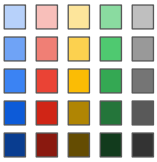
Google Cloud Platform

Cloud IAM

Authentication
Access and
Authorization

v 1.0



Agenda

1. Cloud Identity and Access Management (Cloud IAM)
2. Organization
3. Roles
4. Members
5. Service accounts
6. Cloud IAM Best Practices
7. Lab
8. Review

Identity and Access Management

Who | can do what | on which resource

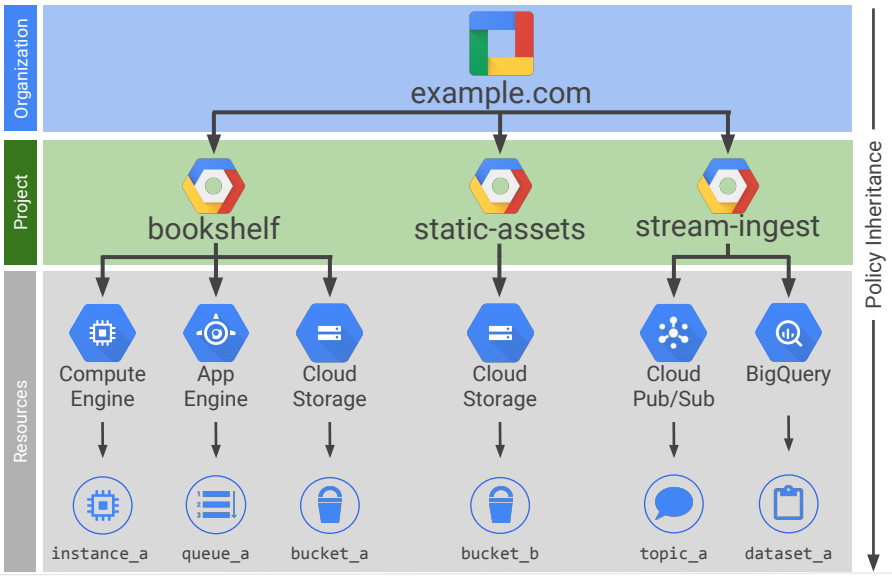
Project Owners invite members to projects and grant roles. Roles consist of a collection of permissions for one or more resources.

IAM objects

- Organization
- Projects
- Members
- Roles
- Resources
- Products
- **G Suite** Super Admins

IAM Resource Hierarchy

- A policy is set on a resource
  - Each policy contains: Set of roles, role members
- Resources inherit policies from parent
  - Resource policies are a union of parent and resource
- If parent policy less restrictive, overrides more restrictive resource policy



Cloud Platform resources are organized hierarchically, where the Organization node is the root node in the hierarchy, the projects are the children of the Organization, and the other resources are the children of projects. Each resource has exactly one parent.

IAM allows you to set policies at the following levels of the resource hierarchy:

- Organization level. The Organization resource represents your company. IAM roles granted at this level are inherited by all resources under the organization.
- Project level. Projects represent a trust boundary within your company. Services within the same project have a default level of trust. For example, App Engine instances can access Cloud storage buckets within the same project. IAM roles granted at the project level are inherited by resources within that project. When setting policies at the project level, be sure to use audit logs to track project level permission changes.
- Resource level. In addition to the existing Cloud Storage and BigQuery ACL systems, additional resources such as Genomics Datasets and Pub/Sub topics support resource-level roles so that you can grant certain users permission to a single resource.

Resources inherit the policies of the parent resource. If you set a policy at the

organization level, it is automatically inherited by all its children projects, and if you set a policy at the project level, it is inherited by all its children resources. The effective policy for a resource is the union of the policy set at that resource and the policy inherited from its parent. This policy inheritance is transitive; in other words, resources inherit policies from the project, which inherit policies from the organization. Therefore, the organization-level policies also apply at the resource level.

The IAM policy hierarchy follows the same path as the Cloud Platform resource hierarchy. If you change the resource hierarchy, the policy hierarchy changes as well. For example, moving a project into an organization will update the project's IAM policy to inherit from the organization's IAM policy.

Child policies cannot restrict access granted at the parent. For example, if you grant editor role to a user for a project, and grant viewer role to the same user for a child resource, then the user still has editor role for the child resource. When using IAM, a best practice is to follow the principle of least privilege. The principle applies to identities, roles, and resources. Always select the smallest scope that’s necessary to reduce your exposure to risk. You wouldn’t want to grant everybody the owner role on your entire organization - intentional hacks or accidental mistakes can bring down your apps. You want to be specific and deliberate. Assign a specific security admin group the security admin role to manage SSL and firewall rules on specific projects.

For more information, see: Identity and Access Management Overview

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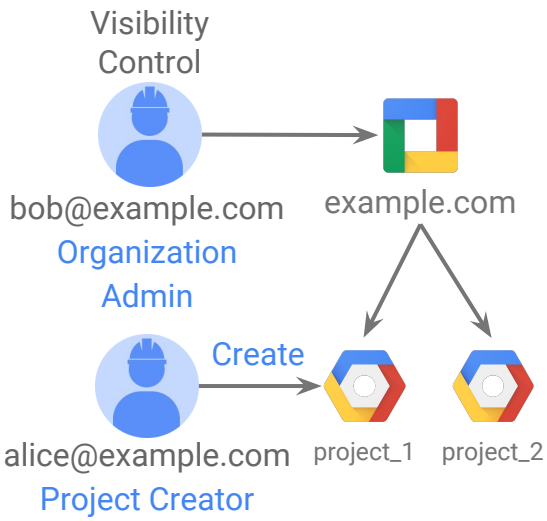
Organization Node

- Organization node is root node for Google Cloud resources
- 2 organization roles:
  - *Organization Admin* - Control over all cloud resources - useful for auditing
  - *Project Creator* - Controls project creation - control over who can create projects



https://cloud.google.com/resource-manager/docs/quickstart-organizations

A large number of projects can become unwieldy to manage at scale. This is why IAM includes the concept of an Organization Node. The Organization Node sits above Projects and is your company's root node for Google Cloud resources. If you have a Google for Work account, when you enable the Organization Node, any project created by users in your domain will automatically belong to your Organization Node - no more shadow projects and no more rogue admins.

The Organization Admin role gives your admin visibility and control over all of your company's resources on Google Cloud Platform. Using the Project Creator role, you can restrict who can create projects regardless of whether they have policies on individual projects. The project roles can also be applied at the organization level and can be inherited by all the projects in your company. For example, you can assign your networking team the Network Admin role at the organization level so they have permissions to manage all the networks in all the projects in your company.

Organization

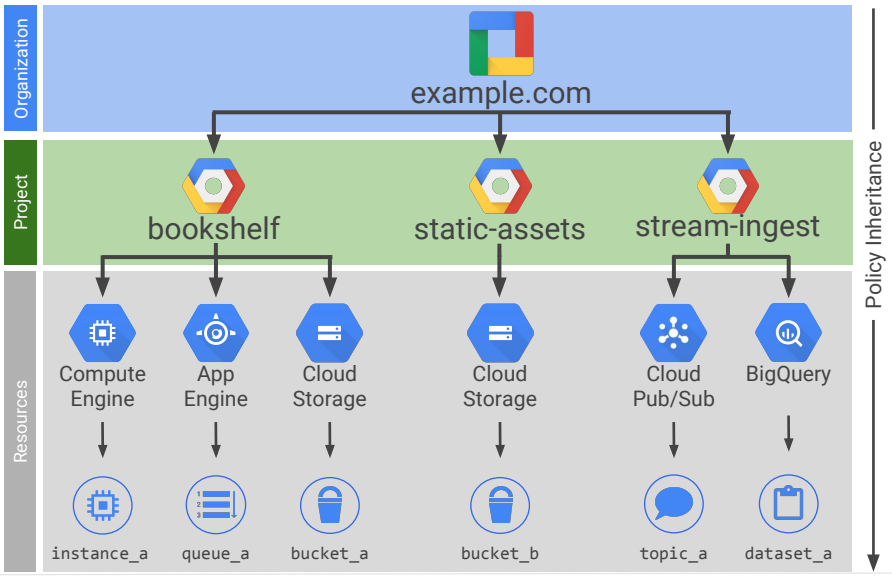
- Organization is created by Google Sales
- Organization Owner(s) established at creation
  - **G Suite** Super Admins are *the only* **Organization Owners**

- **Organization Owner**
  - Assigns the Organization Administrator role from the **G Suite** *Admin Console -- (**Admin** is a separate product)*
    - Organization Administrators manage GCP from the Cloud Console
- Always have more than one organization owner for security purposes

The account with Organization Owner role is empowered to modify all projects within the organization.
Changes to the organization itself still occurs only through Google Sales.
https://cloud.google.com/resource-manager/docs/overview#organization

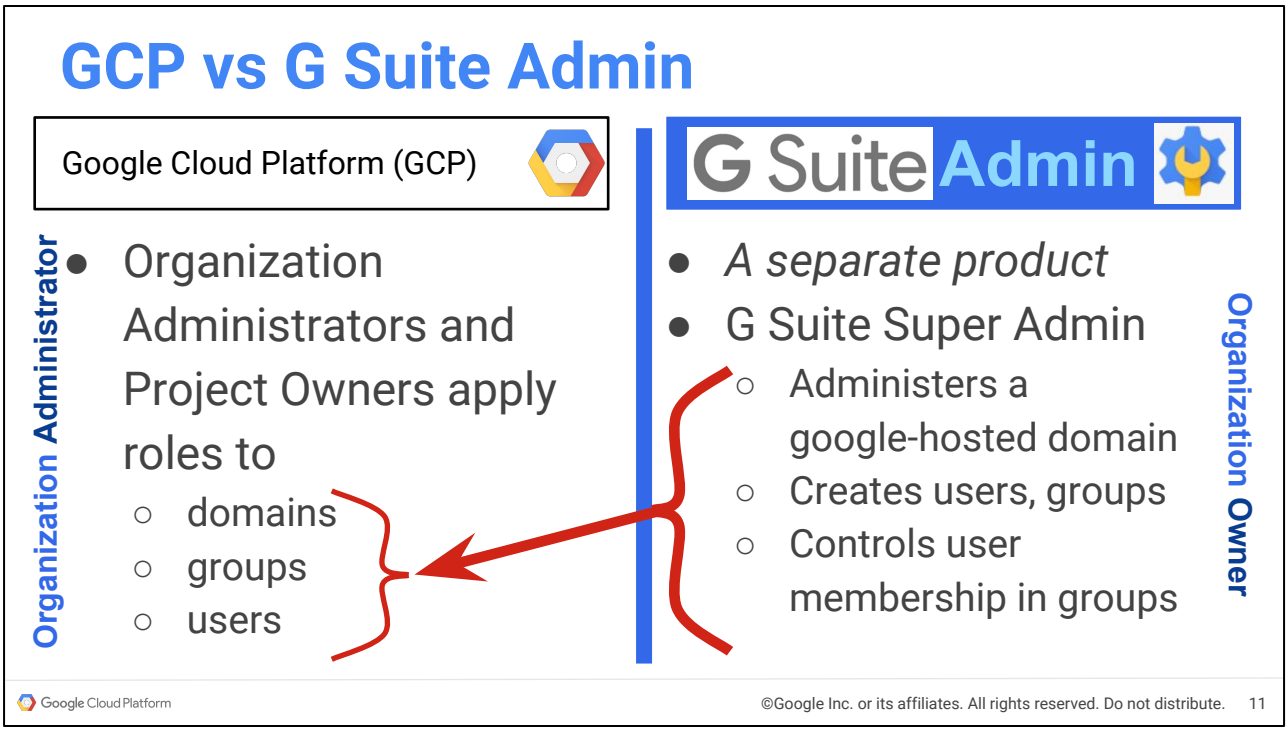
Resource Manager Roles

- **Org Admin**
  - Has full control over all resources
- **Org Viewer**
  - View access to all projects
- **Project Creator**
  - Ability to create new projects
  - Automatic owner of projects created
  - Can migrate projects to an org



Organization-level Administrators can grant a role to a member that spans all projects.
Example use: Granting a security auditor read access to all logs (Log Viewer role) for all projects.
This would be much more efficient than granting the security auditor (or security auditor group) access for each project individually.

Can modify roles.



Both G Suite and GCP are part of a single product line called "Google Cloud". But they are separate products.
When "Organization" is added to GCP, an MSA (Master Services Agreement) is signed that usually includes a Google-hosted domain with the G Suite Admin product.
Best practice is that the account/person who is the G Suite Super Admin is different from the account/person who is the *first* GCP Organization Owner.
G Suite Admin has TWO functions with respect to GCP.
1) The G Suite Super Administrator can assign GCP Organization Owner to an account from within the G Suite Admin console.
A GCP Organization Owner can also create more Organization Owners by assigning the role to an account within the GCP console. The G Suite Super Admin cannot assign any other GCP roles to accounts from the Admin console.
2) The G Suite Super Admin creates users, groups, and controls membership of users in groups. Also, controls Google-hosted domains (domain names: @mycompany1.com, @mycompany2.com)

Resource Manager roles

- Project Creator
  - Ability to create new projects
    - Once a new project is created, the creator is automatically granted **owner** role for that project
  - Can migrate existing projects into an organization
- **Organization Administrator**
  - Administer all resources belonging to an organization
- Organization Viewer
  - View all projects belonging to an organization

Organization Administrator controls Resource Manager roles that span all resources and all projects in the organization.
By default, all members have the ability to create new projects

Organization Administrator role

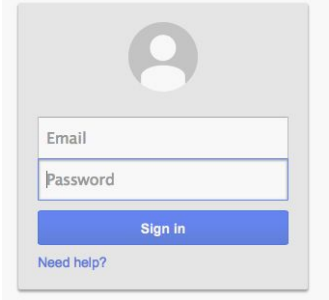
- 1st Organization **Administrator** role - assigned by Google - usually not the **G Suite** Super Admin
- Change IAM policy defaults for the organization
  - Project level settings can override inherited defaults
- Manage billing accounts and payment methods

Personal/trial accounts have no "organization", and organization features are hidden in the UI.
https://cloud.google.com/resource-manager/docs/creating-managing-organization
https://cloud.google.com/resource-manager/docs/quickstart

Cloud Platform Authorization

- Use Google's credential system
  - Manage accounts using Google GSuite **
  - Sync existing credentials using Google Cloud Directory Sync
  - Optionally implement single sign-on (SSO)
- Built-in features
  - Session activity tracking
  - Session management tools
  - Security alerts
  - Suspicious activity detection

** or Google GSuite for Education and Google GSuite for Government



Notes:
The simplest mechanism for accessing Google Cloud Platform is to use a Google account. While simple, this mechanism does not provide centralized identity management. Organizations should instead use Google GSuite user management to create and manage accounts/credentials. Note: This is for user management only. It does not require you to use Google GSuite products like Gmail, Google docs, and Google Slides.

Google GSuite user management is a single place to manage and control accounts, including suspending bad accounts. Because Google manages logins, you get the benefits and security of Google authentication management: Password resets, session and device management (when/where people are logging in), suspicious activity detection and alerts.

For more information on managing Google GSuite user accounts, see: https://support.google.com/a/topic/14588?hl=en&ref_topic=2425090.

Google Cloud Directory Sync (GCDS)

- Synchronizes GSuite accounts to match the user data in existing LDAP or MS Active Directory
  - Synchs groups and memberships, not content or settings
  - Supports sophisticated rules for custom mapping of users, groups, non-employee contacts, user profiles, aliases, and exceptions
- One-way synchronization from LDAP to directory
  - Administer in LDAP, then periodically update to G Suite
- Runs as a utility in your server environment

With Google Cloud Directory Sync (GCDS), the GSuite Admin can automatically add, modify, and delete users, groups, and non employee contacts to synchronize the data in a GSuite domain with an LDAP directory server or MS Active Directory. The data in the LDAP directory server is never modified or compromised. GCDS is a secure tool that help keep track of users and groups.

The GSuite Admin uses the GCDS Configuration Manager to customize synchronizations, and can perform test synchronizations to find what works best for the organization and then schedule synchronizations to occur when needed.

https://support.google.com/a/answer/106368?hl=en

Single Sign-On (SSO)

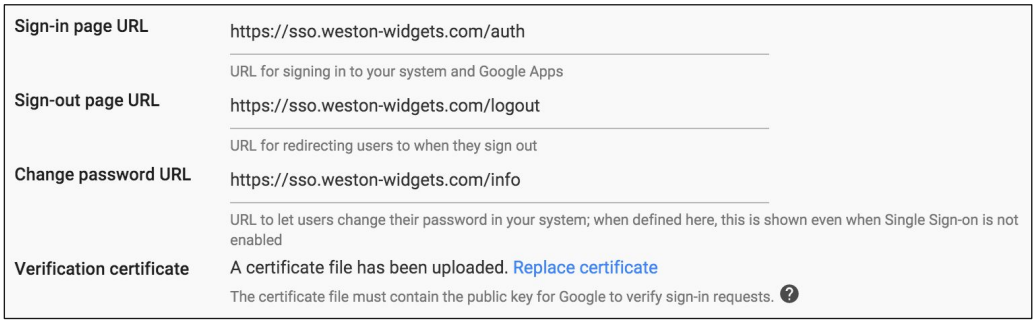
- Use your own authentication mechanism and manage your own credentials
- Federate your identities to Google Cloud Platform
- Users do not have to login a second time to access Cloud Platform resources
- Revoke access to Cloud Platform using your existing credential management
- Google Apps Directory Sync integrates with LDAP

Notes:
If you have your own identity system, you can enable SSO. You can continue using your own system/processes with SSO configured, and when user authentication is required, Google will redirect to your system. If the user is authenticated in your system, access to Cloud Platform is given. Otherwise, the user is prompted to log in.

Your users must have a corresponding account in Google's system (a matching username), typically provisioned using Google Apps Directory Sync

Setting Up SSO

- If your existing auth supports SAML2, SSO configuration is 3 links and a certificate
  - If SAML2 not supported, use third party solution

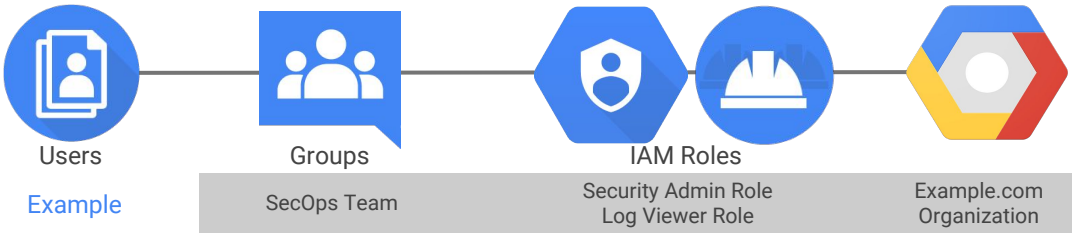


Notes:
SSO configuration is a relatively simple process. SSO is built on SAML2, a secure/industry-standard protocol for exchanging user assertions. With Google SSO, the only assertion that is used is the username.

To prevent tampering, SAML allows information to be digitally signed. To configure this, you need a digital certificate used to validate the signature. This ensures that incoming information originated from you and has not been tampered with. If your system doesn't support SAML2, you can use a third-party ID management plug-in such as Ping or Okta.

IAM Best Practices

- Principle of least privilege
  - Always apply the minimal access level required
- Use groups
- Control who can change policies and group memberships
- Audit policy changes
  - Audit logs record project-level permission changes
  - Additional levels being added



Notes:

The principle of least privilege applies to identities, roles, and resources. Always select the smallest scope necessary to reduce your exposure to risk. You wouldn't grant everybody the owner role on your entire organization - Intentional hacks or accidental mistakes can bring down your applications. You want to be specific and deliberate. Assign a specific group the security admin role to manage SSL certificates and firewalls on specific projects.

Managing permissions for individual users can be cumbersome and error prone. Use groups instead. In the example, there is a SecOps group (for your security operations team). When new members join the team, add them to the group. The SecOps team likely needs multiple roles - for example - security admin to manage firewalls and log viewer for auditing. Assign the relevant roles to the appropriate group.

Policies allow you to secure your resources. You also want to make sure you control how additional users gain access to resources through policies and group memberships. Without strict control over policy changes and group memberships, you may inadvertently allow new users more permissions than they need (which also violates the principle of least privilege).

Best Practices: Use Groups

- If group membership is secure, then assign roles to groups and let the **G Suite** Admins handle membership
  - Always maintain an alternate
  - For high-risk areas, assign roles to individuals directly and forego the convenience of group assignment

Vary from the standard only when you need to do so and you know why you need to make the change and how it's going to implement your policies.

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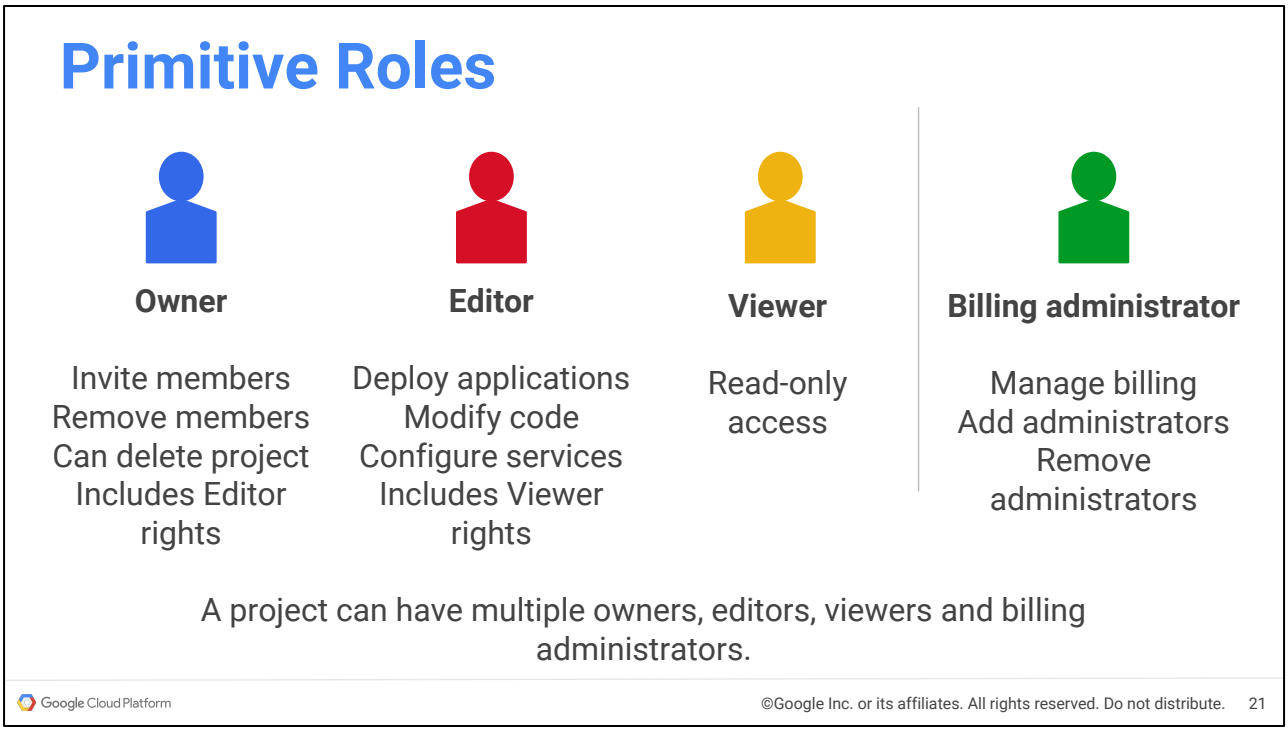


There are two kinds of roles in Cloud IAM:

- *Primitive roles*: The original roles available in the Google Cloud Platform Console. These are the Owner, Editor, and Viewer roles. Still assigned by default to projects. Primitive roles are quite broad.
- *Curated roles*: Curated roles are new IAM roles that give finer-grained access control than the primitive roles (discussed in the next section).

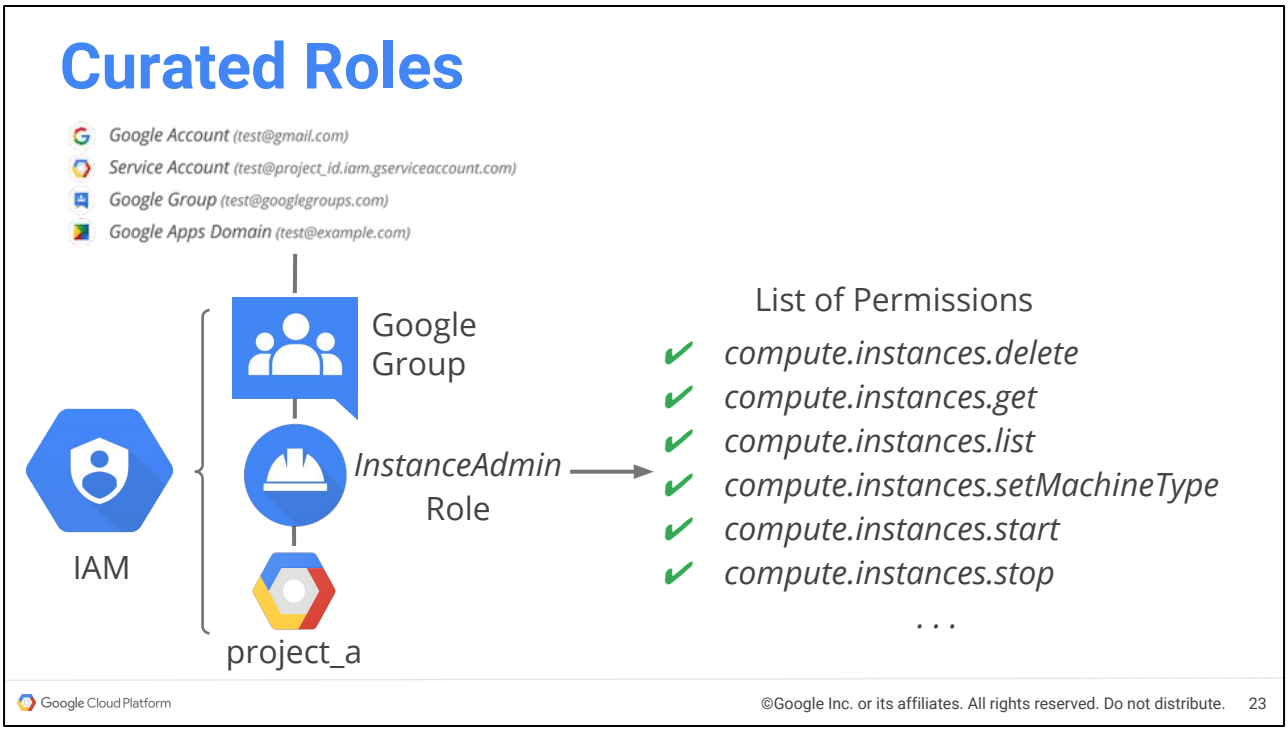
The permissions granted by the primitive roles are...

- “is Owner” allows full administrative access. This includes the ability to add members and set the authorization level of team members.
- “can Edit” allows modify and delete access. This allows a developer to deploy the application and modify or configure its resources.
- “can View” allows read-only access.

It’s a best practice to ensure that a project has more than one owner for continuity reasons. Many organizations will create a Google Group for project ownership, and put at least two Google accounts into that group. Some organizations use a dedicated project owner account. If there is only one owner, and the sole owner’s account is deleted, then the entire project would also be deleted.

The recommended practice is to use Google accounts for your project’s team

members. When someone leaves the company, your G Suite administrator should use the G Suite Admin Console to mark the account as suspended (instead of deleting the account.) The domain administrator can then perform various tasks such as reassigning ownership of apps and docs before deleting the team member's account.



Notes:

IAM curated roles provide significantly greater granularity for permission-granting.

An IAM role is a collection of permissions. Most of the time to do any meaningful operations you need more than 1 permission. For example, to manage instances in a project you need to create, delete, start, stop and change an instance. So the permissions are grouped together into a role to make it easier to manage.

To give a user the desired permissions, you grant a role to the user on a resource. In this example we are granting a group of users the InstanceAdmin role on project a so the user can manage instances in the project. Whenever possible, it is a best practice to use groups. You should also strictly control the ability to change policies and group memberships which will allow additional users to gain access to resources.

For a complete list of roles by product, see:
https://cloud.google.com/iam/docs/#supported_cloud_platform_services

Roles

- Groups of permissions
  - Represent *abstract functions*
  - Customize roles to align with *real jobs*
- Permissions are classes and methods in the APIs
  - `<service>.<resource>.<verb>`
  - Usually (but not always) 1:1 with REST API
- Roles cannot currently be customized

Google provides a set of curated roles for products.
Read the product-specific IAM document to understand why the roles were defined as they are and why some permissions were included and not others.
You really need to understand the API for the product to modify the permissions so you know exactly what behavior you are enabling or disabling.
Permissions are very granular controls.
https://cloud.google.com/iam/docs/understanding-roles
https://cloud.google.com/iam/docs/faq
Customizing Roles is not currently supported - December 2016

Essential roles

- Project roles
- Product-specific roles
  - Crafted for each resource/product (20+)
  - Product-specific IAM documentation
  - Many in Beta
- Organization roles
  - Organization Owner
  - Resource Manager
  - Organization Administrator

There are several kinds of roles. We will look at each of them in context.

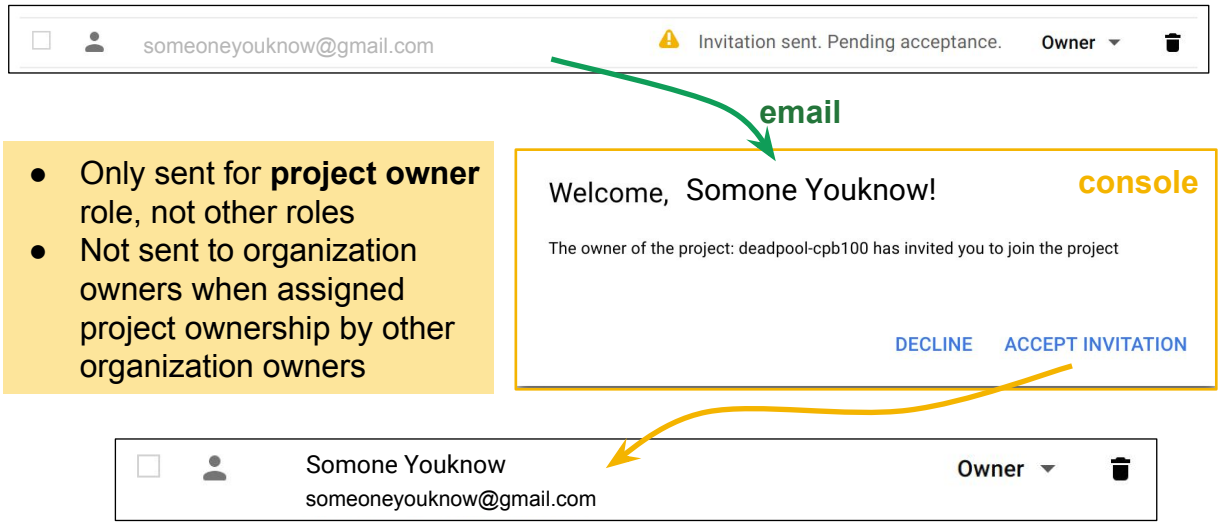
Roles are collections of "permissions". Permissions directly map to classes and methods in the Cloud Platform APIs.
When a role is granted, the permissions it contains, authorize the user to call specific methods in the APIs.

Project roles

- Viewer
  - Read-only actions that do not modify state
  - Browser role (Beta) - only "information about" (metadata)
- Editor
  - + actions that modify state
- Owner
  - + manage access control for a project and all its resources
  - + setup project billing

https://cloud.google.com/iam/docs/understanding-roles
One user with Project Owner role for a particular project can invite another user to become a Project Owner as well.

Project owner invitation and acceptance



- Only sent for **project owner** role, not other roles
- Not sent to organization owners when assigned project ownership by other organization owners

Member invitation and acceptance provides identity verification and an accountability trail.
Anyone with a valid google identity is a potential invitee. There is currently no method to set limits or block specific domains, groups, or emails.
No email is sent when you're granting a role other than the owner.
No email is sent when an organization owner adds another organization owner as an owner of a project within that organization.
Organization owners don't get invitation emails, they are just added.

Product-specific roles

- Roles crafted for each product - *read the IAM doc!*
- Example: Compute Engine roles
  - Compute Engine Instance Admin - VMs and disks
  - Service Account Actor - service accounts
  - Compute Engine Image User - images
  - Compute Engine Network Viewer - read-only for all networking
  - Compute Engine Network Admin - all networking except firewall rules and certificates
  - Compute Engine Security Admin - firewall rules, ssl certificates
  - Compute Engine Storage Admin - disks, images, snapshots

https://cloud.google.com/iam/docs/understanding-roles
There are 20+ products with product-specific roles. Each has a separate IAM document explaining the permission details and the strategy behind the role definition.
No invitation and acceptance with product-specific roles.
Compute Engine example:
https://cloud.google.com/compute/docs/access/iam

Product Role Examples

GCE

Compute Network Admin
Compute Network Viewer (Beta)
Compute Security Admin
Compute Instance Admin (Beta)
Compute Storage Admin (Beta)

GCS

Storage Admin
Storage Object Admin
Storage Object Creator
Storage Object Viewer

Logging

Logs Viewer
Logs Writer
Private Logs Viewer
Logs Config Writer

BigQuery

BigQuery Viewer
BigQuery Editor
BigQuery Admin
BigQuery User

GAE

App Engine Admin
App Engine Deployer
App Engine Service Admin
App Engine Viewer

Dataflow

Dataflow Viewer
Dataflow Developer
Dataflow Worker

Pub/Sub

Pub/Sub Viewer
Pub/Sub Editor
Pub/Sub Admin
Pub/Sub Publisher
Pub/Sub Subscriber

Other roles:

Deployment Manager
Stackdriver debugger
Genomics
…
For full list see docs

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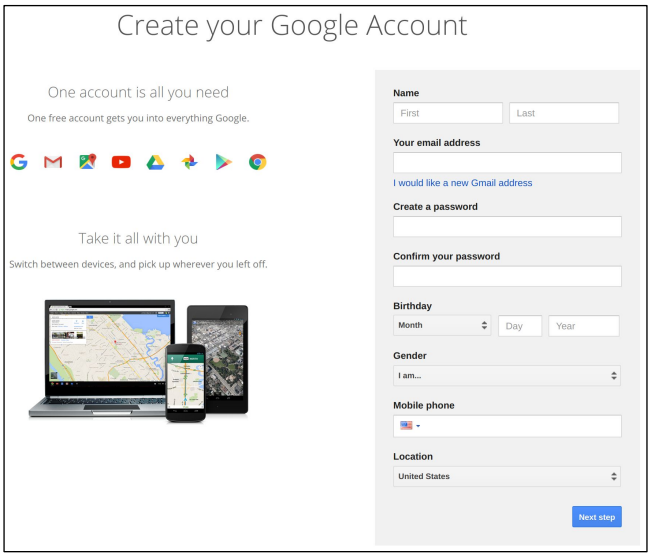
Members

- Users
  - Google accounts: @gmail, @google
  - **G Suite** domains: Google-hosted domains (*mydomain*.com)
  - Google Groups (*groupname*@mydomain.com)
  - GCP does ***not*** create or manage users or groups
    - **G Suite Admin** Super Administrator manages users and groups for an organization. "**G Suite Admin**" is a separate product from GCP.
- Service Accounts
  - Created and managed in GCP

example.com
groups.google.com/a/your-domain.com
Groups for Business feature
groups.your-domain.com

GCP access without Gmail



- You can just use gmail
- You can get a Google password without gmail
- There are benefits to having a domain, including group permissions

https://accounts.google.com/SignUpWithoutGmail?hl=en

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Service Accounts (1 of 2)

- Provide an identity for carrying out **server-to-server** interactions in a project without supplying user credentials
- Used to **authenticate** from one service to another
  - Programs running within Compute Engine instances can automatically acquire access tokens with credentials
  - Token used to access any service API in your project and any other services that granted access to that service account
  - Convenient when not accessing user data

A service account is an identity for your programs to use to authenticate and gain access to Google Cloud Platform APIs. Service accounts authenticate applications running on your virtual machine instances to other Google Cloud Platform services. For example, if you write an application that reads and writes files on Google Cloud Storage, it must first authenticate to the Google Cloud Storage API. You can enable service accounts and grant read-write access to the account on the instance where you plan to run your application. Then, program the application to obtain credentials from the service account. Your application authenticates seamlessly to the API without embedding any secret keys or credentials in your instance, image, or application code.

Service Accounts (2 of 2)

- Identified by an **email** address
  - `123845678986-compute@project.gserviceaccount.com`
- Three types of service accounts
  - User-created (custom)
  - Built-in
    - Compute Engine and App Engine default service accounts
  - Google APIs service account
    - Runs internal Google processes on your behalf

By default, all projects come with the Compute Engine default service account. When you start a new instance using gcloud, the default service account is enabled on that instance.

Apart from the default service account, all projects come with a Google APIs service account, identifiable using the email:

{project-number}@cloudservices.gserviceaccount.com

This is a service account designed specifically to run internal Google processes on your behalf. This account is not listed in the Service Accounts section of Cloud Platform Console but by default, it is automatically granted the editor role on the project and is listed in the IAM section of Cloud Platform Console. This service account is only deleted when the project is deleted. However, you can change the roles granted to this account, including revoking all access to your project. Certain resources rely on this service account and the default editor permissions granted to the service account. For example, managed instance groups and autoscaling uses the credentials of this account to create, delete, and manage instances. If you revoke permissions to the service account, or modify the permissions in such a way that it does not grant permissions to create instances, this will cause managed instance groups and autoscaling to stop working. For these reasons, it is recommended

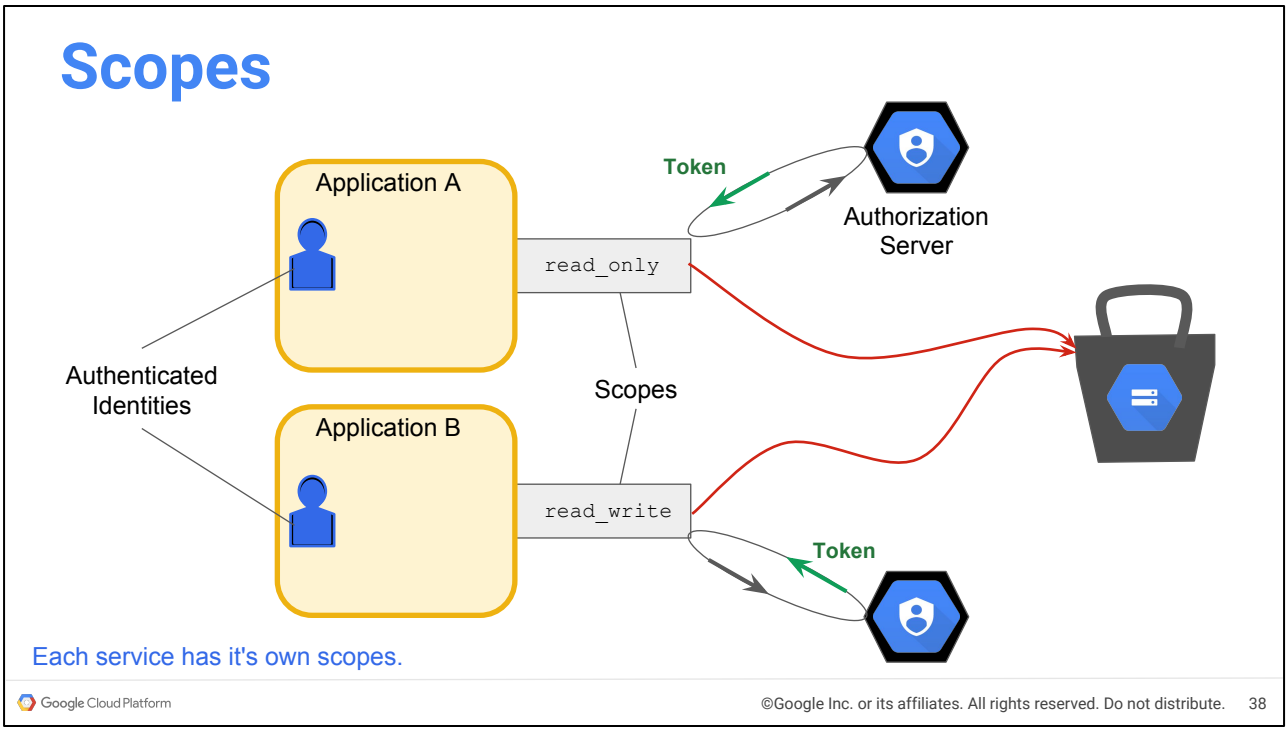
that you do not modify this service account's roles.

Alternatively, you can also start an instance with a custom service account. Custom service accounts provide more flexibility than the default service account but they require more management from you. You can create as many custom service accounts as you need, assign any arbitrary access scopes or IAM roles to them, and assign the service accounts to any virtual machine instance.

App Engine default service accounts are beyond the scope of this course. For more information, see: https://developers.google.com/identity/protocols/application-default-credentials.

Default Compute Engine Service Account

- Automatically created per project with auto-generated name and email address
  - Name has `-compute` suffix
    `39xxxx0965-compute@developer.gserviceaccount.com`
- Automatically added as a project Editor
- By default, enabled on all instances created using `gcloud` or Cloud Platform console
  - Override by specifying another service account or by disabling service accounts for the instance



https://cloud.google.com/storage/docs/authentication

OAuth uses scopes to determine if an authenticated identity is authorized for access to a resource.

Applications use scopes in the access process.

In this example, Applications A and B contain Authenticated Identities (service accounts).
Both of them want to use a Google Cloud Storage bucket.
They request access from Google Authorization Servers
An access token is returned with the scope.
Application A can only read from the bucket.
Application G can read and write.
But neither application can read or modify ACLs (Access Control Lists) because this would require the `full_access` scope that neither has.

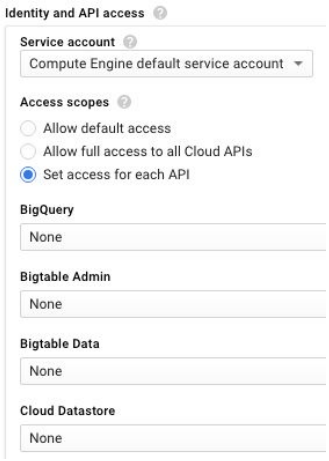
Access scopes grant access only if the respective API has been enabled on the project that the service account belongs to. For example, granting an access scope for Google Cloud Storage on a virtual machine instance allows the instance to call the Cloud Storage API only if you have enabled the Cloud Storage API on the project. If the API is not enabled on the project, the access scope has no effect. Additionally, if you plan to use the service account to

access another project, you must grant the service account the appropriate IAM roles on the target project.

Default Compute Engine service account automatically enabled with the following access scopes:
https://www.googleapis.com/auth/cloud.useraccounts.readonly
https://www.googleapis.com/auth/devstorage.read_only
https://www.googleapis.com/auth/logging.write
https://www.googleapis.com/auth/monitoring.write
https://www.googleapis.com/auth/service.management.readonly
https://www.googleapis.com/auth/servicecontrol

Customizing Scopes for a VM

- You can create an instance with customized scopes for your use case using the default service account
  - Scopes cannot be changed once instance is created
- For user-created service accounts, use IAM roles instead

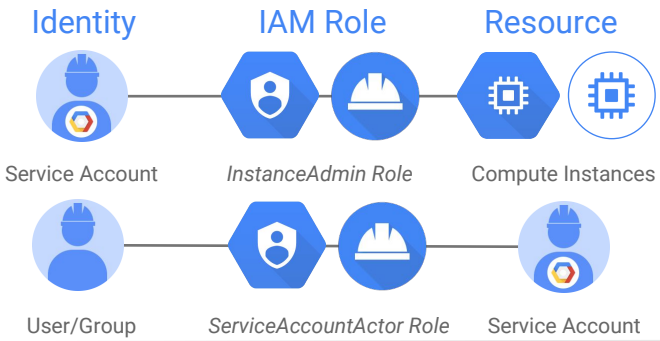


Service accounts can use scopes through the Cloud SDK. `gcloud` and `gsutil` commands automatically pick up tokens, and you can easily run these commands in scripts to automate workflows. You can also write custom tools or application code using Google client libraries or alternatively, write your own code to consume tokens.

These scopes provide the following access
Read only access to the Cloud User Accounts API*
Read-only access to the Cloud Storage JSON API v1
Read/write access to the Stackdriver Logging API v2
Read/write access to the Stackdriver Monitoring API v3
Read-only access to the Google Service Management API v1*
Read-write access to the Google Service Control API v1*

Service Account Permissions

- Default service accounts support primitive (project) and curated (IAM) roles
  - User-created service accounts use IAM roles only
- Roles for service accounts can be assigned to group(s) or user(s)



One of the features of IAM service accounts is that you can treat it as a resource or as an identity.

Service accounts as a resource

By treating a service account as a resource, you can grant permission to a user to access that service account. You can grant an owner, editor, viewer, or a serviceAccountActor role to a user for the service account. For example, if you want to allow a user to create a VM with the service account or authenticate as a service account, you first need to grant the user the serviceAccountActor role. In this case the service account is the resource and you grant a user permission to use this service account resource.

Service accounts as an identity

You can grant a role to a service account to access a resource. In this case the service account is the identity. Some examples include:

- The default Compute Engine and App Engine service accounts are granted editor roles on the project when they are created so that the code executing in your App or VM instance have the necessary permissions. In this case the service accounts are identities that are granted the editor role for a resource (project).

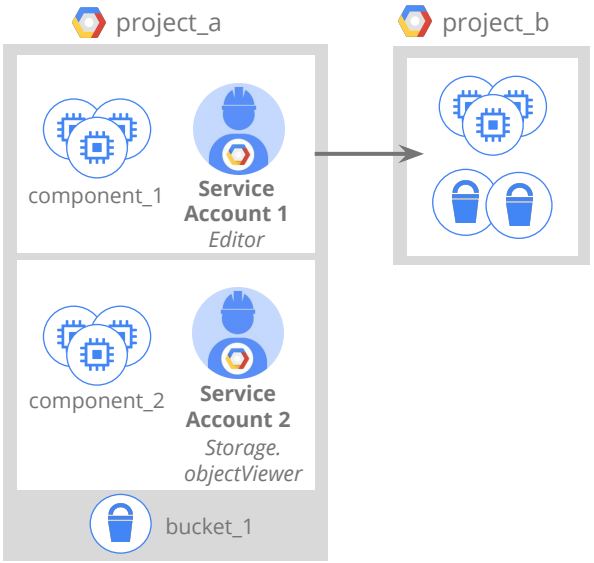
- If you want to allow your automation to access a storage bucket, you grant the service account (that your automation uses) the permissions to read the storage bucket. In this case the service account is the identity that you are granting permissions for another resource (Cloud Storage bucket).

Granting another user the ability to act as a service account

If you want other users to be able to use a service account, you must grant the serviceAccountActor role to the user. Users with the serviceAccountActor role can act as that service account to perform operations such as create and manage Compute Engine instances that use a service account. For information on how to do this see the Compute Engine documentation. Users who are serviceAccountActors for a service account can access all the resources for which the service account has access. Therefore be cautious when granting the serviceAccountActor role to a user.

Example: Service Accounts and IAM

- VMs running component_1 are granted Editor access to project_b using *Service Account 1*
- VMs running component_2 are granted objectViewer access to bucket_1 using *Service Account 2*
- Service account permissions can be changed without re-creating VMs

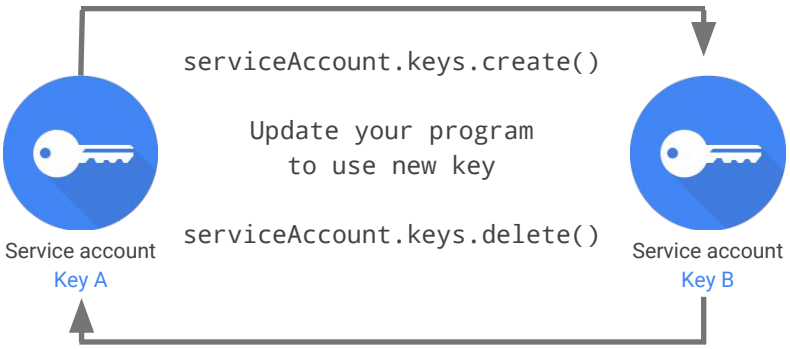


You can grant different groups of VMs in your project different identities. This makes it easier to manage different permissions for each group. For example, if one component in your app needs to have the Editor role on another project, you can have a service account with this permission that is used only by the VMs running the component. Other VMs can be assigned the permissions required by their functionalities. This way you can scope permissions for VMs. You also can change the permissions of the service accounts without having to recreate the VMs.

IAM also lets you slice a project into different microservices, each with access to different resources, by creating service accounts to represent each one. You assign the service accounts to the VMs when they are created, and as a security engineer, you don't have to ensure that credentials are being managed correctly. Google Cloud Platform manages security for you.

Service Accounts and Keys

- Service accounts authenticate with keys
  - Google manages keys and key rotation for Compute Engine and App Engine
  - Alternatively, create, manage, and rotate keys yourself



Users require a username and password to authenticate. Apps use a key. One or more keys can be generated for each IAM service account. Keys are sensitive and need to be carefully managed because they give you access to resources. When you run applications on Compute Engine or App Engine, Google manages the keys for you and automatically rotates them. You never have the risk of losing/exposing your key. When you run apps elsewhere, you can generate and download the keys to use in your code. It is a best practice to keep them safe and rotate them.

A service account is both an identity and a resource. A service account is used as an identity for your application to authenticate; for example, a Compute Engine VM running as a service account. To give the VM access to the necessary resources, you need to grant the relevant IAM roles to the service account. At the same time, you need to control who can create VMs with the service account so random VMs cannot assume the identity. Here, the service account is the resource to be permissioned. You assign the ServiceAccountActor role to the users you trust to use the service account.

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Resource Hierarchy

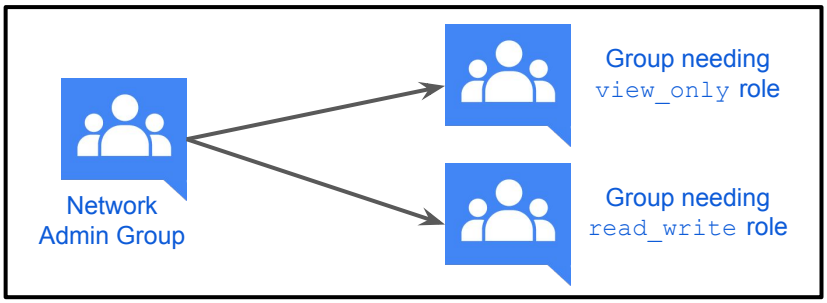
- Use projects to group resources that share the same trust boundary
- Check the policy granted on each resource and make sure you understand the inheritance
- Use "principle of least privilege" when granting roles
- Audit policies in Cloud audit logs: `setiampolicy`
- Audit membership of groups used in policies

1. Mirror your IAM policy hierarchy structure to your organization structure.
2. Use Cloud Platform projects to group resources that share the same trust boundary. For example, resources for the same product or microservice can belong to the same Cloud Platform project.
3. Set policies at the Organization level and at the Project level rather than at the resource level.
4. Check the policy granted on every resource and understand the hierarchical inheritance.
5. If you need to grant a role to a user or group that spans across multiple projects, set that role at the organization level instead of setting it at the project level.
6. Use labels to annotate, group, and filter resources.
7. If you want to limit project creation in your Organization, modify the Organization-level policy to grant the Project Creator role to a group that you manage.
8. Use the security principle of least privilege to grant roles.
9. Grant roles at the smallest scope needed.
10. Audit your policies to ensure compliance. Cloud audit logs contain all the calls to `setiampolicy` so you are able to trace when a policy has been enacted.
11. Audit the ownership and the membership of the Google groups used in policies.

1. Grant roles at the smallest scope needed.
2. For example, if a user only needs access to publish messages to a Pub/Sub topic, grant the Publisher role to the user for that topic.

Groups

- Grant roles to Google groups instead of individuals
  - Update group membership instead of changing Cloud IAM policy
  - Audit membership of groups used in policies
  - Control the ownership of the Google group used in IAM policies



- Use multiple groups to get better control
- Groups are not only associated with job roles
- Groups can exist for the purpose of role assignment

In the diagram, a single group was created that was associated with a job role, "network admin". However, the IAM administration soon realized that there were different sub-groups requiring different permissions. In this example, standard settings are kept in files in a bucket. Some network admins need access to view these files. A few select individuals have the authority to edit and delete these files.

The original group is still used for group mailings and for those roles that every network administrator needs, but the other groups and their membership were established only to assign additional IAM roles. Adding and removing individuals from all three groups controls their total access.

1. Grant roles to a Google group instead of to individual users when possible. It is easier to add members to and remove members from a Google group instead of updating a Cloud IAM policy to add or remove users.
2. If you need to grant multiple roles to allow a particular task, create a Google group, grant the roles to that group, and then add users to that group.
3. Control the ownership of the Google group used in IAM policies.

Service Accounts

- Be very careful granting `serviceAccountActor` role
- When you create a Service Account give it a display name that clearly identifies its purpose
- Establish a naming convention for Service Accounts
- Establish key rotation policies and methods
- Audit with `serviceAccount.keys.list()` method

1. Restrict who can act as service accounts. Users who are Service Account Actors for a service account can access all the resources for which the service account has access. Therefore be cautious when granting the serviceAccountActor role to a user.
2. Grant the service account only the minimum set of permissions required to achieve their goal.
3. Create service accounts for each service with only the permissions required for that service.
4. Use the display name of a service account to keep track of the service accounts. When you create a service account, populate its display name with the purpose of the service account.
5. Define a naming convention for your service accounts.
6. Implement processes to automate the rotation of user-managed service account keys.
7. Take advantage of the IAM service account API to implement key rotation.
8. Audit service accounts and keys using either the serviceAccount.keys.list() method or the Logs Viewer page in the console.
9. Do not delete service accounts that are in use by running instances on Google App Engine or Google Compute Engine.

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Lab #1 Cloud IAM

In this lab you will grant and revoke a variety of roles to various kinds of members.

In this lab you will have two user identities.
The first user is your **main identity**, and the second user is a **test identity**. You will grant and revoke roles with the main identity and then verify the result with the test identity logged in through a second incognito window.

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More...

- Using service accounts
  - https://cloud.google.com/compute/docs/access/create-enable-service-accounts-for-instances
- Authorizing requests to Google Compute Engine
  - https://cloud.google.com/compute/docs/api/how-tos/authorization
- Using OAuth 2.0 to access Google APIs
  - https://developers.google.com/identity/protocols/OAuth2


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