2_Autonomous_IT.pdf

[3] Google cloud Platform

https://cloud.google.com/docs

[4] Google Deployment Manager

https://cloud.google.com/deployment-manager/docs

[5] Terraform

https://registry.terraform.io/providers/hashicorp/google/latest/docs

[6] Stackdriver

https://cloud.google.com/stackdriver/docs