Regions and zones

Compute Engine resources are hosted in multiple locations worldwide. These locations are composed of regions and zones. A region is a specific geographical location where you can host your resources. Regions have three or more zones. For example, the `us-west1` region denotes a region on the west coast of the United States that has three zones: `us-west1-a`, `us-west1-b`, and `us-west1-c`.

Resources that live in a zone, such as virtual machine instances (/compute/docs/instances) or zonal persistent disks (/compute/docs/disks), are referred to as zonal resources. Other resources, like static external IP addresses (/compute/docs/ip-addresses#reservedaddress), are regional. Regional resources can be used by any resource in that region, regardless of zone, while zonal resources can only be used by other resources in the same zone.

For example, to attach a zonal persistent disk to an instance, both resources must be in the same zone. Similarly, if you want to assign a static IP address to an instance, the instance must be in the same region as the static IP address.

Putting resources in different zones in a region reduces the risk of an infrastructure outage affecting all resources simultaneously. Putting resources in different regions provides an even higher degree of failure independence. This lets you design robust systems with resources spread across different failure domains.

Only certain resources are region- or zone-specific. Other resources, such as images, are global resources that can be used by any other resources across any location. For information on global, regional, and zonal Compute Engine resources, see Global, Regional, and Zonal Resources (/compute/docs/regions-zones/global-regional-zonal-resources).

Zones and clusters

Compute Engine implements a layer of abstraction between zones and the physical clusters where the zones are hosted. A cluster represents a distinct physical infrastructure that is housed in a data center. Each zone is hosted in one or more clusters and Compute Engine independently maps zones to clusters for each organization. For example, the `us-central1-a` zone for your organization might not map to the same cluster as the `us-central1-a` zone for another organization.

Read the Zone virtualization (/compute/docs/regions-zones/zone-virtualization) document to learn more about zone-to-cluster mapping and zone virtualization concepts.

Decoupling zones from clusters provides a number of benefits to you and to Compute Engine:

- It allows Compute Engine to ensure resources are balanced across the clusters in a region.
- The list of zones you can choose from remains manageable as Compute Engine continues to grow its regions over time by adding more clusters.

For most organizations, Compute Engine ensures that all projects in an organization have a consistent zone to cluster mapping. For organizations with projects that use VPC Network Peering (/vpc/docs/vpc-peering) or Private services access (/vpc/docs/private-services-access) to share networks or services with other organizations, Compute Engine tries to ensure that the peered organizations all have a consistent zone to cluster mapping. In the case of large-scale SaaS providers, for example, Compute Engine might not provide a consistent mapping for all peered organizations. In these cases, Compute Engine ensures that the peered projects have a consistent zone to cluster mapping.

Choosing a region and zone

You choose which region or zone hosts your resources, which controls where your data is stored and used. Choosing a region and zone is important for several reasons:

Handling failures

Distribute your resources across multiple zones and regions to tolerate outages. Google designs zones to minimize the risk of correlated failures caused by physical infrastructure outages like power, cooling, or networking. Thus, if a zone becomes unavailable, you can transfer traffic to another zone in the same region to keep your services running. Similarly, you can mitigate the impact of a region outage on your application by running backup services in a different region. For more information about distributing your resources and designing a robust system, see Designing Robust Systems (/compute/docs/robustsystems).

Decreased network latency

To decrease network latency, you might want to choose a region or zone that is close to your point of service. For example, if you mostly have customers on the East Coast of the US, then you might want to choose a primary region and zone that is close to that area and a backup region and zone that is also close by.

Identifying a region or zone

Each region in Compute Engine contains a number of zones. Each zone name contains two parts that describe each zone in detail. The first part of the zone name is the **region** and the second part of the name describes the **zone** in the region:

- **Region**

  Regions are collections of zones. Zones have high-bandwidth, low-latency network connections to other zones in the same region. In order to deploy fault-tolerant applications that have high availability, Google recommends deploying applications across multiple zones and multiple regions. This helps protect against unexpected failures of components, up to and including a single zone or region.

  Choose regions that makes sense for your scenario. For example, if you only have customers in the US, or if you have specific needs that require your data to live in the US, it makes sense to store your resources in zones in the `us-central1` region or zones in the `us-east1` region.

- **Zone**

  A *zone* is a deployment area within a region. The fully-qualified name for a zone is made up of `<region>-<zone>`. For example, the fully qualified name for zone `a` in region `us-central1` is `us-central1-a`.

  Depending on how widely you want to distribute your resources, create instances across multiple zones in multiple regions for redundancy.

Available regions and zones

The following sortable table lets you select different options to see where resources are available. For example, you can select `Europe` from the **Select a location** drop-down menu, and

`M2` from the **Select a machine type** drop-down menu to see a list of zones where M2 machines are available in Europe.

You can use the Google Cloud console, the Google Cloud CLI, or the Compute Engine API to see available regions and zones (/compute/docs/regions-zones/viewing-regions-zones) that support specific machine types.

Contact your account team to request access to a machine family in a specific region or zone.

Each zone offers a variety of processors. When you create an instance in a zone, your instance uses the default processor supported in that zone. For example, if you create an instance in the `us-central1-a` zone, your instance by default uses an Intel Haswell processor, unless you specify another option.

Alternatively, you can choose your desired CPU platform. For more information, read Specifying a minimum CPU platform for VM instances (/compute/docs/instances/specify-min-cpu-platform).

Note: Local SSDs (/compute/docs/disks#localssds) are available in all regions and zones. GPUs (/compute/docs/gpus/gpu-regions-zones) are available only in specific zones. Sole-tenancy (/compute/docs/nodes) is available in all regions and zones, and sole-tenant node types (/compute/docs/nodes/sole-tenant-nodes#node_types) are available for each corresponding machine type (/compute/docs/machine-types) offered in that zone, with the exception of E2 machine types, which do not support sole-tenancy.

Select a location ▾ Select a machine type ▾ Select other resources ▾ Clear all

Zones ▾	Location	Machine types	CPUs	Resources	CO_2 emissions
`asia-east1-a`	Changhua County, Taiwan, APAC	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`asia-east1-b`	Changhua County, Taiwan, APAC	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`asia-east1-c`	Changhua County, Taiwan, APAC	E2, N2, N2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`asia-east2-a`	Hong Kong, APAC	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		
`asia-east2-b`	Hong Kong, APAC	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		
`asia-east2-c`	Hong Kong, APAC	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		
`asia-northeast1-a`	Tokyo, Japan, APAC	E2, N2, N2D, N1, M1, M2, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome	GPUs	

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`asia-northeast1-b`	Tokyo, Japan, APAC	E2, N2, N2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome		
`asia-northeast1-c`	Tokyo, Japan, APAC	E2, N2, N2D, N1, M1, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome	GPUs	
`asia-northeast2-a`	Osaka, Japan, APAC	E2, N1, N2, N2D, M1, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		
`asia-northeast2-b`	Osaka, Japan, APAC	E2, N1, N2, N2D, M1, M2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		
`asia-northeast2-c`	Osaka, Japan, APAC	E2, N2, N2D, N1, M1, M2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		
`asia-northeast3-a`	Seoul, South Korea, APAC	E2, N2, N1, M1, M2, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake	GPUs	
`asia-northeast3-b`	Seoul, South Korea, APAC	E2, N2, N1, M1, M2, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake	GPUs	

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
asia-northeast3-c	Seoul, South Korea, APAC	E2, N2, N1, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake	GPUs	
asia-south1-a	Mumbai, India APAC	E2, N2, N2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
asia-south1-b	Mumbai, India APAC	E2, N2, N2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
asia-south1-c	Mumbai, India APAC	E2, N2, N2D, N1, M1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Milan		
asia-south2-a	Delhi, India APAC	E2, N1, N2, M1, M2, C2	Haswell, Broadwell, Skylake, Cascade Lake		
asia-south2-b	Delhi, India APAC	E2, N1, N2, M1, M2, C2	Haswell, Broadwell, Skylake, Cascade Lake		
asia-south2-c	Delhi, India APAC	E2, N1, N2, C2	Haswell, Broadwell, Skylake, Cascade Lake		

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
asia-southeast1-a	Jurong West, Singapore, APAC	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
asia-southeast1-b	Jurong West, Singapore, APAC	E2, N2, N2D, T2D, T2A, N1, M1, C2, C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	
asia-southeast1-c	Jurong West, Singapore, APAC	E2, N2, N2D, T2D, T2A, N1, M1, C2, C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	
asia-southeast2-a	Jakarta, Indonesia, APAC	E2, N2, N1, M1	Ivy Bridge, Haswell, Broadwell, Skylake, Cascade Lake	GPUs	
asia-southeast2-b	Jakarta, Indonesia, APAC	E2, N2, N1	Ivy Bridge, Haswell, Broadwell, Skylake, Cascade Lake	GPUs	

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`asia-southeast2-c`	Jakarta, Indonesia, APAC	E2, N2, N1, M1	Ivy Bridge, Haswell, Broadwell, Skylake, Cascade Lake	GPUs	
`australia-southeast1-a`	Sydney, Australia, APAC	E2, N2, N2D, T2D, N1, C2, M1, M2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`australia-southeast1-b`	Sydney, Australia, APAC	E2, N2, N2D, T2D, N1, C2, M1, M2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`australia-southeast1-c`	Sydney, Australia, APAC	E2, N2, N2D, T2D, N1, C2, M1, M2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`australia-southeast2-a`	Melbourne, Australia, APAC	E2, N1, N2	Haswell, Broadwell, Skylake, Cascade Lake		
`australia-southeast2-b`	Melbourne, Australia, APAC	E2, N1, N2, M1	Haswell, Broadwell, Skylake, Cascade Lake		

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`australia-southeast2-c`	Melbourne, Australia, APAC	E2, N1, N2, M1	Haswell, Broadwell, Skylake, Cascade Lake		
`europe-central2-a`	Warsaw, Poland, Europe	E2, N2, N1, M1	Haswell, Broadwell, Skylake, Cascade Lake		
`europe-central2-b`	Warsaw, Poland, Europe	E2, N2, N1	Haswell, Broadwell, Skylake, Cascade Lake		
`europe-central2-c`	Warsaw, Poland, Europe	E2, N2, N1	Haswell, Broadwell, Skylake, Cascade Lake		
`europe-north1-a`	Hamina, Finland, Europe	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		 Low CO_2 (/sustainability/region-carbon)
`europe-north1-b`	Hamina, Finland, Europe	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		 Low CO_2 (/sustainability/region-carbon)
`europe-north1-c`	Hamina, Finland, Europe	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome		 Low CO_2 (/sustainability/region-carbon)

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`europe-southwest1-a`	Madrid, Spain, Europe	E2, N2, N2D, M1	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`europe-southwest1-b`	Madrid, Spain, Europe	E2, N2, N2D	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`europe-southwest1-c`	Madrid, Spain, Europe	E2, N2, N2D, M1	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`europe-west1-b`	St. Ghislain, Belgium, Europe	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`europe-west1-c`	St. Ghislain, Belgium, Europe	E2, N2, N2D, T2D, N1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`europe-west1-d`	St. Ghislain, Belgium, Europe	E2, N2, N2D, T2D, N1, M1, M2, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`europe-west2-a`	London, England, Europe	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`europe-west2-b`	London, England, Europe	E2, N2, N2D, N1, M1, M2, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`europe-west2-c`	London, England, Europe	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan		
`europe-west3-a`	Frankfurt, Germany Europe	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan		

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`europe-west3-b`	Frankfurt, Germany Europe	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`europe-west3-c`	Frankfurt, Germany Europe	E2, N2, N2D, T2D, N1, M1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan		
`europe-west4-a`	Eemshaven, Netherlands, Europe	E2, N2, N2D, T2D, T2A, N1, M1, M2, C2, C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	
`europe-west4-b`	Eemshaven, Netherlands, Europe	E2, N2, N2D, T2D, T2A, N1, M1, M2, C2, C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	
`europe-west4-c`	Eemshaven, Netherlands, Europe	E2, N2, N2D, T2D, N1, M1, M2, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`europe-west6-a`	Zurich, Switzerland, Europe	E2, N2, N1, C2	Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake		Low CO_2 (/sustainability/region-carbon)
`europe-west6-b`	Zurich, Switzerland, Europe	E2, N2, N1, M1, C2	Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake		Low CO_2 (/sustainability/region-carbon)
`europe-west6-c`	Zurich, Switzerland, Europe	E2, N2, N1, M1, C2	Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake		Low CO_2 (/sustainability/region-carbon)
`europe-west8-a`	Milan, Italy, Europe	E2, N2, N2D, M1, M2	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		
`europe-west8-b`	Milan, Italy, Europe	E2, N2, N2D	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		
`europe-west8-c`	Milan, Italy, Europe	E2, N2, N2D, M1, M2	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`europe-west9-a`	Paris, France, Europe	E2, N2, N2D	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`europe-west9-b`	Paris, France, Europe	E2, N2, N2D	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`europe-west9-c`	Paris, France, Europe	E2, N2, N2D	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`northamerica-northeast1-a`	Montréal, Québec, North America	E2, N2, N2D, T2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`northamerica-northeast1-b`	Montréal, Québec, North America	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`northamerica-northeast1-c`	Montréal, Québec, North America	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`northamerica-northeast2-a`	Toronto, Ontario, North America	E2, N2, N1, M1	Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake		Low CO_2 (/sustainability/region-carbon)
`northamerica-northeast2-b`	Toronto, Ontario, North America	E2, N2, N1, M1	Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake		Low CO_2 (/sustainability/region-carbon)
`northamerica-northeast2-c`	Toronto, Ontario, North America	E2, N2, N1	Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake		Low CO_2 (/sustainability/region-carbon)
`southamerica-east1-a`	Osasco, São Paulo, Brazil, South America	E2, N2, N2D, T2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
`southamerica-east1-b`	Osasco, São Paulo, Brazil, South America	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`southamerica-east1-c`	Osasco, São Paulo, Brazil, South America	E2, N2, N2D, T2D, N1, M1, M2, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`southamerica-west1-a`	Santiago, Chile, South America	E2, N2, C2	Haswell, Broadwell, Skylake, Cascade Lake		
`southamerica-west1-b`	Santiago, Chile, South America	E2, N2, M1, C2	Haswell, Broadwell, Skylake, Cascade Lake		
`southamerica-west1-c`	Santiago, Chile, South America	E2, N2, M1, C2	Haswell, Broadwell, Skylake, Cascade Lake		
`us-central1-a`	Council Bluffs, Iowa, North America	E2, N2, N2D, T2D, T2A, N1, M1, M2, C2, C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	Low CO_2 (/sustainability/region-carbon)
`us-central1-b`	Council Bluffs, Iowa, North America	E2, N2, N2D, T2D, T2A N1, M1, M2, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	Low CO_2 (/sustainability/region-carbon)

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`us-central1-c`	Council Bluffs, Iowa, North America	E2, N2, N2D, T2D, N1, M1, M2, C2,C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`us-central1-f`	Council Bluffs, Iowa, North America	E2, N2, N2D, T2D, T2A, N1, M1, M2, C2, C2D, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan, Ampere Altra Arm	GPUs	Low CO_2 (/sustainability/region-carbon)
`us-east1-b`	Moncks Corner, South Carolina, North America	E2, N2, N2D, T2D, N1, M1, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`us-east1-c`	Moncks Corner, South Carolina, North America	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
`us-east1-d`	Moncks Corner, South Carolina, North America	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
us-east4-a	Ashburn, Virginia, North America	E2, N2, N2D, T2D, N1, M1, M2, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
us-east4-b	Ashburn, Virginia, North America	E2, N2, N2D, T2D, N1, M1, M2, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
us-east4-c	Ashburn, Virginia, North America	E2, N2, N2D, T2D, N1, M1, C2, C2D	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, Ice Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
us-east5-a	Columbus, Ohio, North America	E2, N2, N2D, C2	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		
us-east5-b	Columbus, Ohio, North America	E2, N2, N2D, C2	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
`us-east5-c`	Columbus, Ohio, North America	E2, N2, N2D	Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		
`us-south1-a`	Dallas, Texas, North America	E2, N2	Haswell, Broadwell, Skylake, Cascade Lake		
`us-south1-b`	Dallas, Texas, North America	E2, N2	Haswell, Broadwell, Skylake, Cascade Lake		
`us-south1-c`	Dallas, Texas, North America	E2, N2	Haswell, Broadwell, Skylake, Cascade Lake		
`us-west1-a`	The Dalles, Oregon, North America	E2, N2, N2D, T2D, N1, M1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)
`us-west1-b`	The Dalles, Oregon, North America	E2, N2, N2D, T2D, N1, M1, C2, A2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	Low CO_2 (/sustainability/region-carbon)

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
us-west1-c	The Dalles, Oregon, North America	E2, N2, N2D, T2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		Low CO_2 (/sustainability/region-carbon)
us-west2-a	Los Angeles, California, North America	E2, N2, N2D, N1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		
us-west2-b	Los Angeles, California, North America	E2, N2, N2D, N1, M1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
us-west2-c	Los Angeles, California, North America	E2, N1, M1, C2	Ivy Bridge, Sandy Bridge, Haswell, Broadwell, Skylake, Cascade Lake	GPUs	
us-west3-a	Salt Lake City, Utah, North America	E2, N1, N2, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake		
us-west3-b	Salt Lake City, Utah, North America	E2, N1, N2, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake		

Zones	Location	Machine types	CPUs	Resources	CO_2 emissions
us-west3-c	Salt Lake City, Utah, North America	E2, N1, N2, C2	Ivy Bridge, Sandy Bridge, Broadwell, Skylake, Cascade Lake, Ice Lake		
us-west4-a	Las Vegas, Nevada, North America	E2, N2, N2D, N1, C2, T2D, M1, M2	Ivy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
us-west4-b	Las Vegas, Nevada, North America	E2, N2, N2D, N1, C2, T2D, M1, M2, A2	Ivy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan	GPUs	
us-west4-c	Las Vegas, Nevada, North America	E2, N2, N2D, N1, C2	Ivy Bridge, Broadwell, Skylake, Cascade Lake, AMD EPYC Rome, AMD EPYC Milan		

Transparent maintenance

Google regularly maintains its infrastructure by patching systems with the latest software, performing routine tests and preventative maintenance, and generally ensuring that Google infrastructure is as fast and efficient as Google knows how to make it.

By default, all instances are configured so that these maintenance events are transparent to your applications and workloads. Google uses a combination of datacenter innovations, operational best practices, and live migration technology to move running virtual machine instances out of the way of maintenance that is being performed. Your instance continues to run within the same zone with no action on your part.

By default, all virtual machines are set to live migrate, but you can also set your virtual machines to stop and reboot. The two options differ in the following ways:

- **Live migrate**

  Compute Engine automatically migrates your running instance. The migration process will impact guest performance to some degree but your instance remains online throughout the migration process. The exact guest performance impact and duration depends on many factors, but it is expected most applications and workloads will not notice. For more information, see Live Migration (/compute/docs/instances/live-migration).

- **Stop and reboot**

  Compute Engine automatically signals your instance to shut down, waits a short time for it to shut down cleanly, and then restarts it away from the maintenance event.

For more information on how to set the options above for your instances, see Set VM host maintenance policy (/compute/docs/instances/host-maintenance-options).

Quotas

Certain resources, such as static IPs, images, firewall rules, and VPC networks, have defined project-wide quota limits and per-region quota limits. When you create these resources, it counts towards your total project-wide quota or your per-region quota, if applicable. If any of the affected quota limits are exceeded, you won't be able to add more resources of the same type in that project or region.

To see a comprehensive list of quotas that apply to your project, visit the Quotas (https://console.cloud.google.com/iam-admin/quotas) page in the Google Cloud console.

For example, if your global target pools quota is 50 and you create 25 target pools in example-region-1 and 25 target pools in example-region-2, you reach your project-wide quota and won't be able to create more target pools in any region within your project until you free up space. Similarly, if you have a per-region quota of 7 reserved IP addresses, you can only reserve up to 7 IP addresses in a single region. After you reach that limit, you will either need to reserve IP addresses in a new region or release some IP addresses.

Location selection tips

During VM instance creation, Compute Engine can automatically select zones for your instances based on capacity and availability using the following methods:

- The bulk instance creation API (/compute/docs/instances/using-bulk-api) can automatically choose the zone in which to create instances.
- Regional managed instance groups can be configured with the ANY distribution shape (/compute/docs/instance-groups/regional-mig-distribution-shape#how_any_works), which automatically creates instances in the zones where resources are available.

When selecting zones yourself, here are some things to keep in mind:

- **Communication within and across regions will incur different costs.**

  Generally, communication within regions will always be cheaper and faster than communication across different regions.

- **Design important systems with redundancy across multiple zones or regions.**

  At some point in time, your instances might experience an unexpected failure. To mitigate the effects of these possible events, you should duplicate important systems in multiple zones and regions.

  For example, by hosting instances in zones `europe-west1-b` and `europe-west1-c`, if `europe-west1-b` fails unexpectedly, your instances in zone `europe-west1-c` will still be available. However, if you host all your instances in `europe-west1-b`, you will not be able to access any instances if `europe-west1-b` goes offline. Also, consider hosting your resources across regions. For example, to plan for continued availability of your workload in the unlikely scenario that the `europe-west1` region experiences a failure, consider deploying the workload on backup instances in the `europe-west3` region. For more tips on how to design systems for availability, see Designing Robust Systems (/compute/docs/robustsystems).

What's next

- Learn how to view available regions and zones (/compute/docs/regions-zones/viewing-regions-zones).
- Learn how to change your default zone or region (/compute/docs/regions-zones/changing-default-zone-region).

- Learn more about geography and zones (/docs/geography-and-regions).
- Learn more about the global, regional, and zonal resources (/compute/docs/regions-zones/global-regional-zonal-resources).

Try it for yourself

If you're new to Google Cloud, create an account to evaluate how Compute Engine performs in real-world scenarios. New customers also get $300 in free credits to run, test, and deploy workloads.

Try Compute Engine free (https://console.cloud.google.com/freetrial)

Last updated 2022-08-26 UTC.