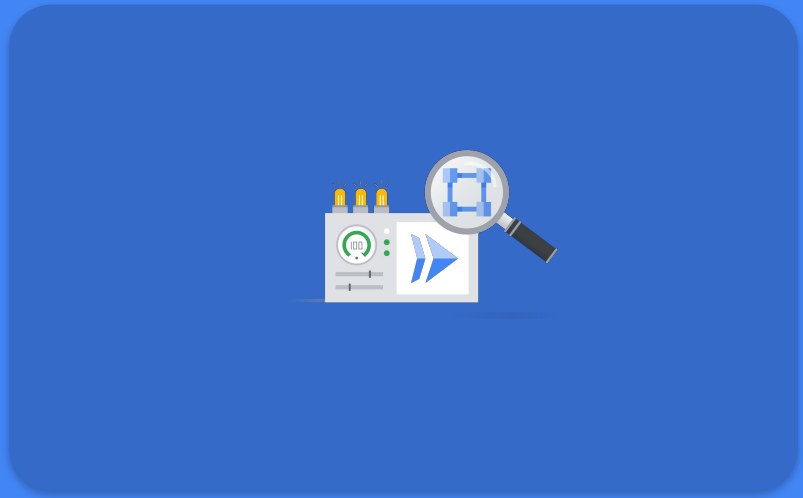
Serverless Networking Guide



January 2024

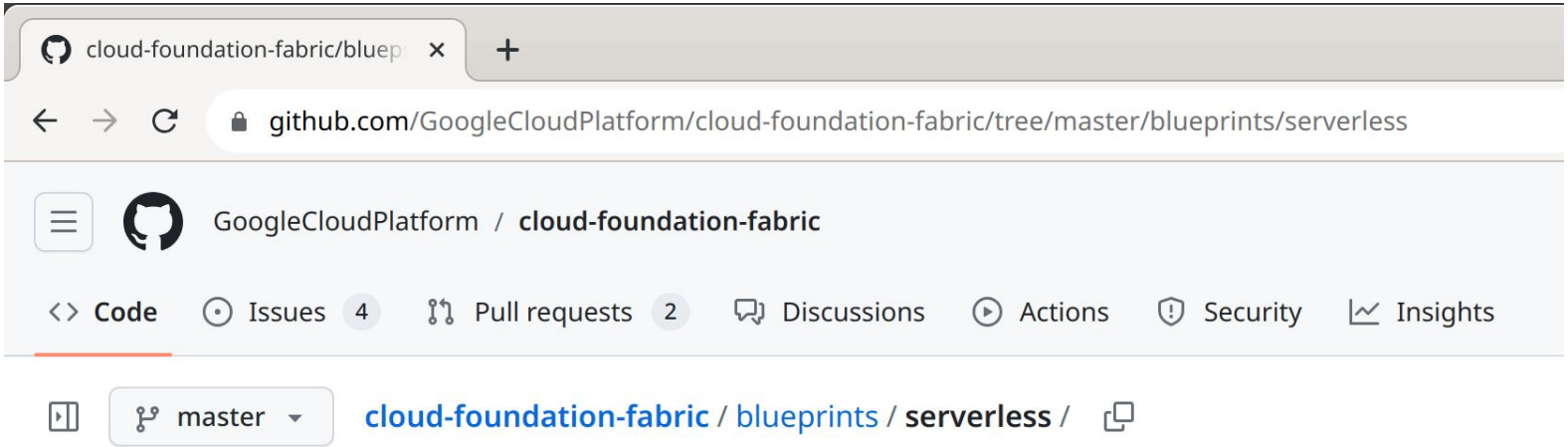
Meet our characters

This is Ginny. She is a talented engineer working for ACME, interested in everything Cloud.

And this is her friend Nick, an experienced Google Cloud Engineer always willing to help.

Google Cloud

Check out the code



You can check out code with examples of this guide from the cloud-foundation-fabric repository.
All serverless related examples are at blueprints/serverless.

Google Cloud

Section I: The Basics

Exploring Cloud Run

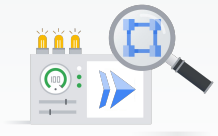
Corporate Env

Microservices

Access to Data

SaaS World

Security Controls



Exploring Cloud Run

My serverless "Hello, World!"

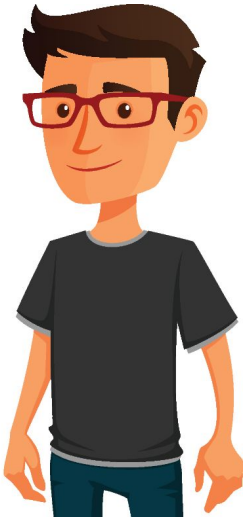
Terraform code

```
> Hello world
```

Google Cloud

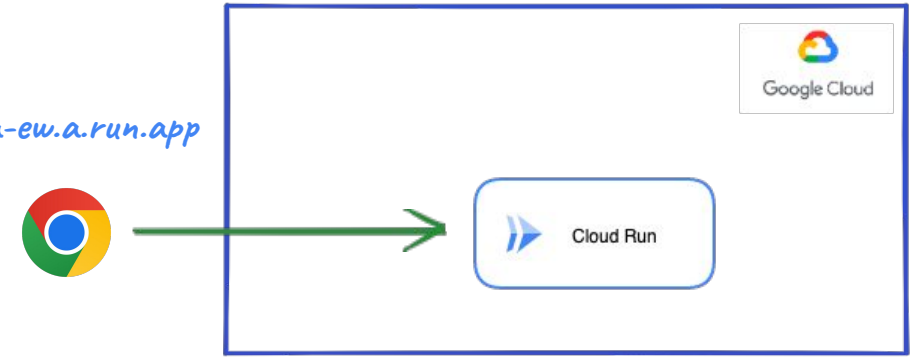
Hey Nick, I heard about serverless and I want to make my first serverless "Hello, World!". But now I'm puzzled, how will I connect to a serverless service?

Hahaha! Hi Ginny, yeah, networking may not be obvious in the serverless world. But first, there are several serverless options, hmmm... do you know Cloud Run?



Google Cloud

https://hello-olc7uafoka-ew.a.run.app

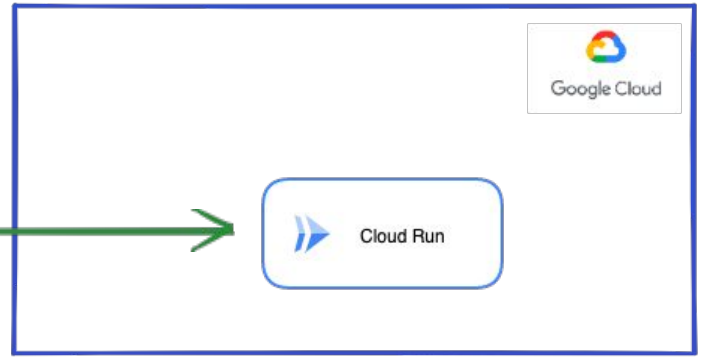


Cloud Run doesn't run within a VPC, but when you deploy an app you get a default URL to access it based on your project, service name and region where it is deployed.

Google Cloud

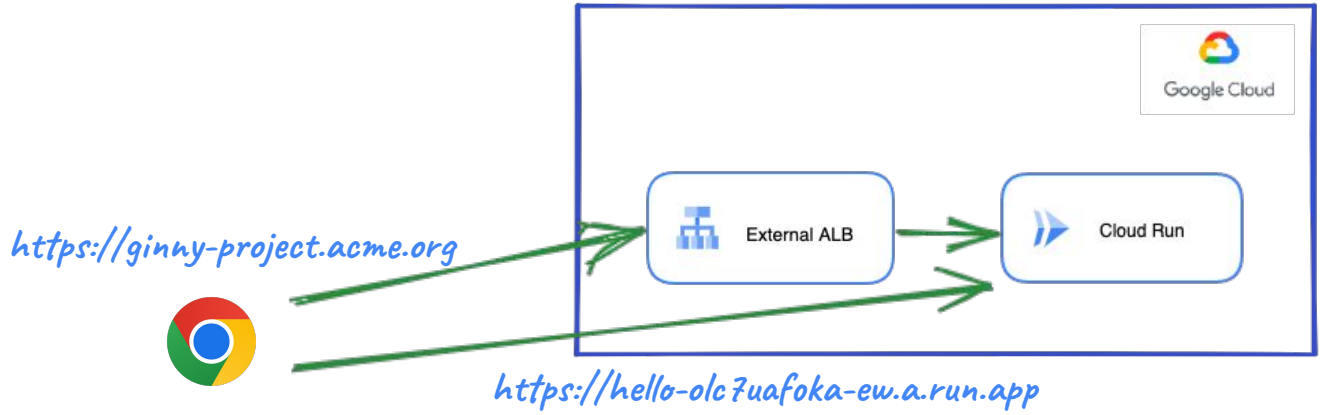
~~https://hello-olc7uafoka-ew.a.run.app~~

https://ginny-project.acme.org



Oh, great, easy! Hmm... but what if I want to use my own domain?

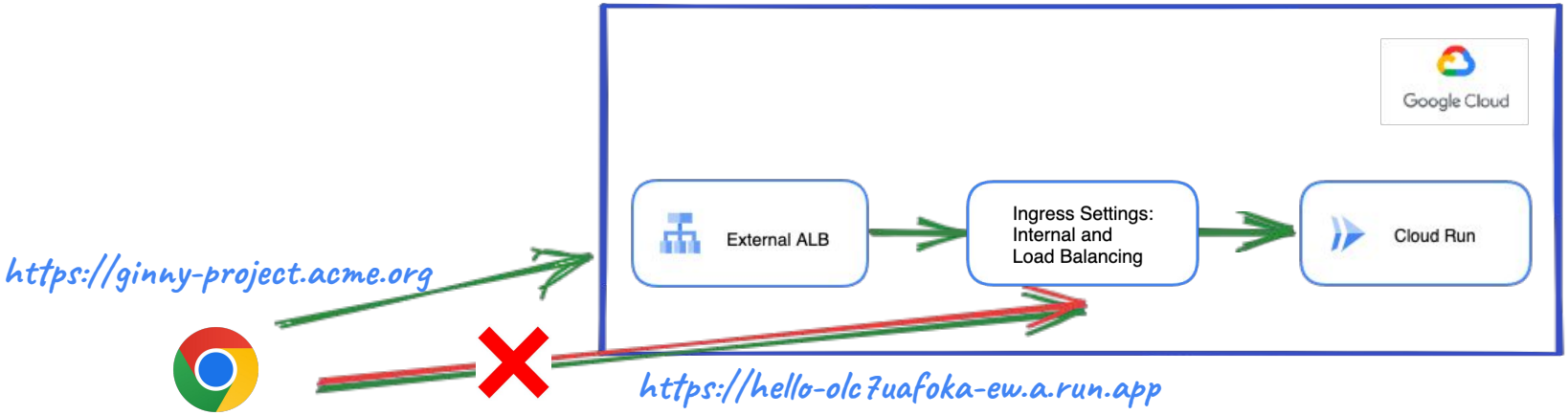
Google Cloud



To use your own custom domain you need an external Application Load Balancer in front of your Cloud Run app.

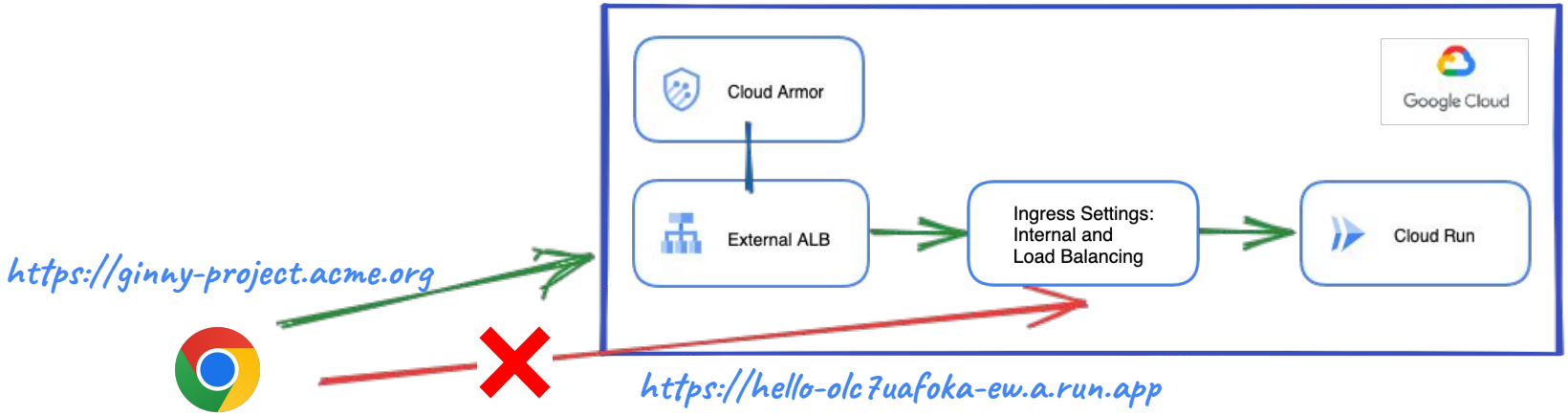
However, note that your app is still accessible through its default URL.

Google Cloud



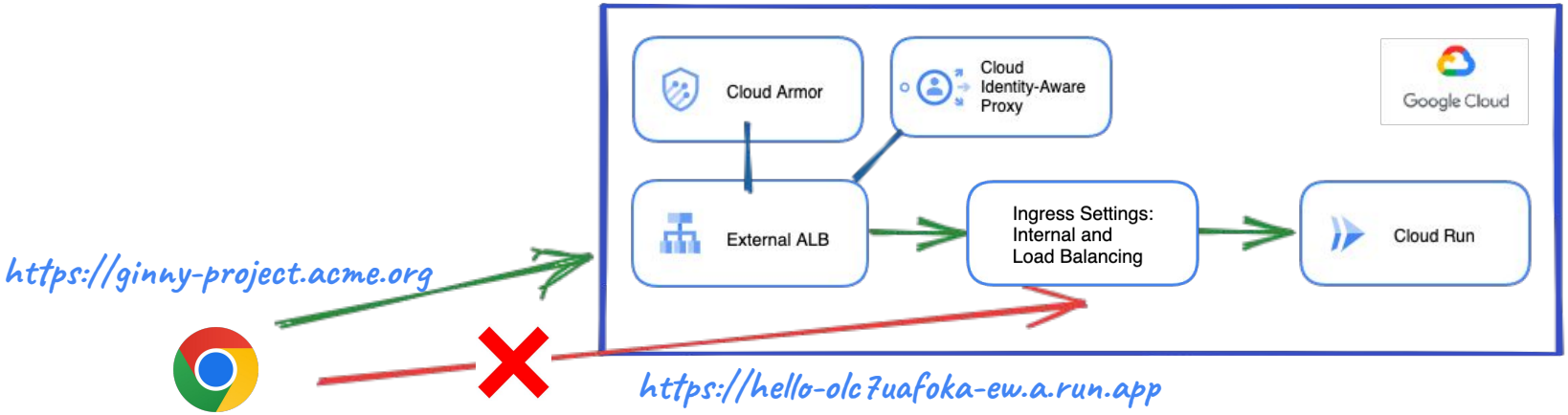
To block that access you can configure Ingress Settings to only accept Internet requests if they come through the Load Balancer.

Google Cloud

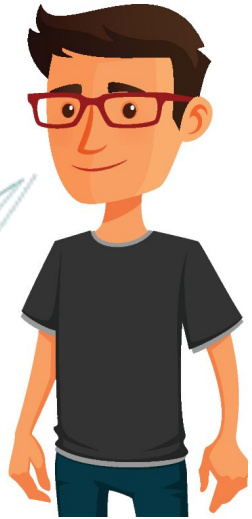


Got it! And since I put an external Application Load Balancer in front, I can use Cloud Armor to protect my web app, right? This is cool!

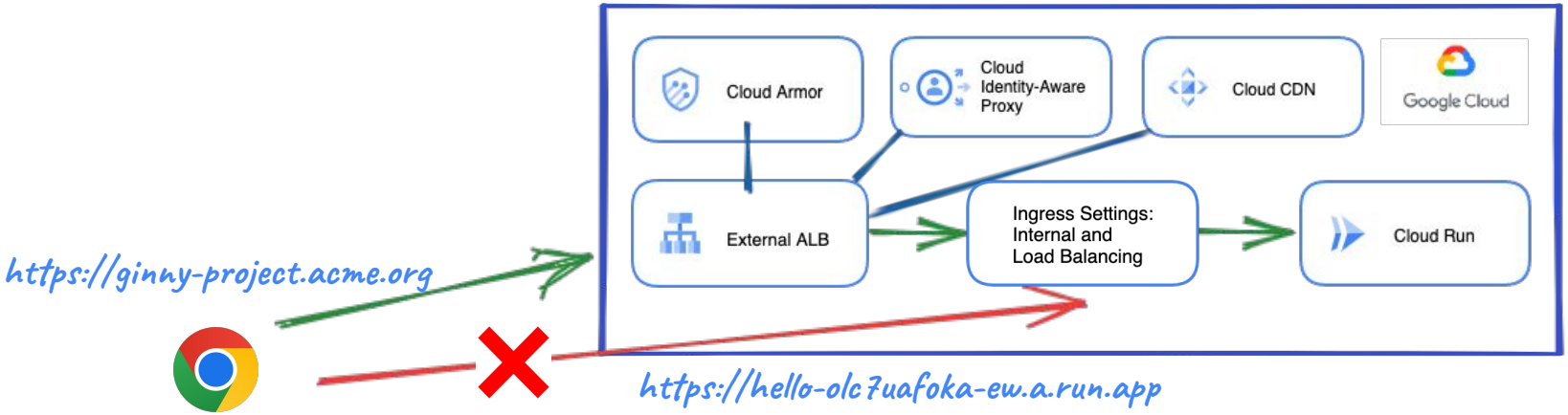
Google Cloud



Absolutely, you can protect your services with Cloud Armor. And if you want to control access using identity and context you can also enable IAP at the Load Balancer Backend Services. This will provide a central authorization layer for applications.

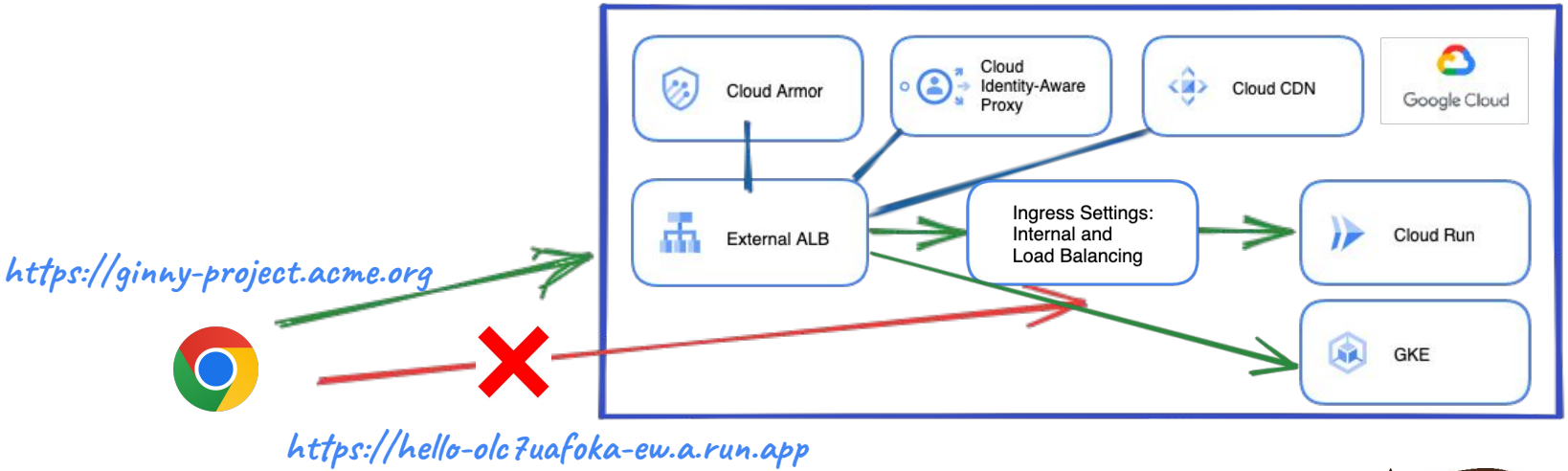


Google Cloud

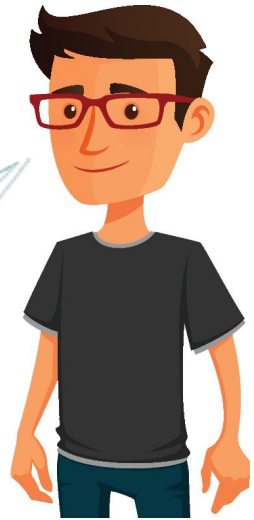


Not only that, you can also cache your static content through Cloud CDN, and Cloud Armor will to protect the origin through Backend Policies as well as cached content through Edge Security Policies.

Google Cloud

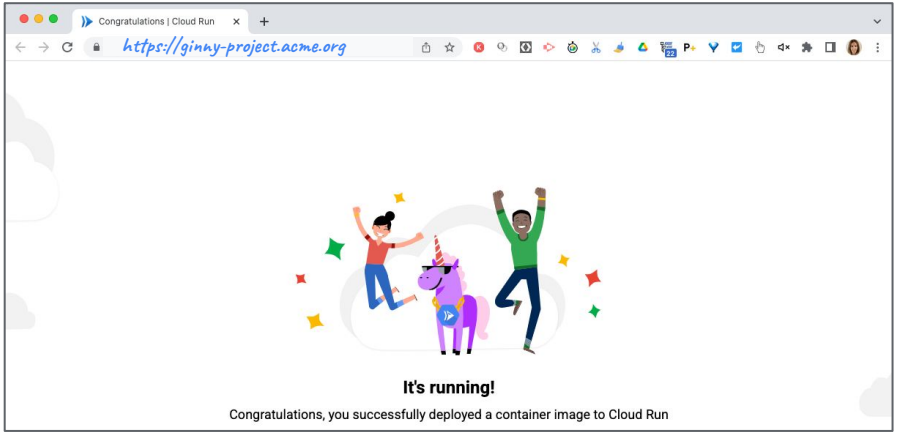


And you can use this same Load Balancer to load balance traffic to applications running in other type of backends like GCE or GKE besides Cloud Run.



Google Cloud

That's it. And all of this can be easily created with Terraform, isn't it great?

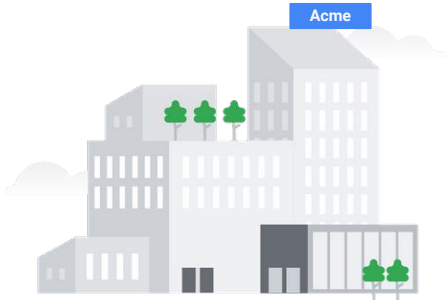


Google Cloud

The corporate environment

Developing an enterprise application

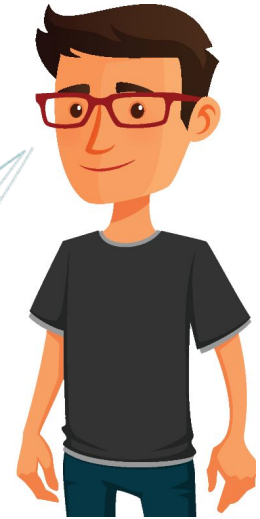
Terraform code



Google Cloud

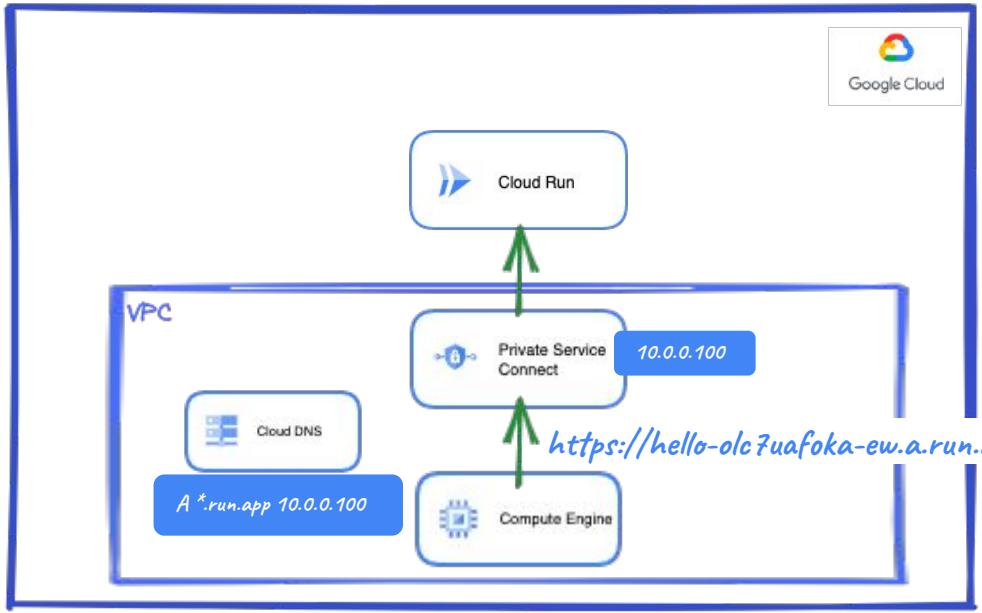
Hi, Nick! You know? I showed my toy Cloud Run app and now my manager is interested in exploring it for corporate use. But I'm afraid Cloud Run doesn't fit, does it?

You mean, privately access it? Sure, I'll show you how you can do that!



Google Cloud

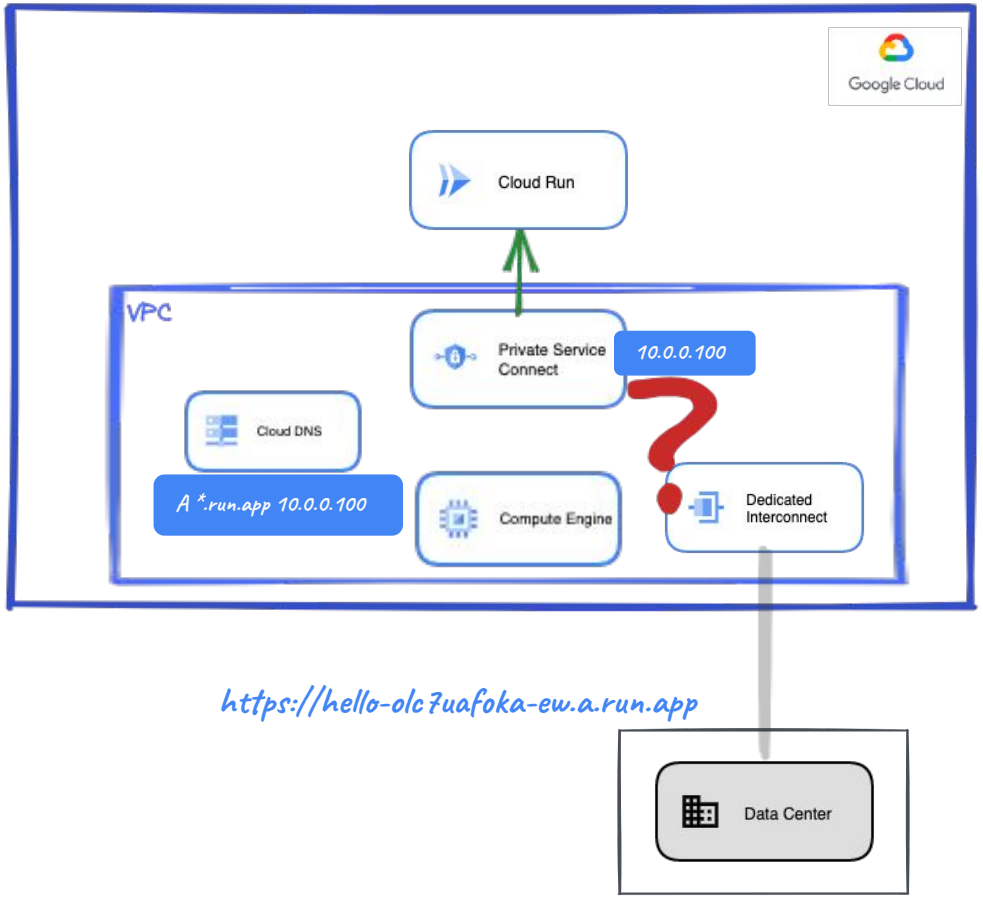
I imagine your company has deployed some apps in VMs and you want to access Cloud Run services from them, right?



You can use either Private Google Access or Private Service Connect. For PSC, just enable Private Google Access at the subnet where the VM is, create a PSC endpoint and make DNS point to it.

Google Cloud

Well, ahem... We don't have workloads in GCP yet. I was thinking accessing from onprem through Cloud VPN or Interconnect. Is that possible?

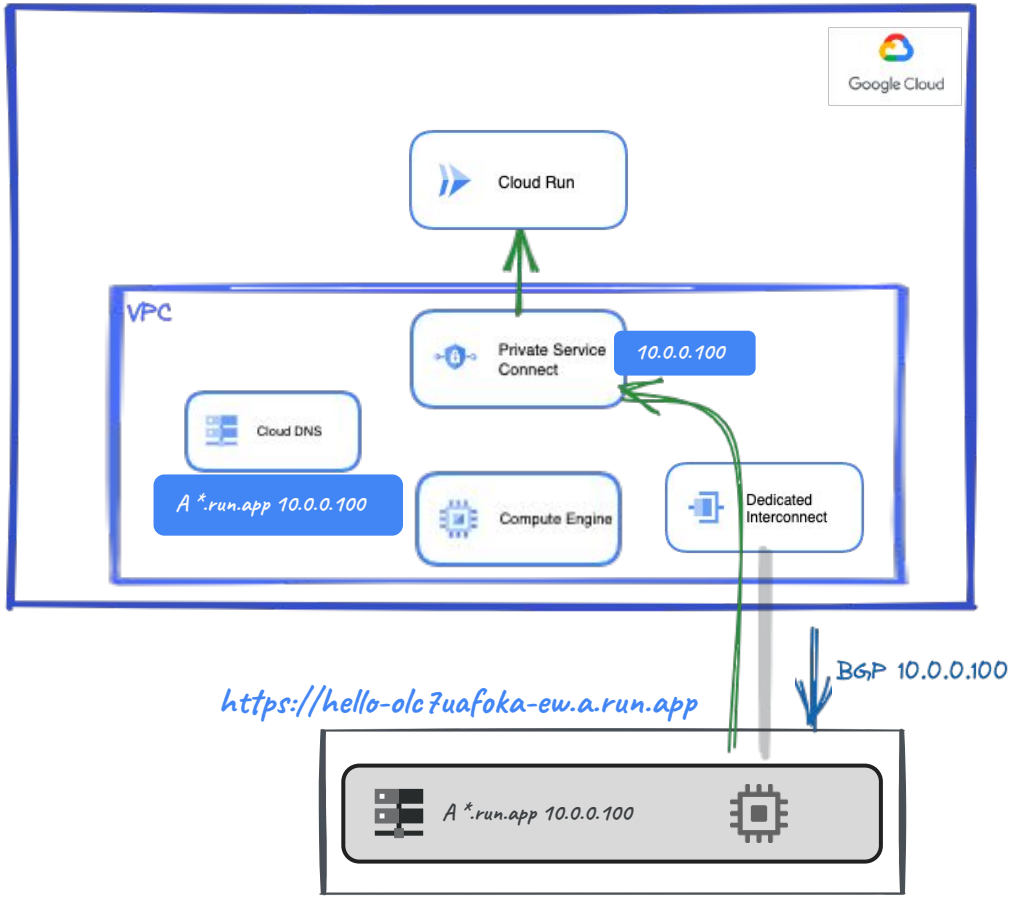


https://hello-olc7uafoka-ew.a.run.app

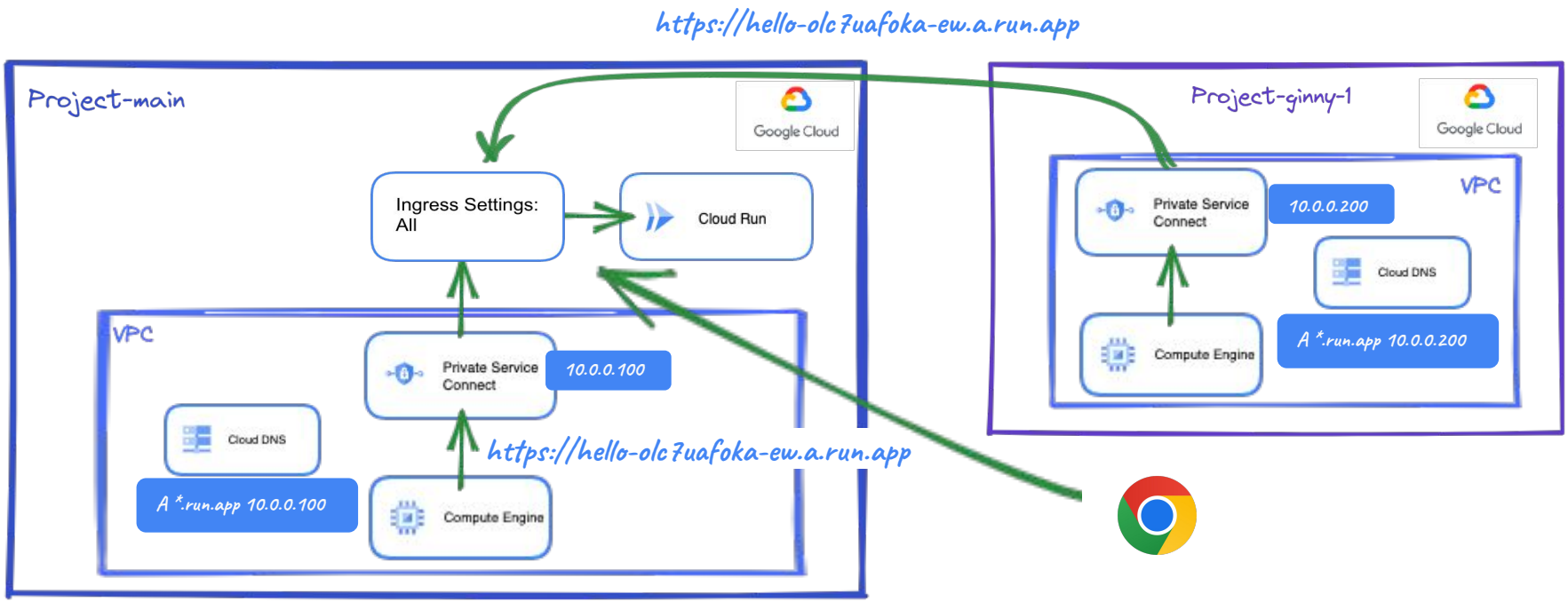
Google Cloud

Absolutely! Announce the PSC endpoint to onprem, make DNS changes if needed and you are good to go!

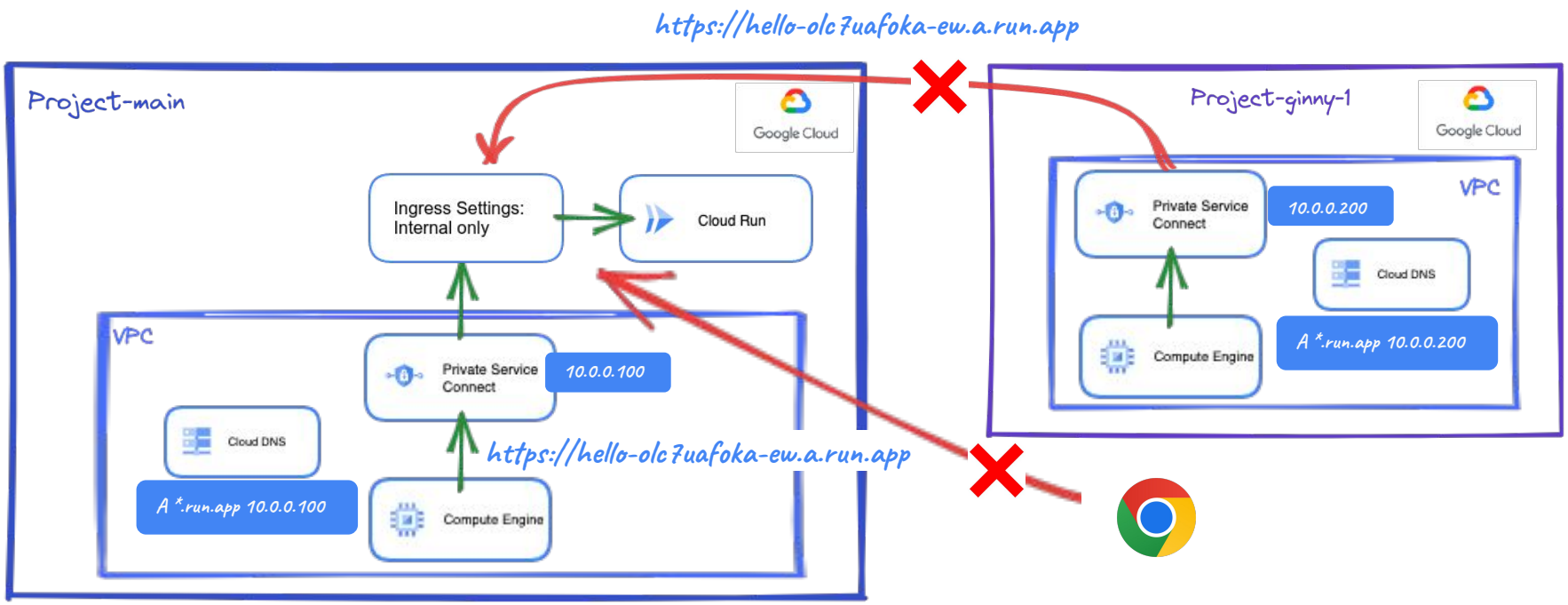
Google Cloud



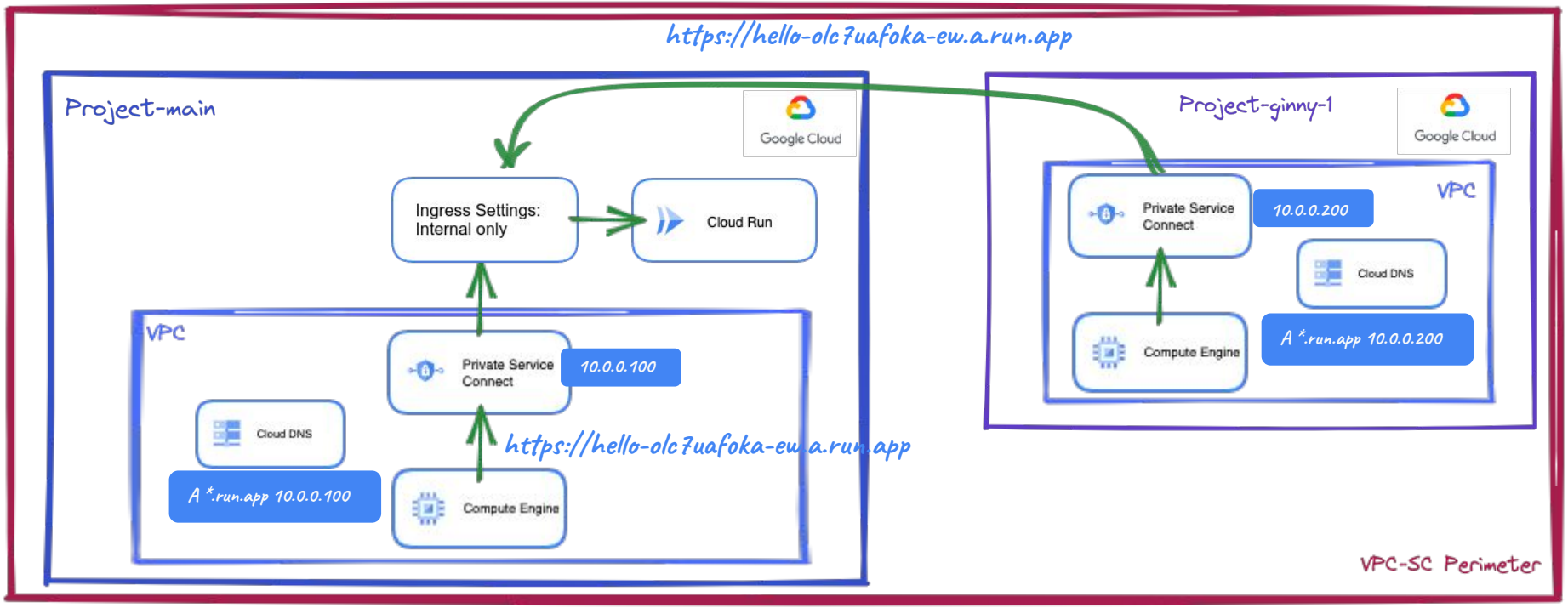
Looks simple! Ok, we've considered one project but corporate apps are intended to be used by multiple teams and projects. Would that work?



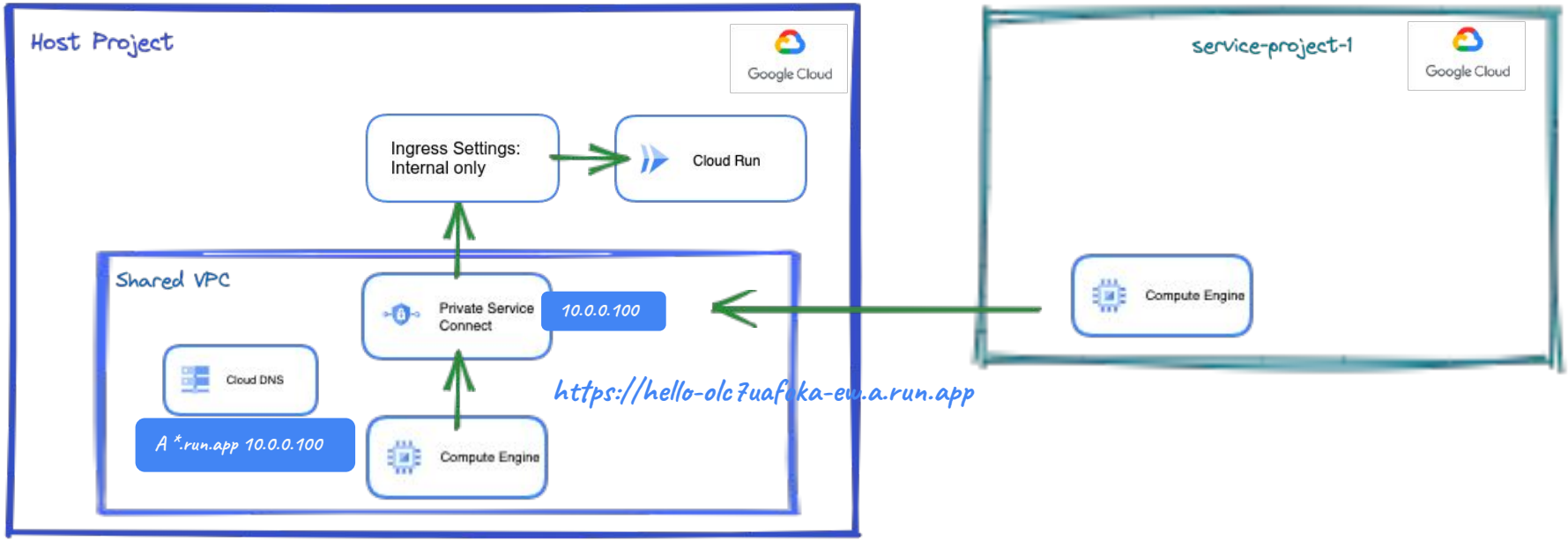
Yeah, good point. By default, you can access your service from anywhere: the same project, another project, or... the Internet, remember?



Hmmm... Configuring Ingress settings to Internal only you could block access from the Internet, but access from another project will not work as this call is NOT considered internal.

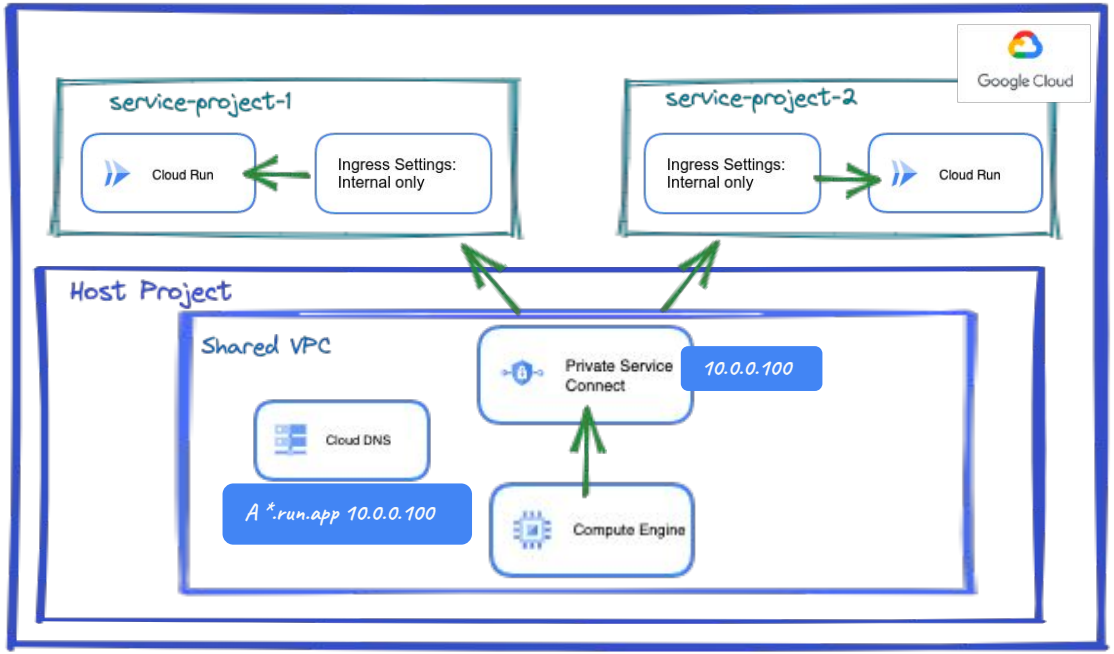


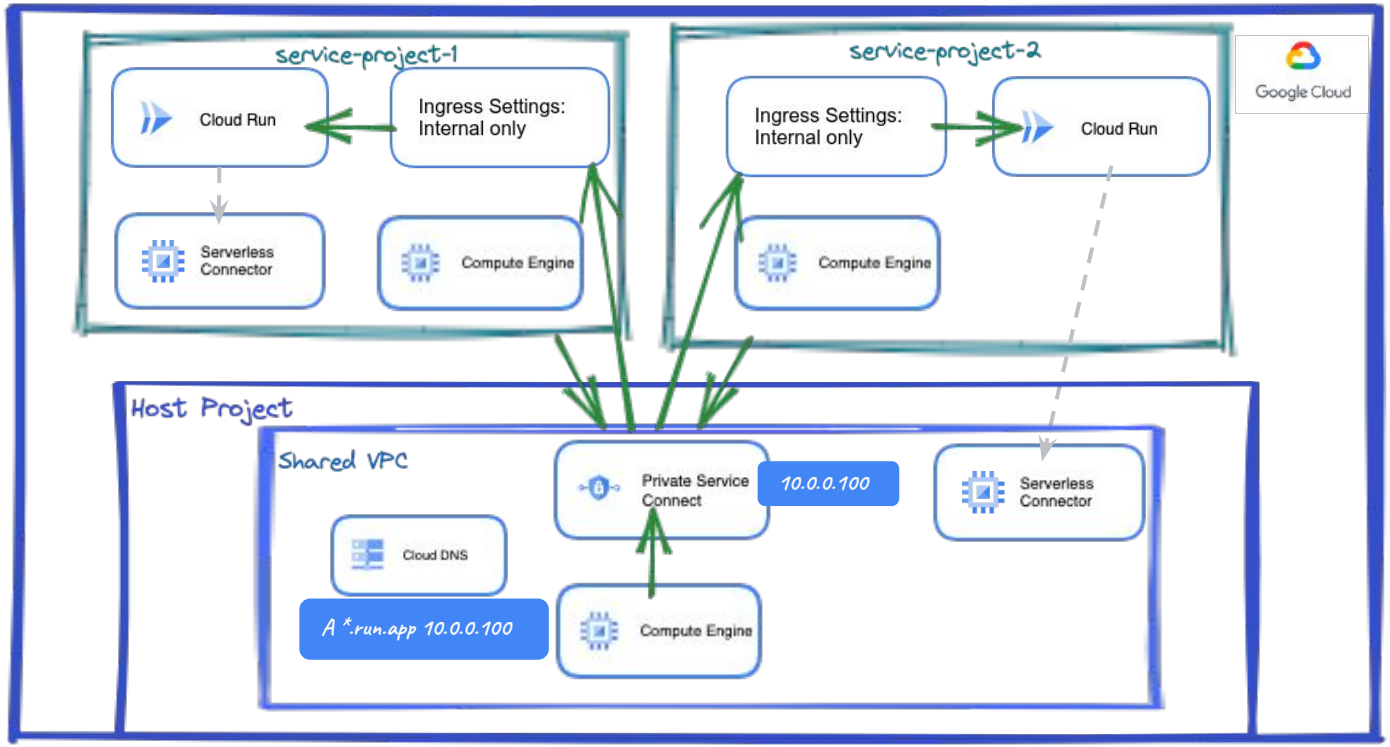
However, if you include the projects within the same VPC-SC perimeter, this call will be considered internal and will work!



Accessing from a Service Project of the Host Project where Cloud Run service is running is also considered internal traffic.

In reality, you can deploy Cloud Run in any project using the Shared VPC. Calls between these projects are considered internal.

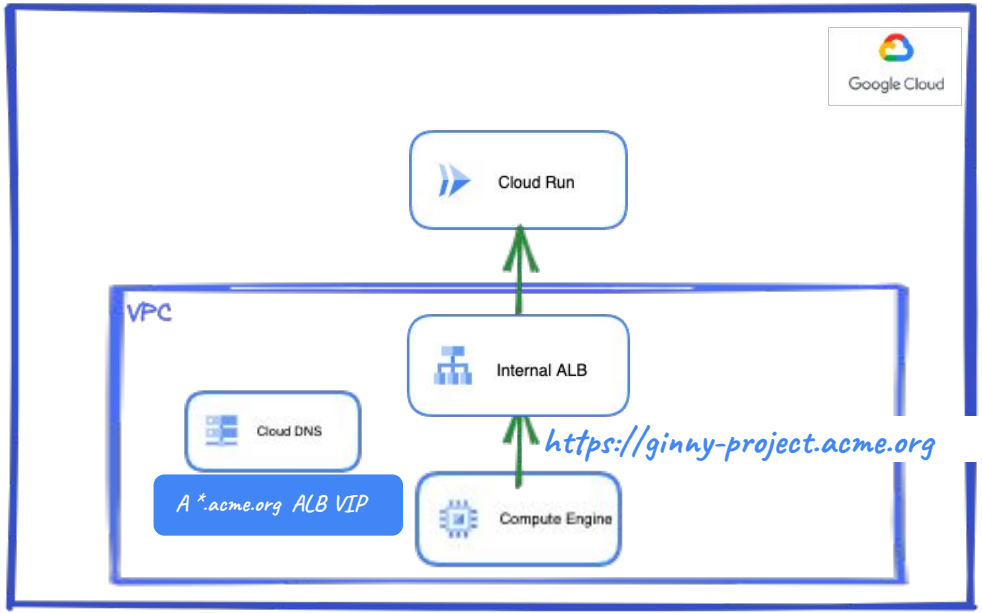




That includes calls between service projects. Note: in a service project, Cloud Run needs a serverless connector even though this is Ingress Traffic.

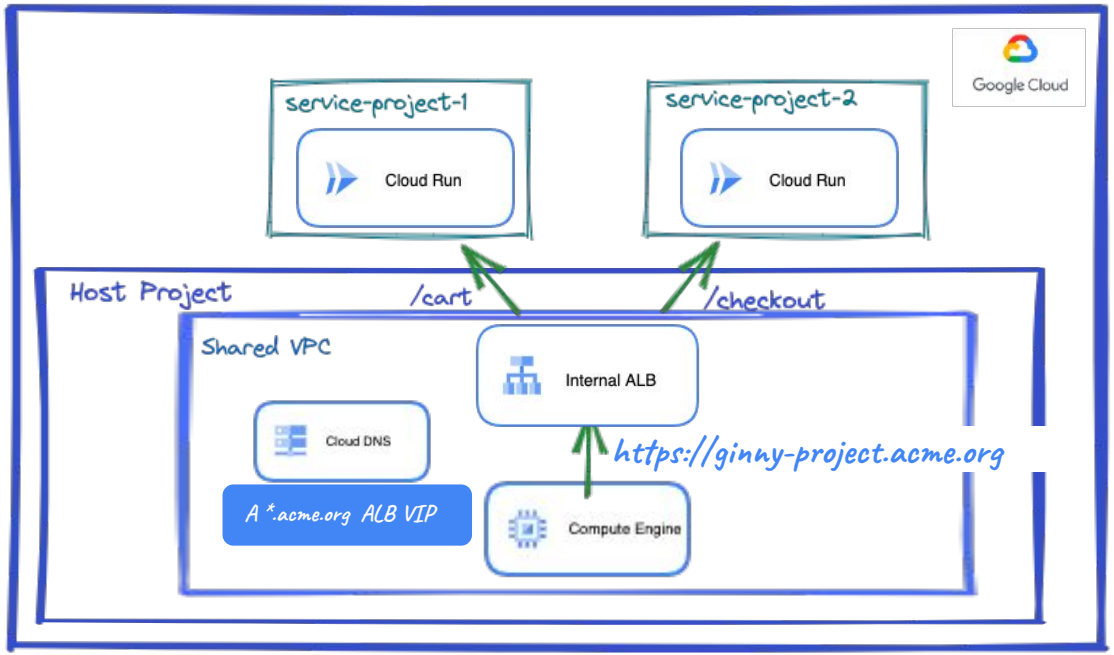
Wow, we've added quite some pieces! I think now I can tell my manager Cloud Run may fit our corporate use cases. One more thing, could we access Cloud Run services using our own custom domain?

Google Cloud



You cannot use your own domain with PSC but you can use internal Application Load Balancer with Serverless NEGs to set it. And you could even use the same domain to access externally and internally!

Google Cloud



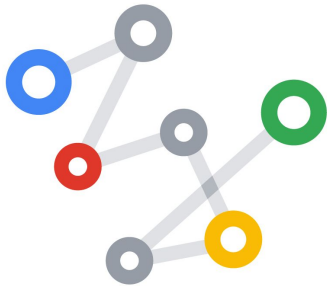
Great! We're considering using different Service projects for each team. Could the infrastructure team centrally manage this internal ALB?

Yes, cross-project service referencing allows you to create Backend Services and Frontend resources in different projects.

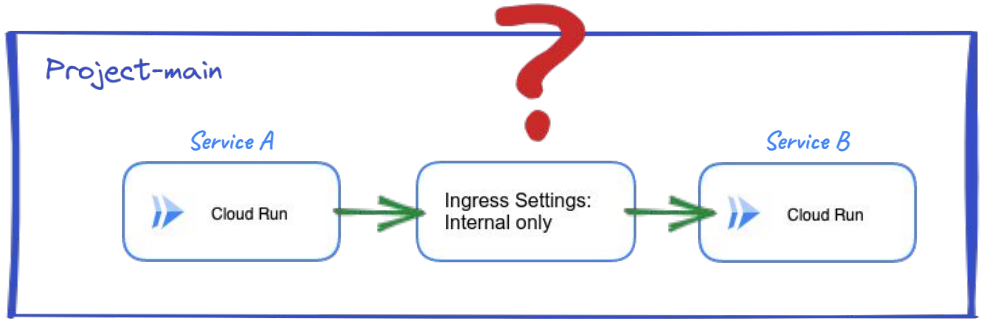
Microservices architectures

Developing Microservices applications

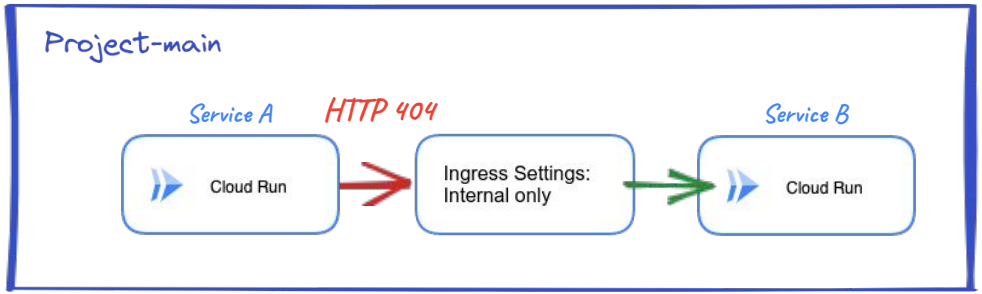
Terraform code



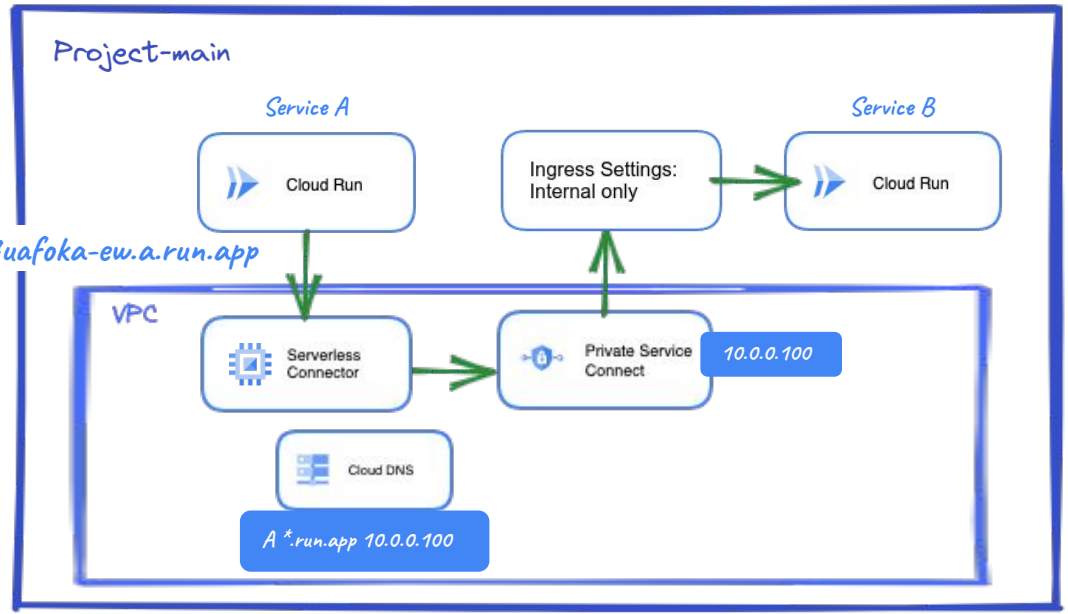
Google Cloud



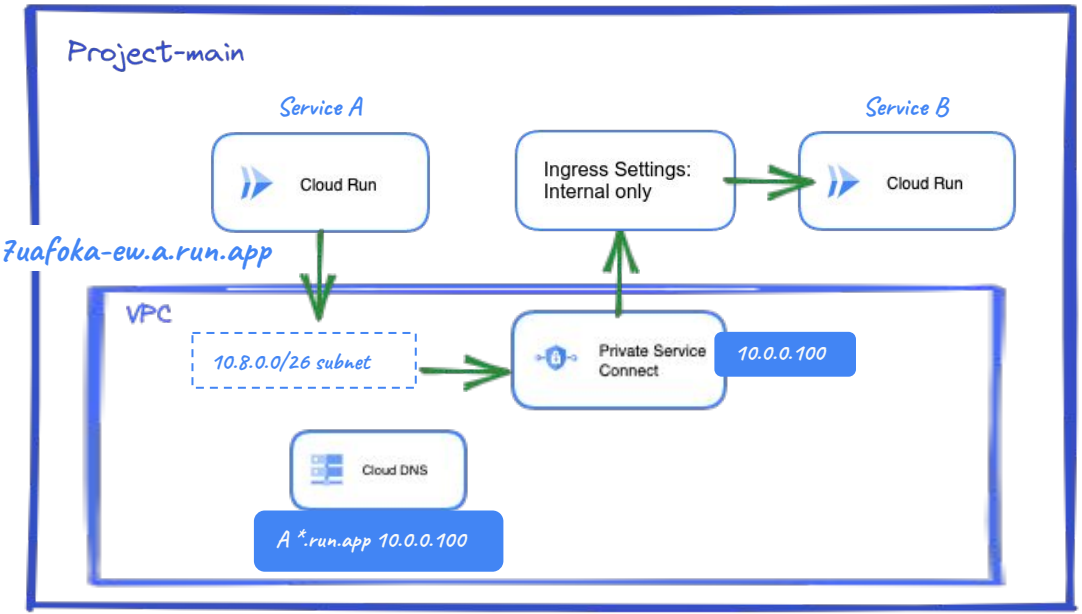
Hey, Nick! I would like to discuss microservices. For instance, when a Cloud Run service calls another Cloud Run service within the same project, it is considered internal, right?



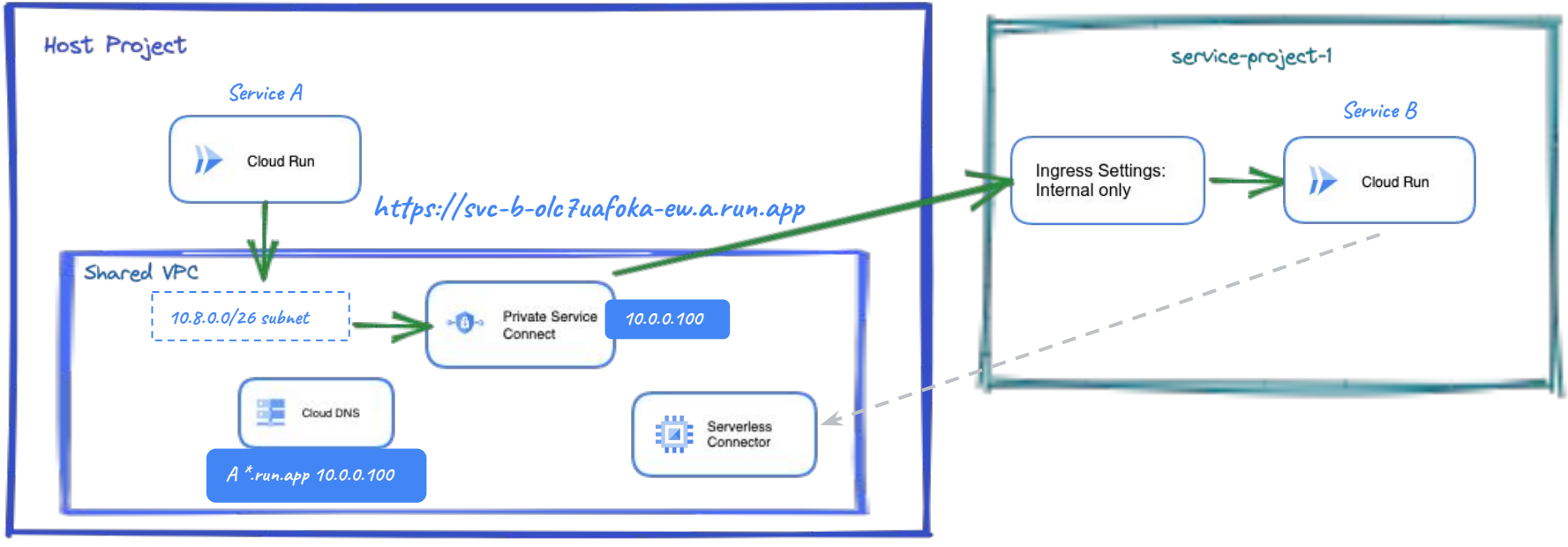
Great question! Actually this is NOT considered internal! You will get a HTTP 404 Not Found status code.



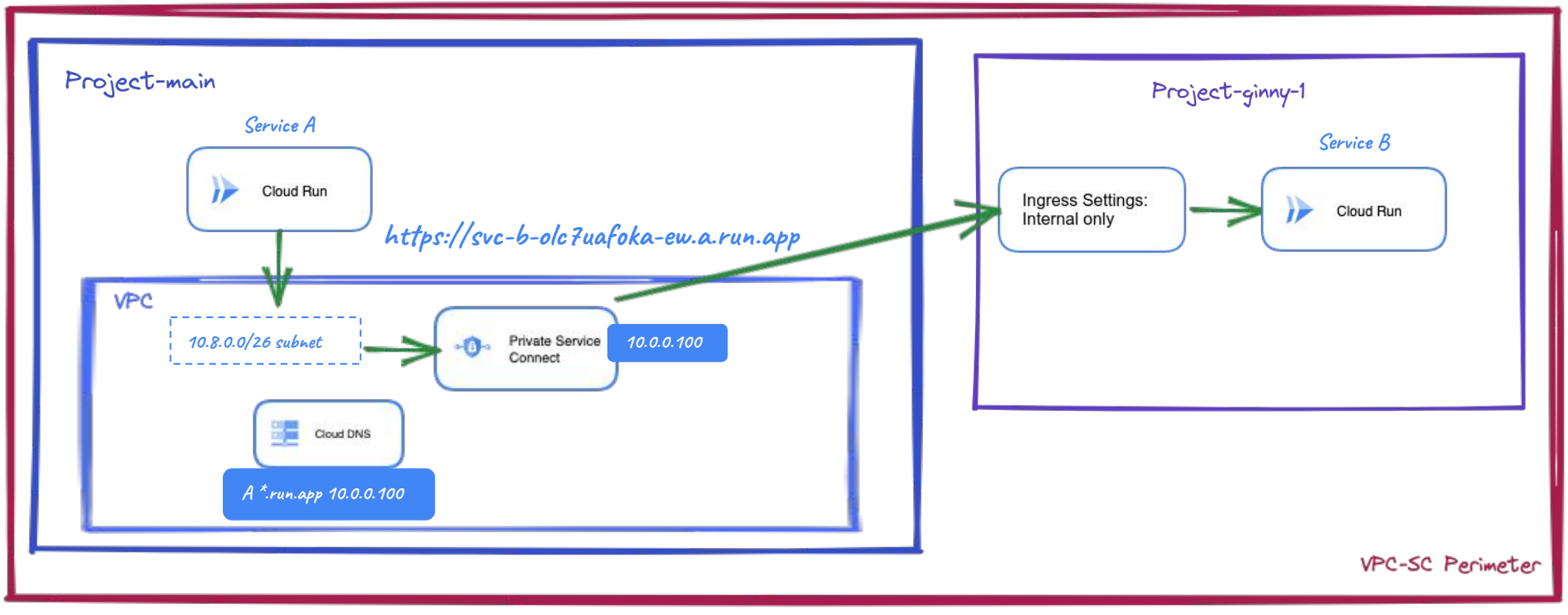
For this call to be considered internal, you have two options. One is accessing through PGA/PSC. You will need a Serverless VPC connector to reach PGA/PSC.



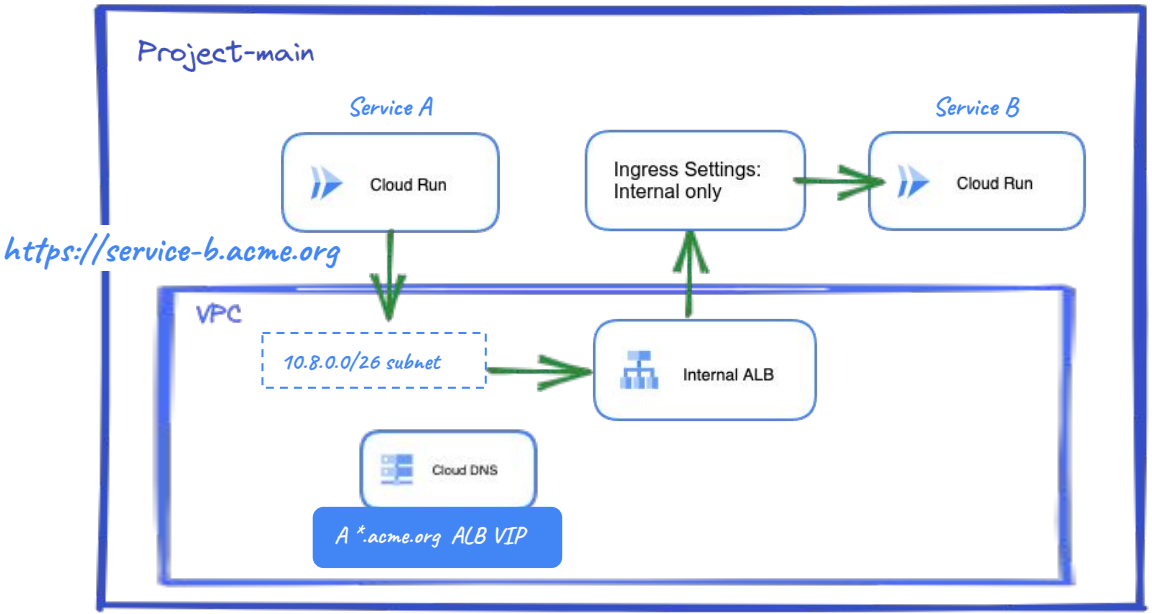
Cloud Run also supports Direct VPC Egress, that is, directly using IPs from a subnet in your VPC. This provides lower latency, higher throughput, lower costs and ease of use.



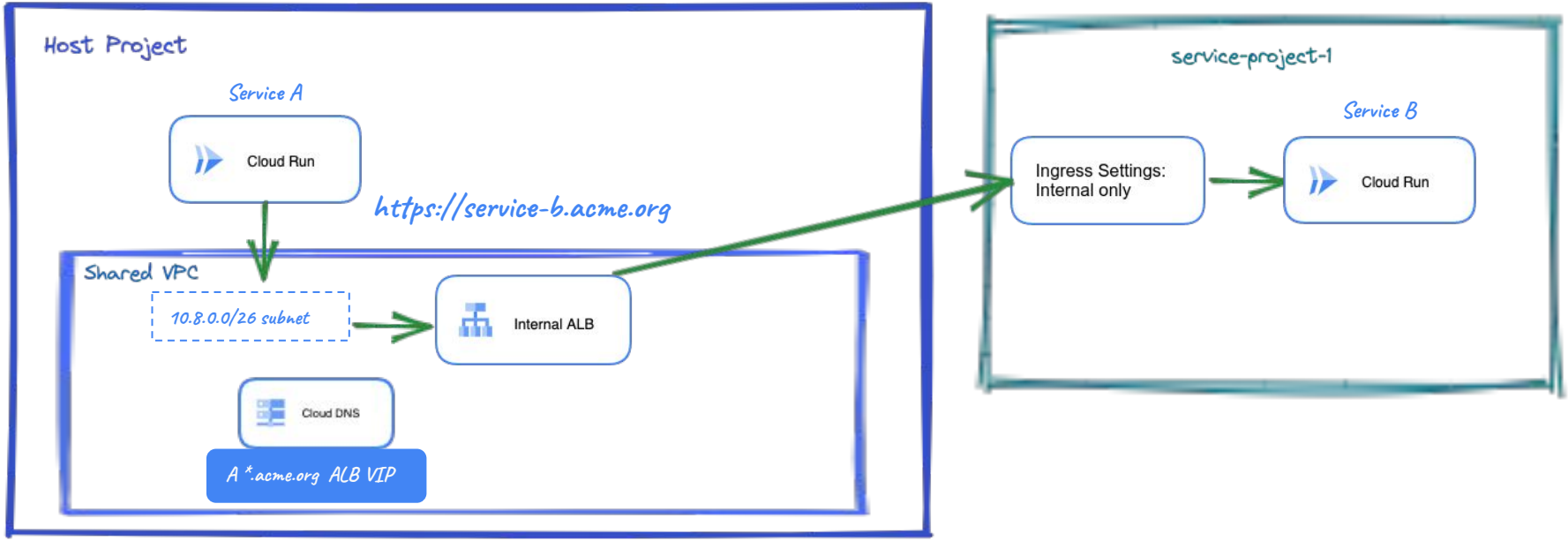
PGA/PSC also works with calls between services in projects associated to a Shared VPC.



If projects are not associated to the same Shared VPC, you need to include them within the same VPC-SC perimeter.



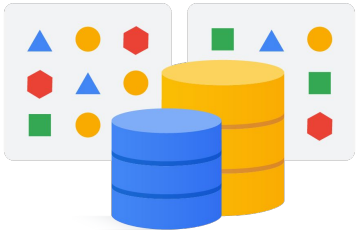
The second option is to use an internal ALB with Cloud Run as a Serverless NEG backend. The beauty of this is that you can also set your own custom domain.



With an internal ALB you can also access a Cloud Run service in a service project.

Access to Data

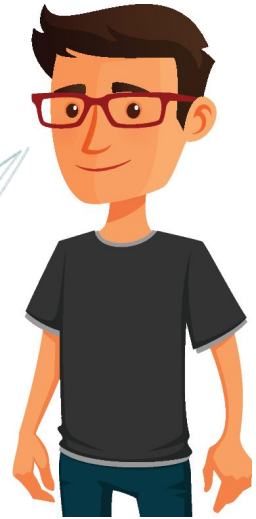
Databases, filesystems, oh my!



Google Cloud

Hi Nick. I'm excited about Cloud Run! As my team and I continue to develop the app, we're realizing that we will need access to data. How can we do this?

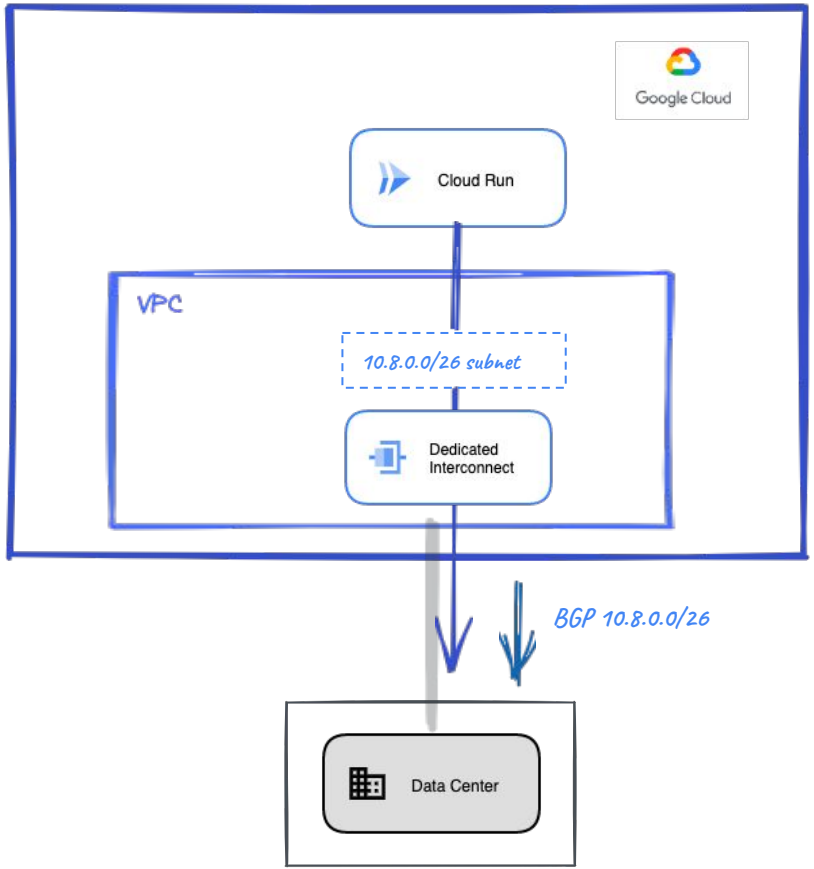
Hi Ginny. Well, it depends where your data is but let's take a look at it!

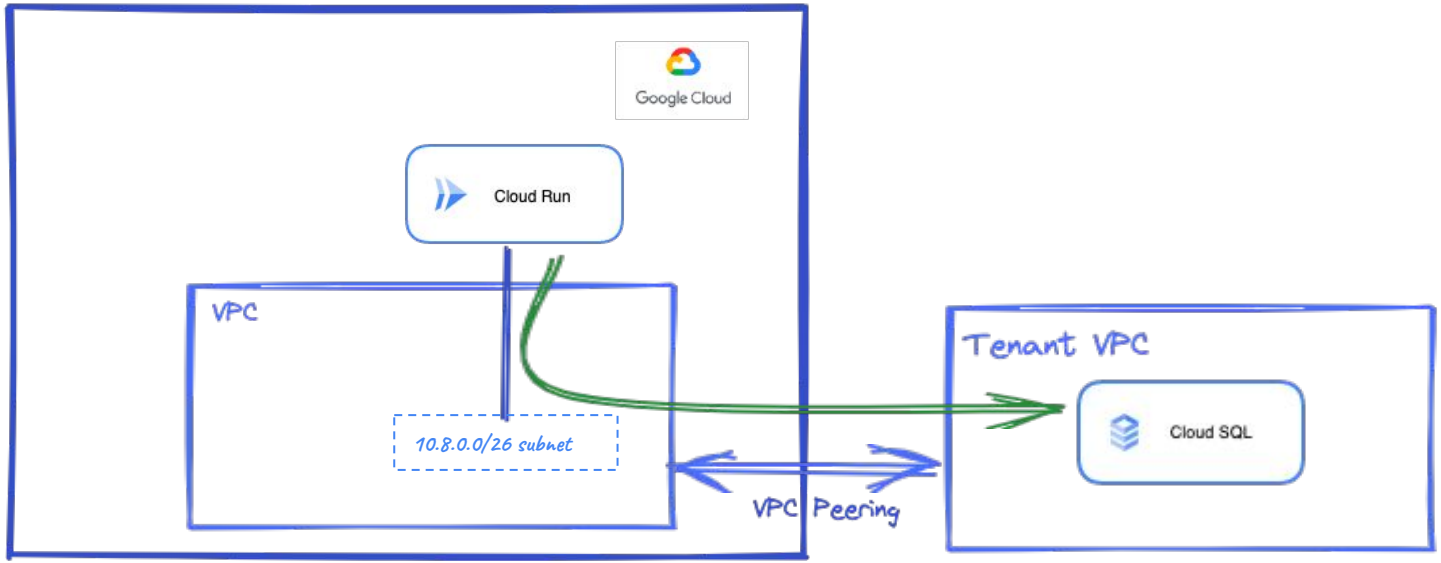


Google Cloud

Let's assume your data is on an onprem DB or network file systems. Cloud Run can access it through Direct VPC Egress.

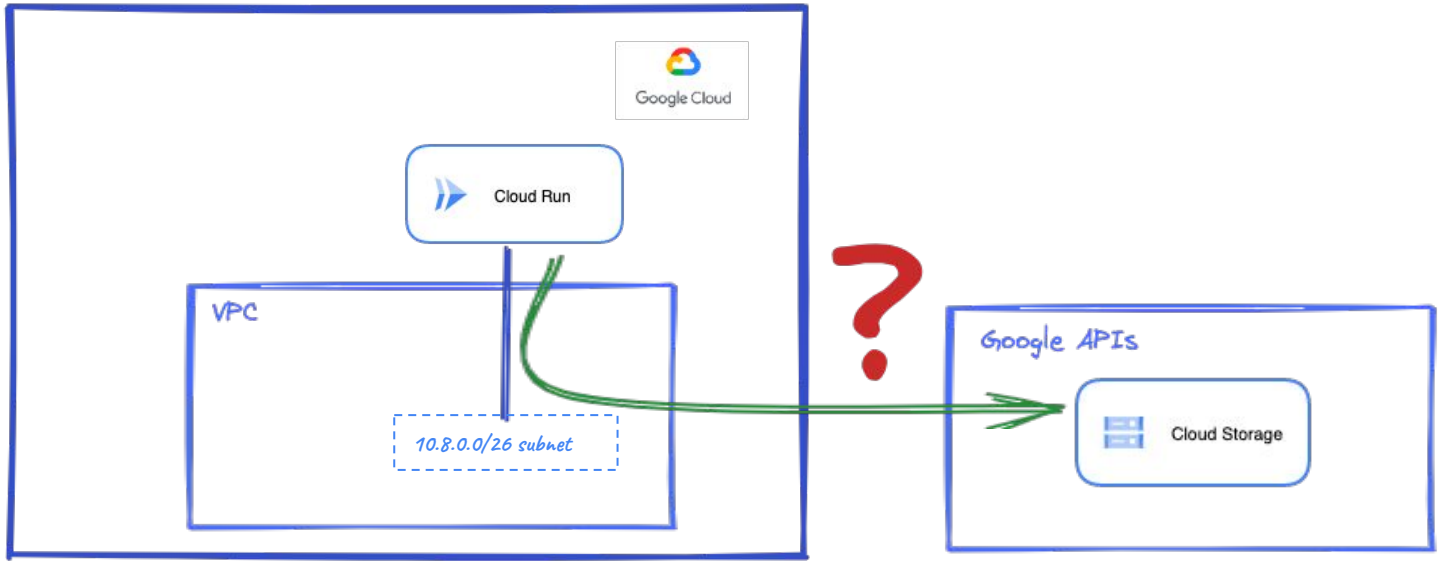
Make sure you announce the subnet where Cloud Run is running over Interconnect for onprem connectivity .



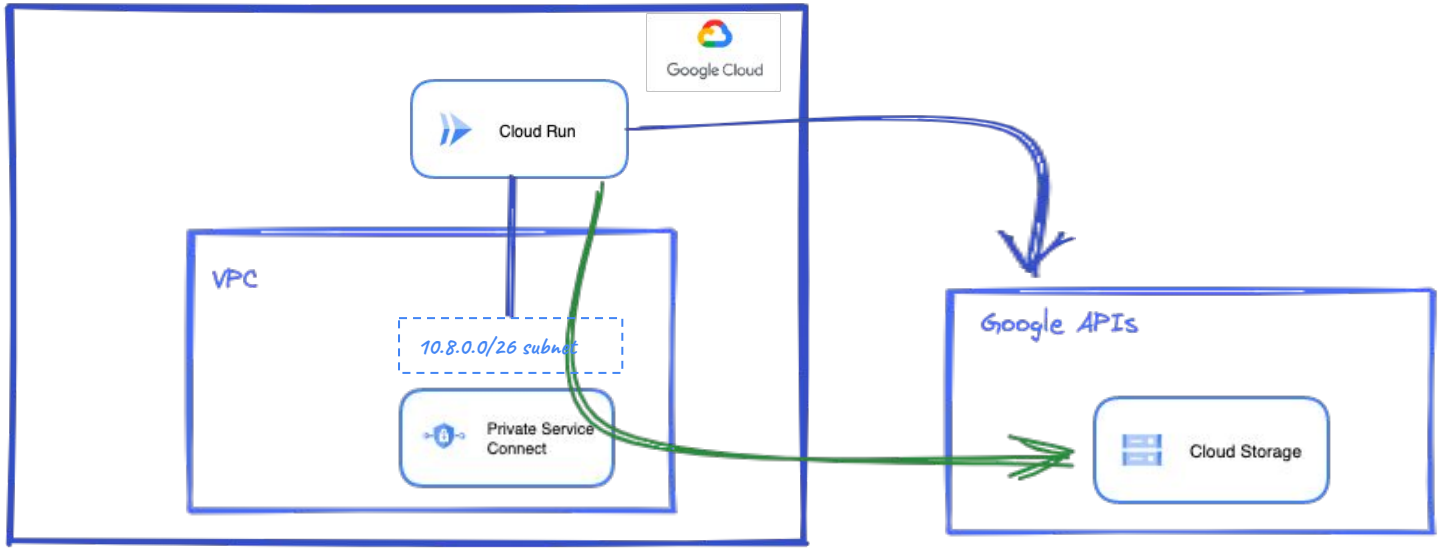


I guess that using Direct VPC Egress, Cloud Run can also access data in a Cloud SQL Database, right?

You got it, Ginny!



Ok, cool. We may need to access files too. Could we access a Storage bucket?



You can access Google APIs like GCS or BigQuery directly using public IP addressing, or privately using Direct VPC Egress if you enable PGA/PSC.

Google Cloud

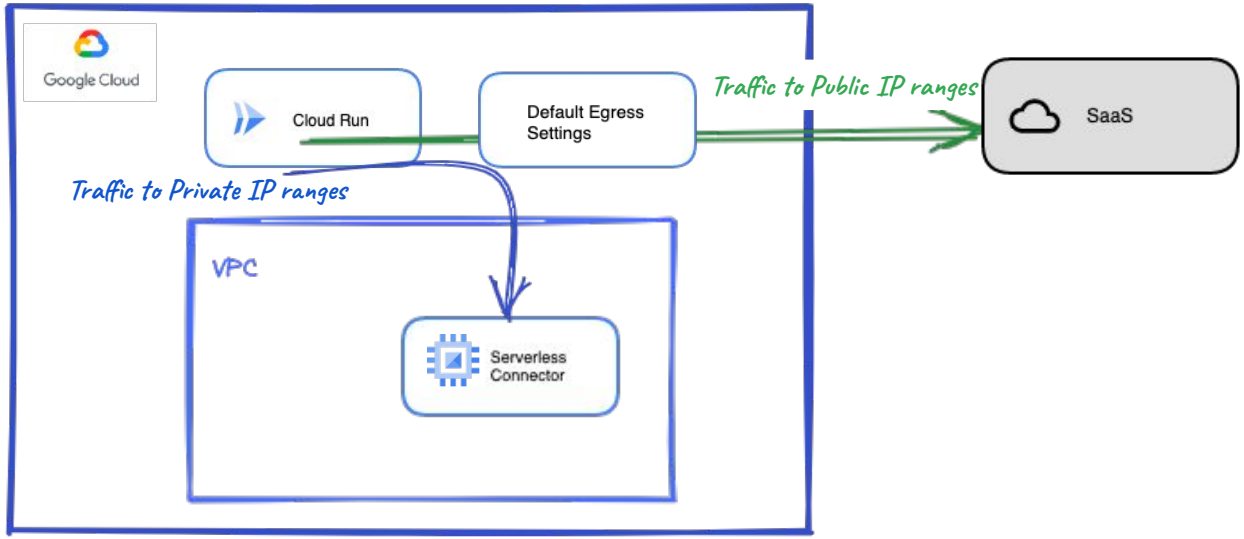
The SaaS world

Connecting with providers

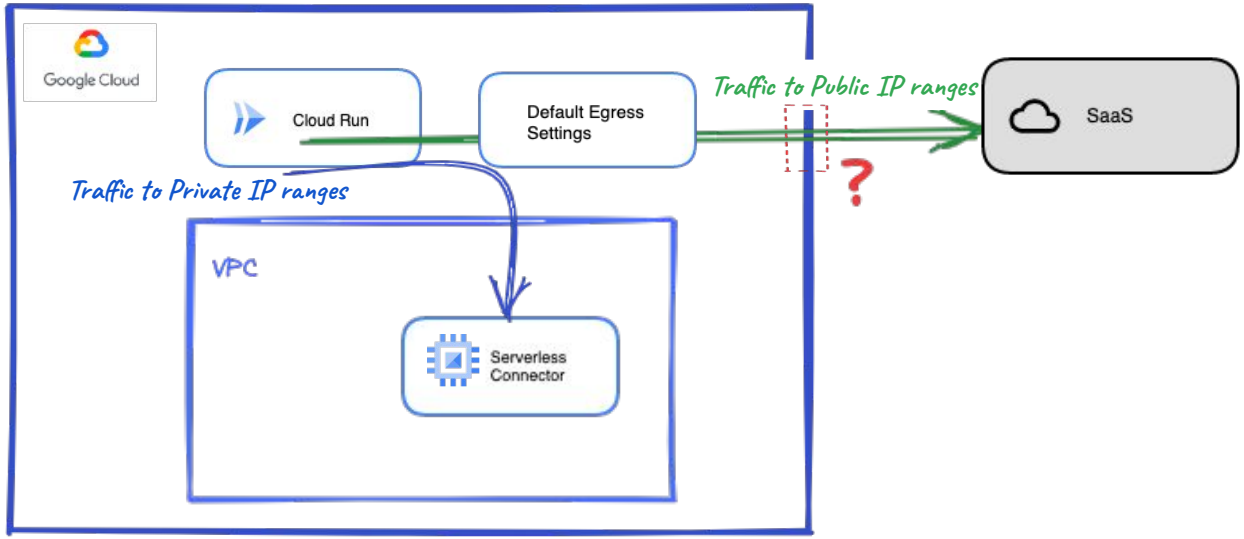
Google Cloud

Hi again Nick. My team is thrilled to use Cloud Run and we realize we have more requirements. E.g. we use SaaS solutions running in other clouds, could we access them?

Sure, you can access SaaS solutions, let me show you how!

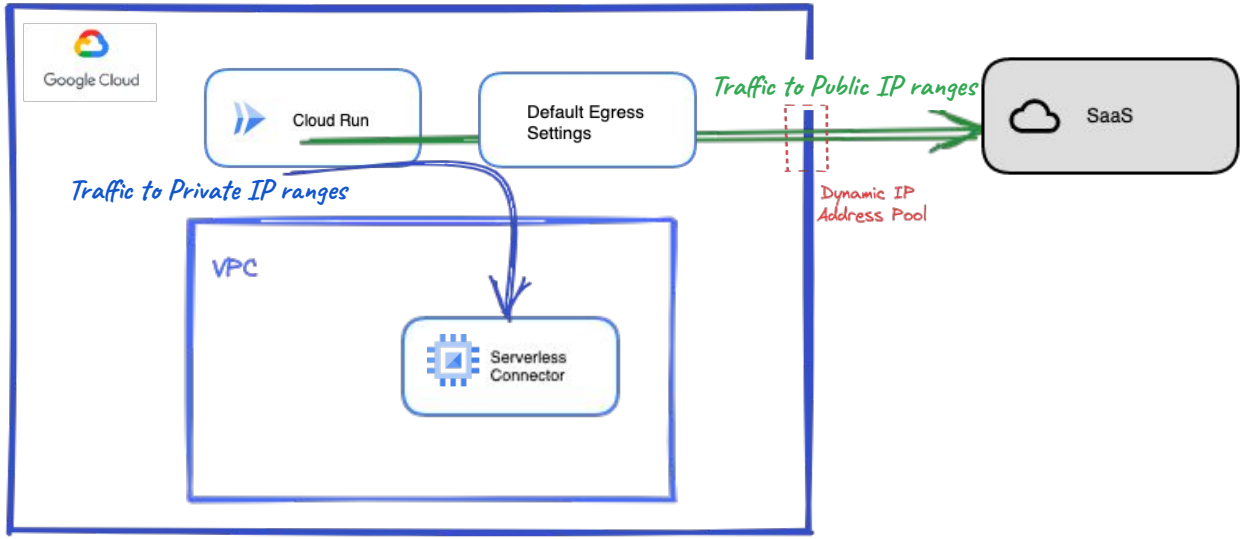


Cloud Run services have direct Internet access. If you configure a Serverless Connector or Direct VPC Egress, default Egress Settings send traffic through them only to private IP ranges. The rest will reach Internet directly.

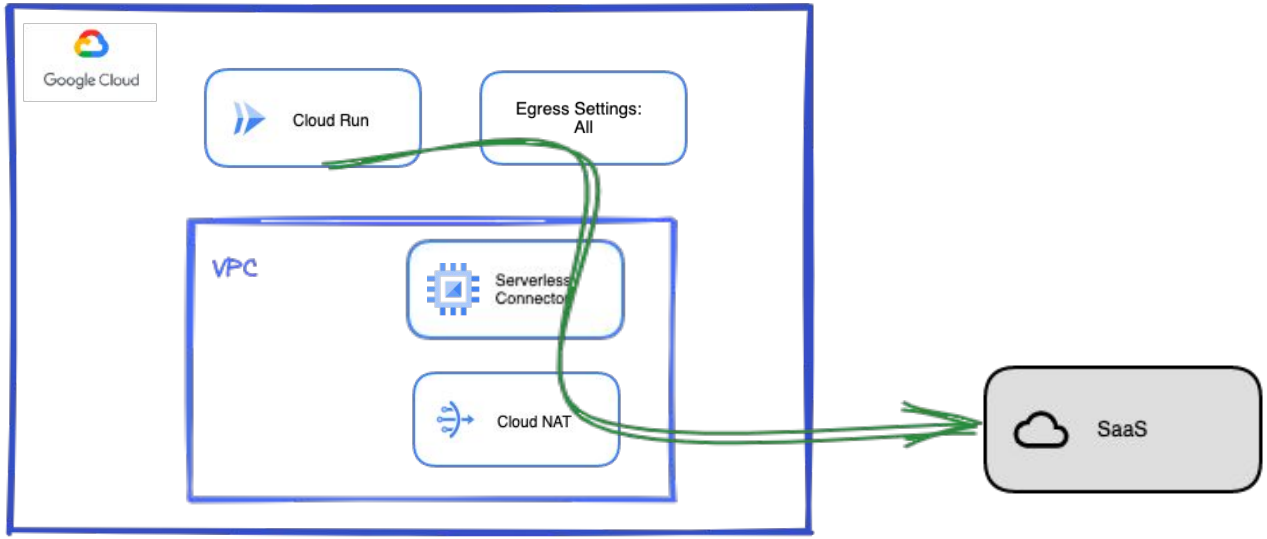


Alright, so direct access to the Internet. But my provider has several customers and they allow access filtering by IP. Which IP does Cloud Run use, can I assign one or...?

Google Cloud



No, you can't. Cloud Run IP addresses belong to a Dynamic IP Address Pool shared by all instances of all customers, and they can change!



If you need a static public IP address, you can configure Egress Settings to send all outgoing traffic through a connector and set up Cloud NAT (Direct VPC Egress doesn't support it for now).

Google Cloud

Security Controls

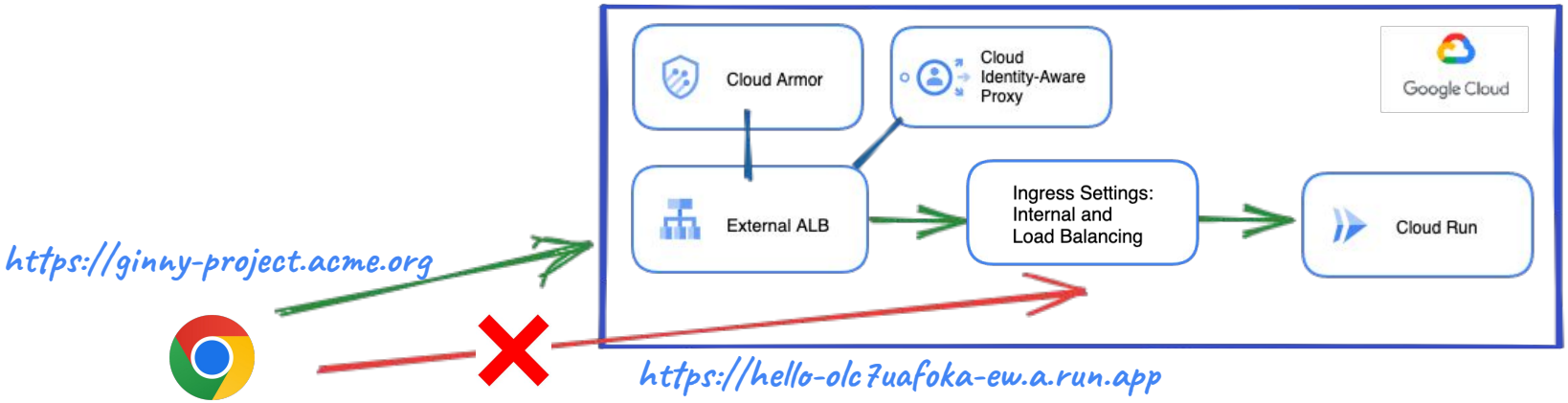
Applying Security in the corporate environment

Google Cloud

Hi, Nick! You know? I showed Cloud Run capabilities to the Security Team and they are not sure it meets their security policies. Could we review Cloud Run security controls?

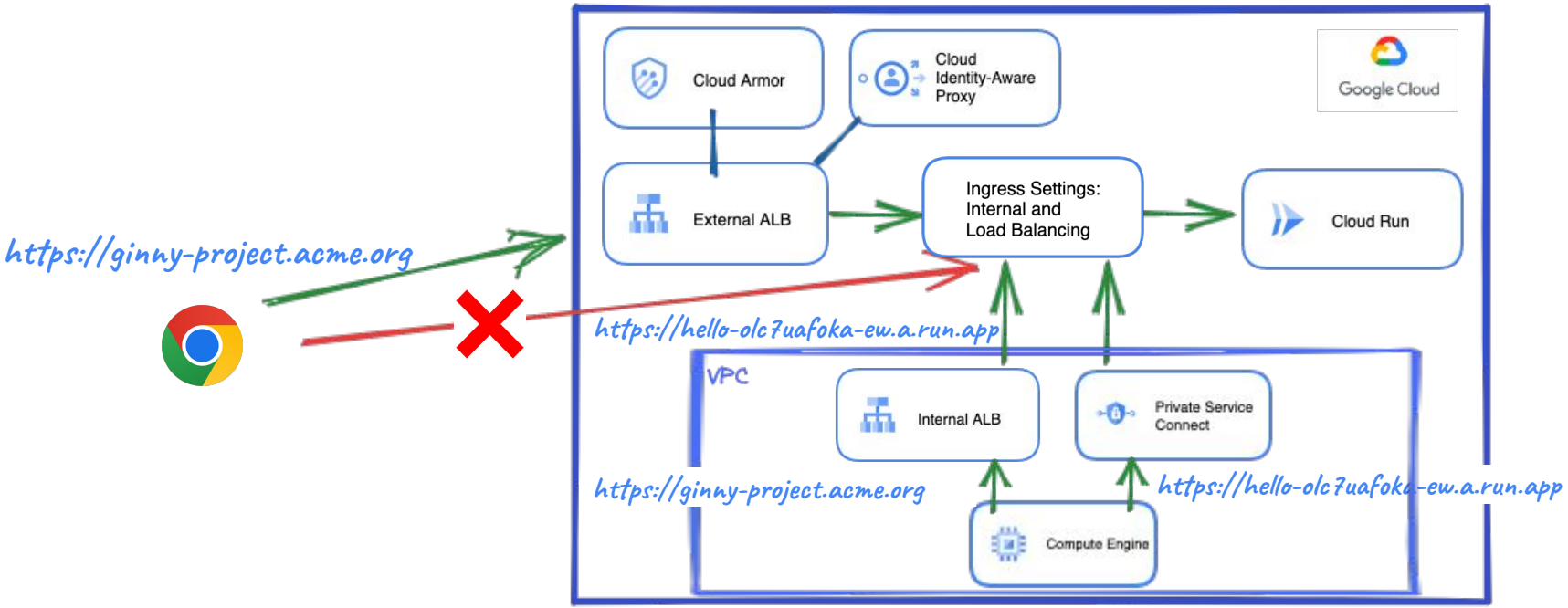
Absolutely, let's review different security controls!

Google Cloud

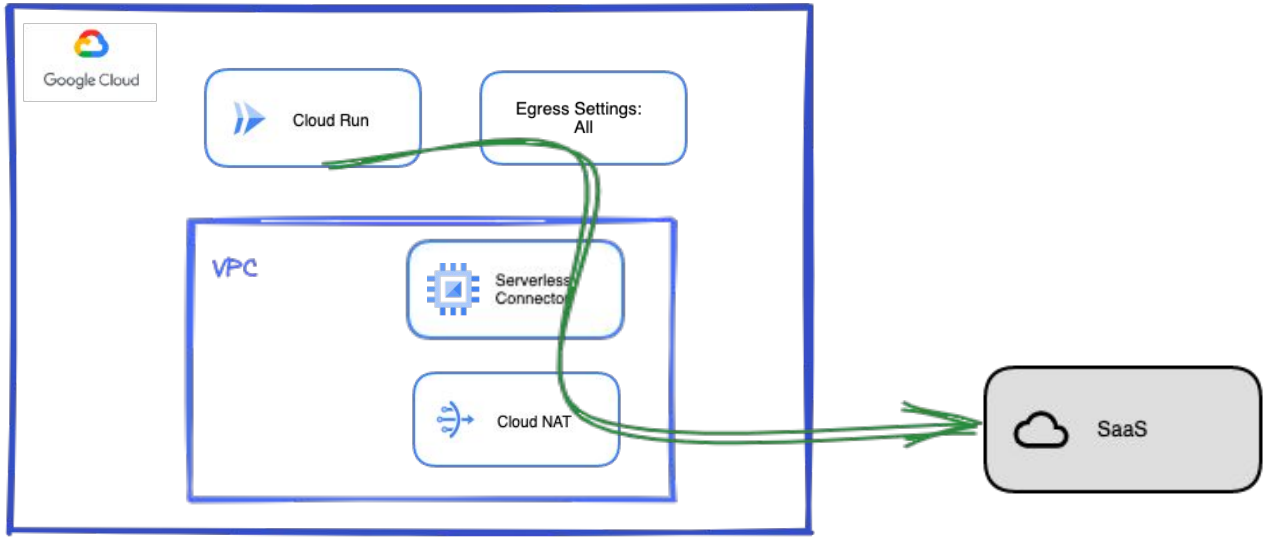


In previous chapters we mentioned that a service can be exposed through an external Load Balancer, secured with Ingress Settings to Internal and Load Balancing, Cloud Armor and IAP.

Google Cloud



Regardless of the Ingress Settings, the service can also be reached through PGA/PSC or through an internal ALB.

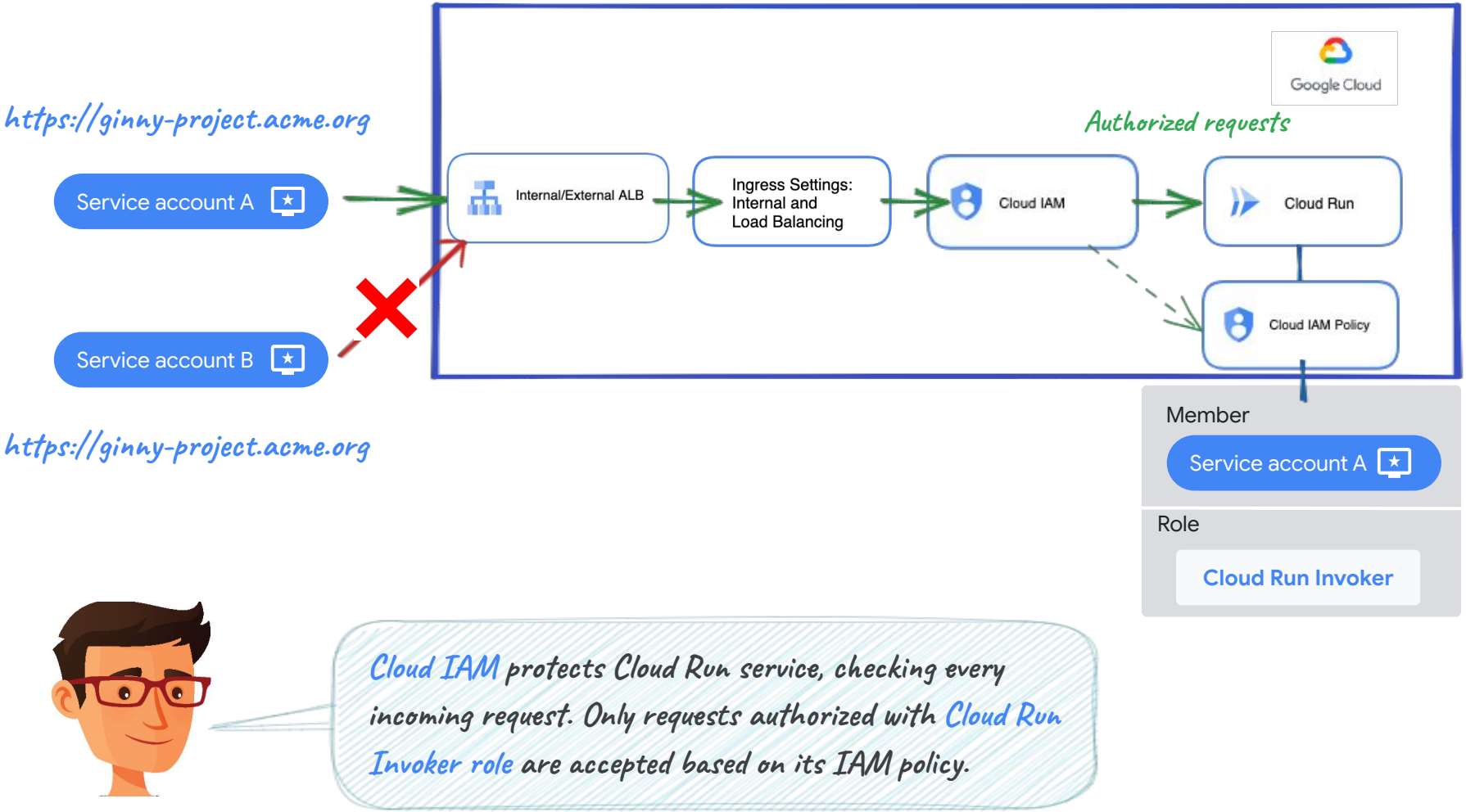


You can configure Egress Settings to send all outgoing traffic through a VPC, apply Firewall rules, and set up Cloud NAT to get a static Public IP address to access Internet.

Ok great, I got it! You told me about Networking specific security controls. But what about authentication and authorization? Can we also build them on top?

Great point! Let's review what Access Control methods you have available.

Google Cloud



Cloud IAM protects Cloud Run service, checking every incoming request. Only requests authorized with Cloud Run Invoker role are accepted based on its IAM policy.

https://ginny-project.acme.org

End-user account

Cloud Identity-Aware Proxy

External ALB

Ingress Settings: Internal and Load Balancing

Cloud IAM

Cloud Run

Cloud IAM Policy

Google Cloud

Authorized requests

Member

IAP service agent

Role

Cloud Run Invoker

And for internal Web Apps with external access, how do we manage authentication?

You can authenticate users via IAP, and grant the invoker role to IAP's service agent.

https://ginny-project.acme.org

Anonymous

Google Cloud

Authorized requests

External ALB

Ingress Settings: Internal and Load Balancing

Cloud IAM

Cloud Run

Cloud IAM Policy

Member

allUsers

Role

Cloud Run Invoker

Alright, but what about public APIs, do you also need to authenticate?

No, for public APIs or websites, you can assign the Cloud Run Invoker role to allUsers.

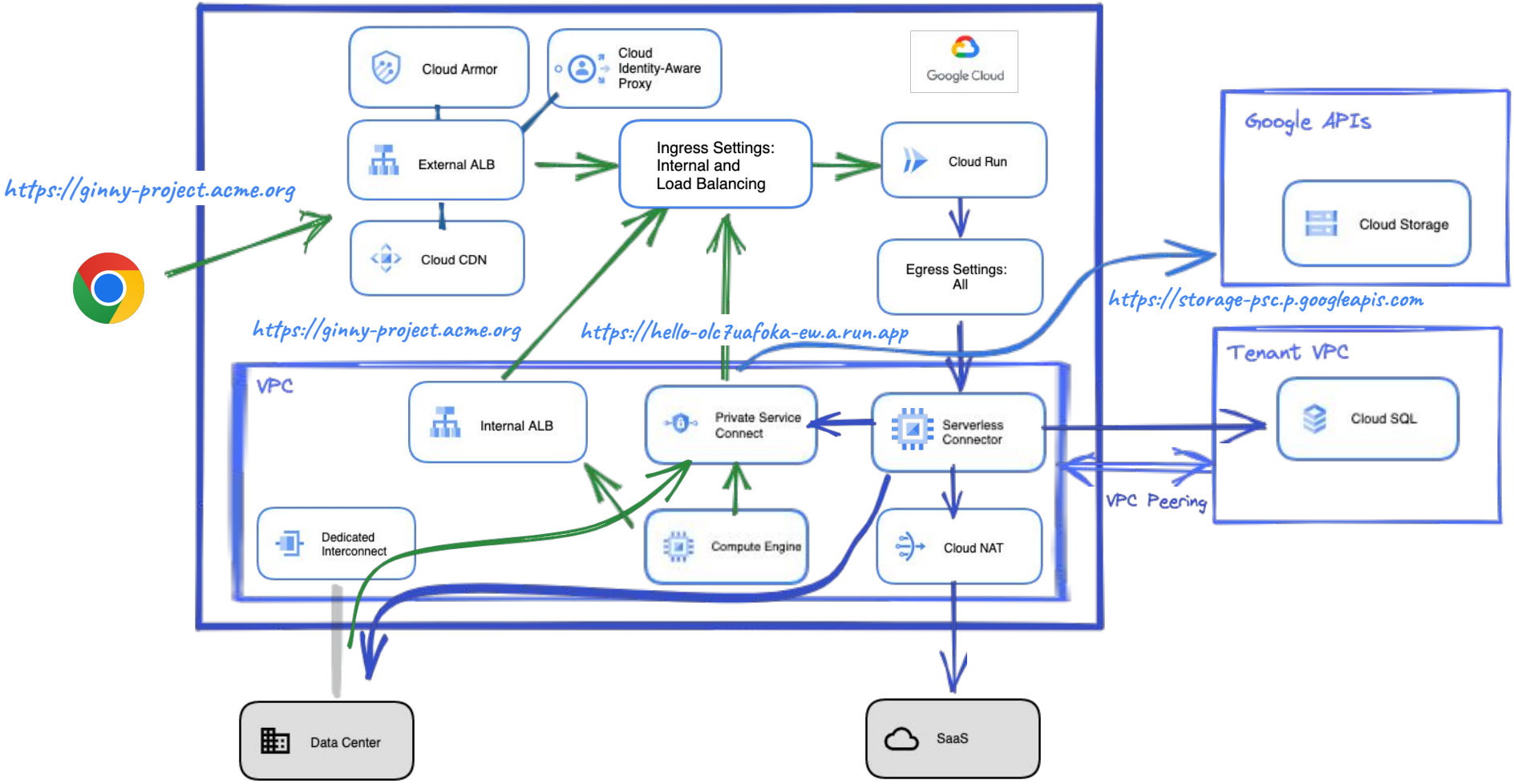
All together

Google Cloud

Thanks a lot, Nick! I think now I have all the pieces in the puzzle to use Cloud Run in my company. I've summarized it here to see if I got it right!

Hey, this diagram is great! It has all the main elements we have discussed.

Google Cloud


Cloud Armor
Cloud Identity-Aware Proxy
Google Cloud
External ALB
Ingress Settings: Internal and Load Balancing
Cloud Run
https://ginny-project.acme.org
Cloud CDN
Egress Settings: All
Google APIs
Cloud Storage
https://storage-psc.p.googleapis.com
https://ginny-project.acme.org
https://hello-olc7uafoka-ew.a.run.app
Tenant VPC
VPC
Internal ALB
Private Service Connect
Serverless Connector
Cloud SQL
VPC Peering
Dedicated Interconnect
Compute Engine
Cloud NAT
Data Center
SaaS

Google Cloud