

## Course Resources

### Segment 5

**Twelve-factor app:** <https://12factor.net/>

**Site Reliability Engineering Book:** <https://sre.google/books/>

### Segment 6

**Cloud Adoption Framework:**

[https://services.google.com/fh/files/misc/google\\_cloud\\_adoption\\_framework\\_whitepaper.pdf](https://services.google.com/fh/files/misc/google_cloud_adoption_framework_whitepaper.pdf)

**Google Cloud Migration:** <https://cloud.google.com/architecture/migration-to-gcp-getting-started>

### Deciding service to use to move data

Data Source	Scenario	Product
AWS or Azure	Any	Storage Transfer Service
Cloud Storage (to Cloud Storage, different bucket)	Any	Storage Transfer Service
On-premises	Enough bandwidth to meet deadline, less than 1 TB of data	gsutil
On-premises	Enough bandwidth to meet deadline, but more than 1 TB of data	Storage Transfer Service for on-premises data
On-premises	Not enough bandwidth to meet deadline	Transfer Appliance

### Storage classes

Storage class	Minimum duration	Typical monthly availability		
Standard Storage	None	>99.99% in multi-regions and dual-regions 99.99% in regions	Retrieval Cost ↓	Storage Cost ↑
Nearline Storage	30 days	99.95% in multi-regions and dual-regions 99.9% in regions		
Coldline Storage	90 days	99.95% in multi-regions and dual-regions 99.9% in regions		
Archive Storage	365 days	99.95% in multi-regions and dual-regions 99.9% in regions		

## Segment 7

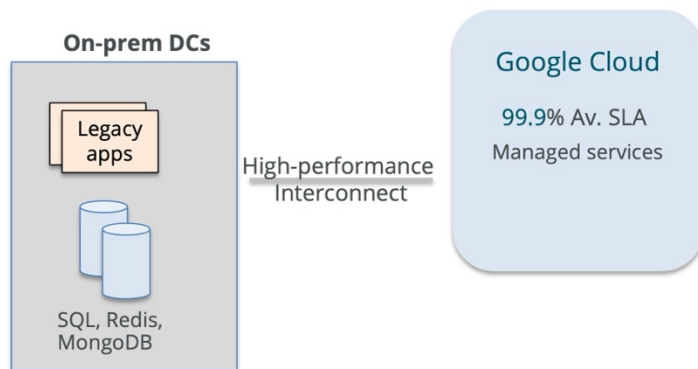
### Availability of GCP services

Service	Scope	HA design
Pub/Sub	Global topics, regional messages	Resilient against zonal outages with synchronous message replication.
Dataflow	Zonal	Can avoid data loss in a zone or region outage by reusing the same subscription to the Pub/Sub topic (Dataflow only acks the messages in Pub/Sub if they were persistent in the destination) and failover to another Dataflow job in another zone or region.
Dataproc	Regional control plane, zonal clusters	In a zonal outage, you can recreate a new instance of the cluster in another zone. Once cluster is available, data processing can resume.
App Engine	Regional	App runs redundantly across all of the zones within the selected region.
Cloud Functions	Regional	Data and traffic are automatically load balanced across zones within a region. Both control and data planes are resilient against zonal failures.

Cloud Run	Regional	Data and traffic are automatically load balanced across zones within a region. Both control and data planes are resilient against zonal failures.
External IP addresses	Regional or Global	Resilient against zone outages (Regional) and region outages (Global)
Google Kubernetes Engine	Zonal or regional	Mitigation of regional outage requires deployment across multiple regions, which is not offered as a built-in capability. However, multiple regional clusters can be deployed and traffic controlled with <a href="#">multi-cluster ingress</a> .
Compute Engine VMs	Zonal	For a high-availability VM deployment, use Compute Engine instance templates and/or managed instance groups to run and scale identical VM instances in multiple zones.
Persistent Disks	Zonal or Regional (with synchronous inter-zone replication)	In the event of an outage in your virtual machine's zone, you can force attach a regional Persistent Disk to a VM instance in the disk's secondary zone.
Cloud Firestore	Regional or Multi-Regional	Regional availability SLA is 99.99% and Multi-Region is 99.999%. Strong consistency.
Cloud BigQuery	Regional or Multi-Regional	Data written to BigQuery is written to both the primary and secondary zones.
Cloud Bigtable	Zonal clusters	To configure a Bigtable instance for HA, create a new app profile that uses multi-cluster routing. Deploy clusters in multiple zones and/or regions as needed. Failover will be automatic. Note: eventual consistency.

## Segment 8

### Case Study Summary: EHR Healthcare

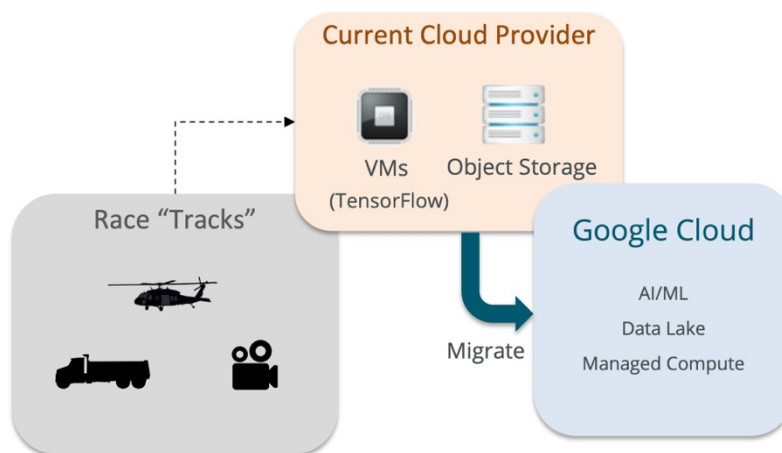


- SaaS Product, web-based, Kubernetes
- MySQL+MS SQL Server, Redis, MongoDB
- Hosted on multiple on-prem locations
- Legacy integrations with partners – remain on-prem
- Requirements: reduce latency, low infrastructure admin cost, centralized monitoring, high-performance interconnect.

Services to consider:

- Cloud Interconnect
- Cloud Identity and Google Cloud Directory Sync
- Operations Suite
- Google Kubernetes Engine
- Cloud SQL
- Cloud Memorystore
- BigQuery
- Anthos

### Case Study Summary: Helicopter Racing League

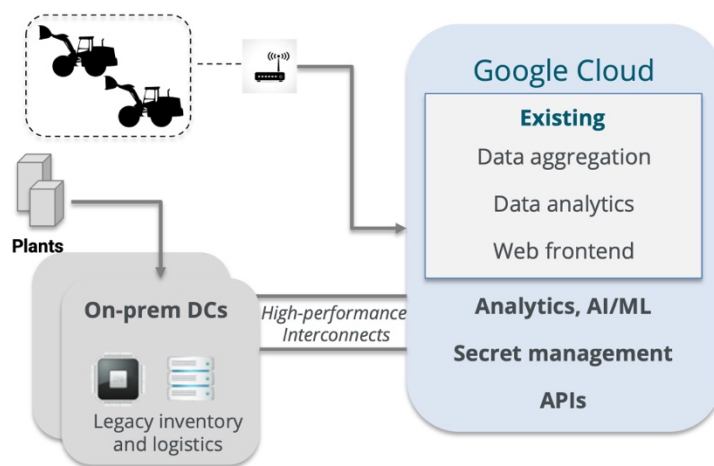


- Global event streaming, live telemetry
- AI/ML for predictions
- Requirements: Global availability, lower latency, real-time analytics, serve predictions to partners, low ops, improve prediction throughput and accuracy
- Data lake for large volumes of race data

Services to consider:

- Cloud Storage
- Cloud Functions
- Managed Instance Groups
- Transcoder API
- Cloud Pub/Sub
- Cloud Dataflow
- Bigtable
- BigQuery
- Vertex AI

### Case Study Summary: TerramEarth

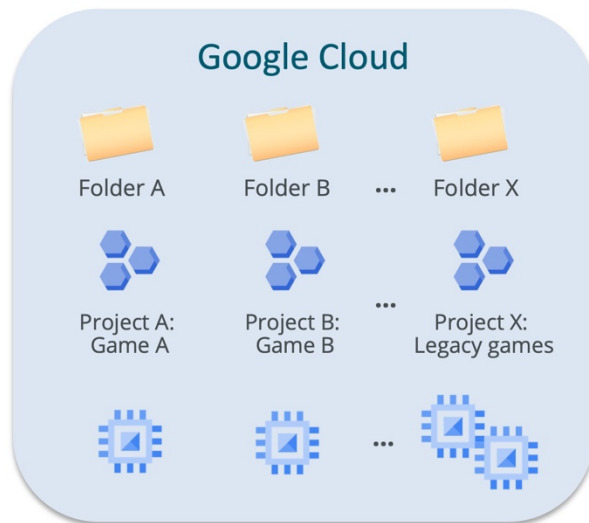


- Manufacturing, IoT, global
- 2 million vehicles (and growing), 200-500MB of data per day
- Real-time and batch telemetry data
- Multiple interconnects already present.
- Remote developers
- Requirements: predictions (AI/ML), elasticity, low ops. Increase development speed and reliability (CI/CD), platform for API services, self-service portal, cloud-native key and secrets management, enable partners to access data.

Services to consider:

- Apigee / Cloud Endpoints / API Gateway
- Cloud Run
- App Engine
- Organization Policy Service
- Identity-Aware Proxy
- Secret Manager
- Cloud Source Repositories, Cloud Build, Cloud Deploy
- BigQuery
- Vertex AI

## Case Study Summary: Mountkirk Games



- Online mobile gaming, global, near real-time leaderboard
- Fully on Google Cloud, but still running mostly VMs. Separate dev/test environments
- Plan to use GKE, Global Load Balancer, and multi-region Spanner for leaderboard
- Each game in an isolated project
- Legacy games bundled in single project
- Requirements: Multi-region, low latency (top priority), elastic, rapid development, multiple gaming platforms, managed services and pooled resources, GPU processing, game activity logs in structured files for batch analysis.

### Services to consider:

- Google Kubernetes Engine
- Global HTTP(S) Load Balancer
- Cloud Spanner
- Cloud Firestore
- Cloud Memorystore
- Cloud Storage
- Pub/Sub
- Cloud Dataflow
- BigQuery

### Other Resources

Google Cloud Cheat Sheet: <https://googlecloudcheatsheet.withgoogle.com/>

Blog article: 5 principles for cloud-native architecture:

<https://cloud.google.com/blog/products/application-development/5-principles-for-cloud-native-architecture-what-it-is-and-how-to-master-it>