Google Cloud Local SSD: Detailed Explanation

1 Overview of Local SSD

Google Cloud Platform (GCP) Local SSDs are high-performance, low-latency storage devices physically attached to the host server of a Virtual Machine (VM). Designed for workloads requiring rapid data access, Local SSDs offer exceptional read and write speeds but are temporary, meaning data is lost when the VM is stopped or restarted. They are ideal for applications needing fast, ephemeral storage, with data backed up elsewhere for persistence. This document explains Local SSDs' functionality, features, use cases, pricing, backup strategies, and provides a visual representation of their architecture.

2 How Local SSDs Work

Local SSDs are directly attached to the physical server hosting a GCP VM, providing faster access compared to network-based storage like Persistent Disks. The workflow is as follows:

1. **Attachment to VM**: Local SSDs are attached to a VM during creation or configuration, with each SSD providing 375 GB of storage. Multiple SSDs can be combined for larger capacity.

2. **Data Operations**: Applications running on the VM read from and write to Local SSDs with minimal latency, ideal for high-throughput tasks.

3. **Temporary Nature**: Data on Local SSDs is ephemeral and persists only for the VM's lifecycle. If the VM stops, restarts, or fails, the data is lost.

4. **Backup Requirement**: To preserve data, users must copy it to durable storage options like Persistent Disks or Cloud Storage before stopping the VM.

5. **Configuration**: Users configure Local SSDs via the GCP Console, CLI, or API, specifying the number of SSDs and integrating them with the VM's file system.

3 Key Features

Local SSDs offer several features that make them suitable for high-performance workloads:

- **High Performance**: Deliver low-latency and high IOPS (Input/Output Operations Per Second), significantly faster than Persistent Disks or Cloud Storage.

- **Fixed Capacity**: Each Local SSD provides 375 GB, with up to 24 SSDs attachable to a single VM (up to 9 TB total, depending on VM type).

- **Temporary Storage**: Designed for ephemeral data, suitable for temporary or reproducible datasets.

- **Direct Attachment**: Physically attached to the VM's host server, eliminating network latency for data access.

- **Compatibility**: Supported on most GCP Compute Engine VM types, with flexible configuration options.

4 Use Cases

Local SSDs are ideal for scenarios requiring high-speed, temporary storage:

- **High-Performance Databases**: Supports databases like MySQL, Cassandra, or MongoDB, where fast disk I/O is critical for query performance.

- **Data Caching**: Used in caching systems like Redis or Memcached to store frequently accessed data, improving application responsiveness.

- **Big Data and Analytics**: Accelerates processing of large datasets in frameworks like Apache Hadoop or Spark, leveraging high throughput.

- **Temporary Scratch Space**: Provides temporary storage for batch processing tasks, such as machine learning model training or data transformation, where intermediate data is discarded.

- **Media Processing**: Speeds up tasks like video rendering or image processing, where large temporary files are generated.

5 Data Backup Strategies

Since Local SSDs are ephemeral, data preservation requires careful planning:

- **Durable Storage**: Copy critical data to Persistent Disks, Hyperdisks, or Cloud Storage before stopping or restarting the VM.

- **No Native Backups**: Local SSDs do not support disk images, snapshots, or clones, so manual data transfer is necessary.

- **Automation**: Use scripts or automation tools (e.g., GCP APIs) to periodically copy data from Local SSDs to durable storage.

- **Example Workflow**: Attach a Persistent Disk to the VM, mount it, and copy data from the Local SSD to the Persistent Disk using tools like `rsync` or `cp`.

For detailed guidance, refer to Backing Up Local SSD Data.

6   Pricing

Local SSDs are priced based on usage:

- **Hourly Billing**: Charged per hour per Local SSD (375 GB) attached to a VM, in addition to VM compute costs.

- **No Sustained Use Discounts**: Unlike Persistent Disks, Local SSDs do not qualify for sustained use discounts, reflecting their premium performance.

- **Cost Consideration**: Users pay for the number of SSDs and the duration they are attached, making it cost-effective for short-term, high-performance tasks.

For detailed pricing, refer to GCP Local SSD Pricing.

7   Limitations

Local SSDs have specific constraints:

- **Temporary Data**: Data is lost on VM stop, restart, or failure, requiring external backups for persistence.

- **Fixed Size**: Each SSD is 375 GB, with no option for smaller or custom sizes.

- **VM Dependency**: Only available with specific Compute Engine VM types and cannot be detached or moved independently.

- **No Redundancy**: Lack built-in replication or redundancy, unlike Persistent Disks or Cloud Storage.

8   Architecture Diagram

The following diagram illustrates the Local SSD architecture, showing its integration with a VM and data backup to durable storage.

8.1   Diagram Explanation

The diagram shows a GCP Virtual Machine with an attached Local SSD (375 GB) for high-speed, temporary storage. An application (e.g., a database) reads and writes data to the Local SSD. To preserve data, it is copied to durable storage options like a Persistent Disk or Cloud Storage, as Local SSD data is lost when the VM stops. The architecture highlights the direct attachment of Local SSDs to the VM and the need for backup to ensure data persistence.
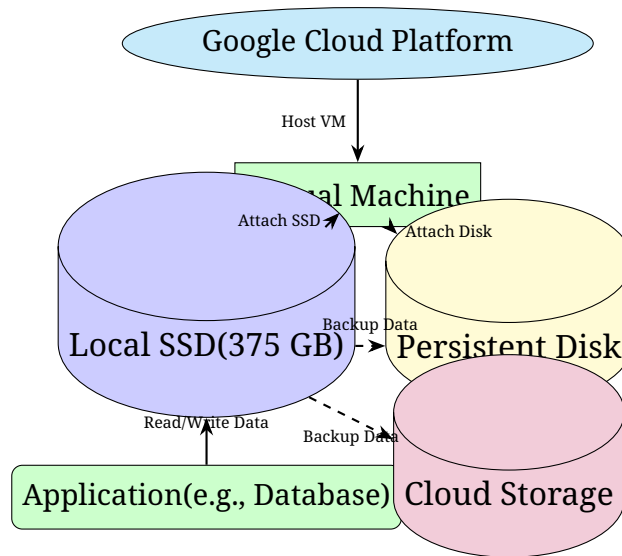
Figure 1: GCP Local SSD Architecture

9   Getting Started

To use Local SSDs in GCP, follow these steps:

1. **Create a GCP Account**: Sign up at cloud.google.com if you don't have an account.

2. **Create a VM**: In the GCP Console, create a Compute Engine VM and select a machine type that supports Local SSDs.

3. **Attach Local SSDs**: Specify the number of Local SSDs (each 375 GB) during VM creation or modification.

4. **Configure Storage**: Mount the Local SSDs to the VM's file system and configure the application to use them.

5. **Set Up Backups**: Attach a Persistent Disk or configure Cloud Storage to back up critical data from Local SSDs.

For detailed instructions, refer to GCP Local SSD Documentation.

10   Conclusion

Google Cloud Local SSDs provide high-performance, low-latency storage for workloads requiring rapid data access, such as databases, caching, and big data analytics. While their temporary nature requires careful data management, their speed and cost-effectiveness make them ideal for ephemeral, high-throughput tasks. By integrating with durable storage options and leveraging GCP's flexible configuration, Local SSDs empower developers to build efficient, scalable applications.