**Error 1: BigQuery Service Unavailable (503)**

**Error Message:**

google.api\_core.exceptions.ServiceUnavailable: 503 The service is currently unavailable

**Reasons:**

* Temporary downtime in the BigQuery service
* Network issues between Airflow and BigQuery
* Regional disruptions in Google Cloud

**Solution:**

1. **Check Google Cloud Status Dashboard:**
   * Visit<https://status.cloud.google.com/> to see if there are any known issues affecting BigQuery.
2. **Wait for Service Restoration:**
   * If there's a known issue, wait for Google Cloud to resolve it.
3. **Verify Network Connectivity:**
   * Ensure your environment can reach Google Cloud services. Check firewall rules and network configuration.

**Error 2: BigQuery API Not Enabled (403)**

**Error Message:** google.api\_core.exceptions.PermissionDenied: 403 BigQuery API has not been used in project [PROJECT\_ID]

**Reason:**

* The BigQuery API is not activated for your project.

**Solution:**

1. **Enable the BigQuery API:**
   * Go to the Google Cloud Console.
   * Search for "BigQuery API" and enable it.

**Error 3: Invalid Service Account Configuration (401)**

**Error Message:** google.auth.exceptions.DefaultCredentialsError: Could not automatically determine credentials

**Reasons:**

* Missing or incorrect service account key file
* Environment variables for authentication are not set

**Solution:**

1. **Create a Service Account Key:**
   * Go to the Google Cloud Console, navigate to IAM & Admin, and create a new service account.
   * Grant the service account necessary permissions (e.g., BigQuery User).
   * Download the service account key as a JSON file.
2. **Set Environment Variable:**
   * Set the GOOGLE\_APPLICATION\_CREDENTIALS environment variable to the path of the downloaded JSON file.

**Error 4: Insufficient Permissions (403)**

**Error Message:** google.api\_core.exceptions.Forbidden: 403 Access Denied: Project [project-id]: User does not have bigquery.tables.get permission

**Reason:**

* The service account lacks the required BigQuery permissions.

**Solution:**

1. **Grant Permissions to Service Account:**
   * Go to the Google Cloud Console, navigate to IAM & Admin.
   * Select the service account used by Airflow.
   * Grant the necessary roles (e.g., BigQuery Data Viewer, BigQuery User) to the service account.

**Error 5: Query Timeout**

**Error Message:** google.cloud.bigquery.job.QueryJobConfig: Query timeout after [X] seconds

**Reasons:**

* Complex query or large dataset
* Insufficient resources allocated to the query

**Solution:**

1. **Optimize Query:**
   * Reduce the amount of data processed by using appropriate filters and projections.
   * Simplify query logic and use efficient functions.
2. **Increase Timeout:**
   * Adjust the timeout setting in your Airflow task configuration.
3. **Allocate More Resources:**
   * If necessary, increase the resources allocated to the BigQuery job in Airflow.

**Error 6: Syntax Error**

**Error Message:** google.api\_core.exceptions.BadRequest: 400 Syntax error: Unexpected keyword SELECT at [1:1]

**Reason:**

* Incorrect SQL syntax in the query

**Solution:**

1. **Review SQL Syntax:**
   * Double-check the query for typos, missing keywords, or incorrect function usage.
   * Use a SQL linter or formatter to identify potential issues.
2. **Test Query in BigQuery Console:**
   * Run the query in the BigQuery web console to validate syntax and get error messages.

**Error 7: Resources Exceeded**

**Error Message:** google.api\_core.exceptions.ResourceExhausted: Query exceeded resource limits

**Reasons:**

* Exceeding query quota limits
* Insufficient resources allocated to the query

**Solution:**

1. **Optimize Query:**
   * Reduce data processed and query complexity.
2. **Increase Resource Allocation:**
   * Allocate more resources to the BigQuery job in Airflow.
3. **Request Quota Increase:**
   * Contact Google Cloud support to request an increase in your BigQuery quota.

**Error 8: Airflow Task Retry Limits Exceeded**

**Error Message:** Airflow Task Retry Limit Exceeded: Task failed after [retries] attempts

**Reason:**

* The BigQuery task failed multiple times and reached the retry limit.

**Solution:**

1. **Investigate Task Failure:**
   * Check Airflow logs for detailed error messages.
   * Identify the root cause of the failure (e.g., query errors, connection issues).
2. **Increase Retry Limit:**
   * Adjust the retry limit in the Airflow task configuration for intermittent errors.
3. **Address Root Cause:**
   * Fix the underlying issue causing the task failures.

**Error 9: BigQuery Connection Error in Airflow**

**Error Message:** Airflow BigQuery Connection Error: Connection ID [gcp\_connection\_id] not found

**Reason:**

* Incorrect GCP connection ID or invalid credentials/project information.

**Solution:**

1. **Verify GCP Connection:**
   * Ensure the correct GCP connection ID is used in the Airflow task.
   * Check the GCP connection details for valid credentials and project information.

**Error 10: Missing Dataset Permissions**

**Error Message:** google.api\_core.exceptions.Forbidden: Access Denied: Dataset [dataset\_id] not found

**Reason:**

* The Airflow service account lacks permission to access the dataset.

**Solution:**

1. **Grant Dataset Permissions:**
   * Go to the Google Cloud Console, navigate to the dataset.
   * Grant the necessary permissions (e.g., Viewer, User) to the service account used by Airflow.