

Oct 20, 2021

## Terra Troubleshooting

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protocol .

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This protocol contains step-by-step instructions and tips for troubleshooting issues you may encounter while using Terra. If your problem cannot be addressed with this protocol, please email [TOAST@cdc.gov](mailto:TOAST@cdc.gov) for assistance and to add your question to help others in the future.

For technical assistance, please contact: [TOAST@cdc.gov](mailto:TOAST@cdc.gov)

Yuan Li, Jill V Hagey, Michael Weigand, Technical Outreach and Assistance for States Team 2021. Terra Troubleshooting. [protocols.io](https://protocols.io)  
<https://protocols.io/view/terra-troubleshooting-bvtpn6mn>

Terra, Illumina, Sequencing, MiSeq, iSeq, MiniSeq, NextSeq, NovaSeq, Paired-end, Next Generation Sequencing, NGS, SARS-CoV-2, COVID, Pangolin, Short-Read, Coronavirus, Genomics, Genetics, Virology, Molecular Biology, Troubleshooting

protocol ,

Jun 14, 2021

Jan 21, 2022

Jun 14, 2021  Jill Hagey Centers for Disease Control and Prevention

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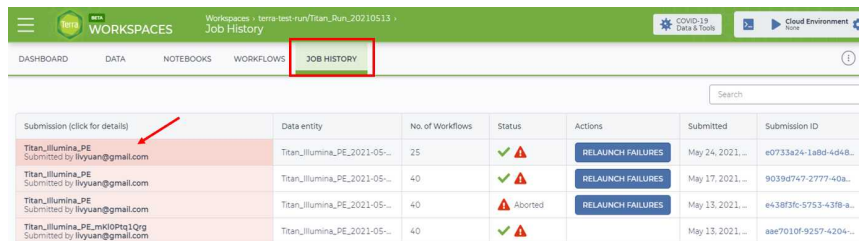
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## The workflow status is “Failed” for a sample, why?

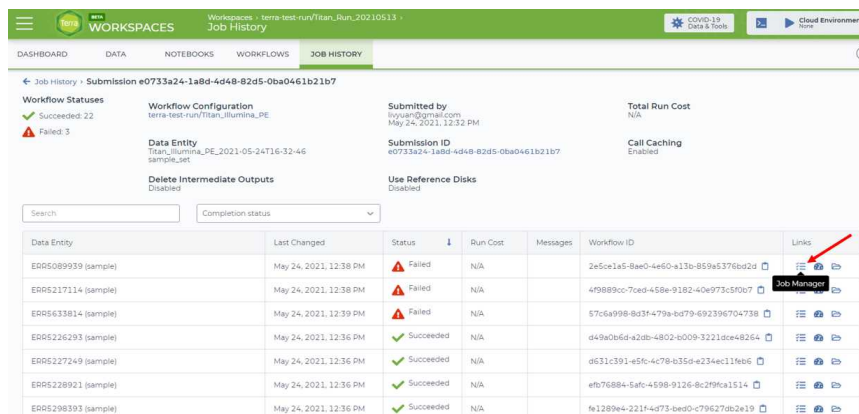
- 1 To start troubleshooting the workflow (Titan in this case) for a failed sample, click on the 'JOB HISTORY' panel in the workspace page. It should bring you to the following page:



Submission (click for details)	Data entity	No. of Workflows	Status	Actions	Submitted	Submission ID
Titan_illumina_PE Submitted by lvyuan@gmail.com	Titan_illumina_PE_2021-05-...	25	✓	RELAUNCH FAILURES	May 24, 2021...	e0733a24-1a8d-4d48-...
Titan_illumina_PE Submitted by lvyuan@gmail.com	Titan_illumina_PE_2021-05-...	40	✓	RELAUNCH FAILURES	May 17, 2021...	9039d747-2777-40a...
Titan_illumina_PE Submitted by lvyuan@gmail.com	Titan_illumina_PE_2021-05-...	40	Aborted	RELAUNCH FAILURES	May 13, 2021...	e438f3f0-5753-43b8-a...
Titan_illumina_PE_mk10P1q1Qg Submitted by lvyuan@gmail.com	Titan_illumina_PE_2021-05-...	40	✓	RELAUNCH FAILURES	May 13, 2021...	ee7010f0-9257-4204-...

Job history Page

Click on the job submission that contains the failed sample under the 'Submission' tile, and it will take you to a new page that shows a table. In the table find the row that contains the failed sample (e.g. ERR5089939 as shown below), click on the “Job Manager” tile in the last column of the row, and it will take you to a new page.



Data Entity	Last Changed	Status	Run Cost	Messages	Workflow ID	Links
ERR5089939 (sample)	May 24, 2021, 12:38 PM	Failed	N/A		2e5ce1a5-8ae0-4e60-a13b-859a5376bd2d	Job Manager
ERR5217114 (sample)	May 24, 2021, 12:38 PM	Failed	N/A		4f9889c0-7ced-458e-9182-40e973c5f007	
ERR5633814 (sample)	May 24, 2021, 12:39 PM	Failed	N/A		57c6a998-bd3f-479a-bd79-692396704738	
ERR5226293 (sample)	May 24, 2021, 12:36 PM	Succeeded	N/A		d49a0b6d-e3db-4802-b009-3221dce48264	
ERR5227249 (sample)	May 24, 2021, 12:36 PM	Succeeded	N/A		d631c391-e5fc-4c78-b35d-e23aec11feb6	
ERR5228921 (sample)	May 24, 2021, 12:36 PM	Succeeded	N/A		e8b76884-5afc-4598-9126-8c2f9ca1514	
ERR5298393 (sample)	May 24, 2021, 12:36 PM	Succeeded	N/A		fe1289e4-221f-4d73-bed0-c796270b2e19	

Workflow status of job

You might be asked to authentic your account at this step. Just click on your account and wait for the page to load. On this new page, click on the “LIST VIEW” tab and it will show the task(s) that failed (e.g. “read\_QC\_trim” as shown below), which is indicate by a red exclamation mark in a triangle under the “Links” tab.

**Job Manager** LOG OUT

titan\_illumina\_pe  
ID: 2e5ce1a5-8ae0-4e60-a13b-859a5376bd2d  
workspace-id: 16e74a34-e85c-48e2-8145-d02c5d643350 submission-id: e0733a24-1a8d-4d48-82d5-0ba0461b21b7

Status: Failed ⚠  
Tasks: 0 succeeded, 1 failed, 0 currently being processed  
Submitted: May 24, 12:33 PM  
Started: May 24, 12:34 PM  
Ended: May 24, 12:36 PM (0h 2m)

Errors (1 total)  
read\_QC\_trim ⚠ 📁 📄

**LIST VIEW** ERRORS INPUTS LABELS TIMING DIAGRAM

Task Name	Status	Start	Duration	Inputs	Outputs	Links	Attempts
read_QC_trim	<span>⚠</span>	May 24, 12:34 PM	0h 2m	<span>📁</span>	<span>📄</span>	<span>⚠</span> <span>📁</span> <span>📄</span>	1

List View tab of the Job Manager page

Click on the task that failed (e.g. "read\_QC\_trim" as shown below) and it will show the step(s) within the task that failed (e.g. fastqc\_clean as shown below), which is indicated by a red exclamation mark in a triangle under the "Links" tab.

**Job Manager** LOG OUT

read\_QC\_trim  
ID: 1ae54950-bf18-42c2-83b4-28f4f35786dc

Status: Failed ⚠  
Tasks: 4 succeeded, 1 failed, 0 currently being processed  
Submitted: May 24, 12:34 PM  
Started: May 24, 12:34 PM  
Ended: May 24, 12:36 PM (0h 2m)

Errors (1 total)  
fastqc\_clean ⚠ 📁 📄

**LIST VIEW** ERRORS INPUTS TIMING DIAGRAM

Task Name	Status	Start	Duration	Inputs	Outputs	Links	Attempts
fastqc_trim	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
kraken2_trim	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
trimmomatic	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
bbduk	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
fastqc_clean	<span>⚠</span>	May 24, 12:34 PM	0h 2m	<span>📁</span>	<span>📄</span>	<span>⚠</span> <span>📁</span> <span>📄</span>	1

List of tasks that are part of the read\_qc\_trim job.

Move the mouse over the warning sign (red exclamation mark in a triangle) and you will see the error message. In this case the error message reads "Task read\_QC\_trim.fastqc\_clean:NA:1 failed. Job exited without an error, exit code 0. PAPI error code 9. Please check the log file for more details: gs://fc-16e74a34-e85c-48e2-8145-d02c5d643350/e0733a24-1a8d-4d48-82d5-0ba0461b21b7/titan\_illumina\_pe/2e5ce1a5-8ae0-4e60-a13b-859a5376bd2d/call-read\_QC\_trim/read\_QC\_trim/1ae54950-bf18-42c2-83b4-28f4f35786dc/call-fastqc\_clean/fastqc\_clean.log."

**Job Manager** LOG OUT

read\_QC\_trim  
ID: 1ae54950-bf18-42c2-83b4-28f4f35786dc

Status: Failed ⚠  
Tasks: 4 succeeded, 1 failed, 0 currently being processed  
Submitted: May 24, 12:34 PM  
Started: May 24, 12:34 PM  
Ended: May 24, 12:36 PM (0h 2m)

Errors (1 total)  
fastqc\_clean ⚠ 📁 📄

**LIST VIEW** ERRORS INPUTS TIMING DIAGRAM

Task Name	Status	Start	Duration	Inputs	Outputs	Links	Attempts
fastqc_trim	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
kraken2_trim	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
trimmomatic	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
bbduk	<span>✅</span>	May 24, 12:34 PM	0h 0m	<span>📁</span>	<span>📄</span>	<span>📁</span> <span>📄</span>	1
fastqc_clean	<span>⚠</span>	May 24, 12:34 PM	0h 2m	<span>📁</span>	<span>📄</span>	<span>⚠</span> <span>📁</span> <span>📄</span>	1

Task read\_QC\_trim.fastqc\_clean:NA:1 failed. Job exited without an error, exit code 0. PAPI error code 9. Please check the log file for more details: gs://fc-16e74a34-e85c-48e2-8145-d02c5d643350/e0733a24-1a8d-4d48-82d5-0ba0461b21b7/titan\_illumina\_pe/2e5ce1a5-8ae0-4e60-a13b-859a5376bd2d/call-read\_QC\_trim/read\_QC\_trim/1ae54950-bf18-42c2-83b4-28f4f35786dc/call-fastqc\_clean/fastqc\_clean.log

Error message for failed task

To find the log file shown in the error message ("fastqc\_clean.log"), click on the file folder icon ("execution directory") to the right of the warning sign, and this will bring you to a new Cloud Storage page.

**Job Manager** read\_QC.trim ID: 1ae54950-bf16-42c2-83b4-284f35786dc ↑ ×

**Status: Failed** Errors (1 total)

Tasks: 4 succeeded, 1 failed, 0 currently being processed  
Submitted May 24, 12:34 PM  
Started May 24, 12:34 PM  
Ended May 24, 12:36 PM (0h 2m)

**fastqc\_clean**

Task Name	Status	Start	Duration	Inputs	Outputs	Links	Attempts
fastqc_raw	✓	May 24, 12:34 PM	0h 0m	1	1	<a href="#">View</a>	1
krahenQ_raw	✓	May 24, 12:34 PM	0h 0m	1	1	<a href="#">View</a>	1
trimmomatic	✓	May 24, 12:34 PM	0h 0m	1	1	<a href="#">View</a>	1
bbduk	✓	May 24, 12:34 PM	0h 0m	1	1	<a href="#">View</a>	1
fastqc_clean	✗	May 24, 12:34 PM	0h 2m	1	1	<a href="#">View</a> <a href="#">Execution directory</a>	1

Execution directory button for accessing log files

On the cloud storage page, click on the “fastqc\_clean.log” file and it will bring you to a new page.

**Google Cloud Platform** Select a project Search products and resources

**Cloud Storage** Bucket details fc-16e74a34-e85c-48e2-8145-d02c5d643350 REFRESH LEARN

**OBJECTS** **CONFIGURATION** **PERMISSIONS** **RETENTION** **LIFECYCLE**

Buckets: [fc-16e74a34-e85c-48e2-8145-d02c5d643350](#) [h0733a2a-1a8b-4548-8205-0ba040162107](#) [rtan\\_rumma\\_ga](#) [2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29](#) [call-read\\_QC\\_trim](#) [read\\_QC\\_trim](#) [1ae54950-bf16-42c2-83b4-284f35786dc](#)

Filter by name prefix only Filter objects and folders

Name	Size	Type	Created time	Storage class	Last modified	Public access	Encryption	Retention expiration date
DATE	20 B	application/octet-stream	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
READ_PAIRS	1 B	application/octet-stream	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
Test20210513_1_clean.fastqc.gz	6.4 KB	application/gzip	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
Test20210513_2_clean.fastqc.gz	6.4 KB	application/gzip	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
fastqc_clean.log	8.2 KB	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
gcs_delocalization.sh	4.4 KB	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
gcs_localization.sh	2.2 KB	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
gcs_transfer.sh	13.4 KB	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
pipeline-log/	—	Folder	—	—	—	—	—	—
IC	2 B	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
input	2.1 KB	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
output	2.8 KB	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—
stdout	149 B	text/plain; charset=UTF-8	May 24, 2021	Standard	May 24, 2021	Not authorized	Google-managed key	—

Rows per page: 100 1 - 12 of 12

Google Cloud storage page with all files generated by workflow.

On the “fastqc\_clean.log” page click on the “Authenticated URL” and it will show you the content of the “fastqc\_clean.log” file in a new page.

**Google Cloud Platform** Select a project Search products and resources

**Cloud Storage** Object details fc-16e74a34-e85c-48e2-8145-d02c5d643350 h0733a2a-1a8b-4548-8205-0ba040162107 rtan\_rumma\_ga 2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29 call-read\_QC\_trim read\_QC\_trim 1ae54950-bf16-42c2-83b4-284f35786dc fastqc\_clean.fastqc\_clean.log LEARN

Since you are not authorized to know the public access status of this object, it is possible that the public URL displayed is not valid.

**Overview**

- Type: text/plain; charset=UTF-8
- Size: 8.2 KB
- Created: May 24, 2021, 12:36:13 PM
- Last modified: May 24, 2021, 12:36:13 PM
- Custom time: —

**Public URL**

[https://storage.googleapis.com/fc-16e74a34-e85c-48e2-8145-d02c5d643350/h0733a2a-1a8b-4548-8205-0ba040162107/rtan\\_rumma\\_ga/2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29/call-read\\_QC\\_trim/read\\_QC\\_trim/1ae54950-bf16-42c2-83b4-284f35786dc/fastqc\\_clean.fastqc\\_clean.log](https://storage.googleapis.com/fc-16e74a34-e85c-48e2-8145-d02c5d643350/h0733a2a-1a8b-4548-8205-0ba040162107/rtan_rumma_ga/2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29/call-read_QC_trim/read_QC_trim/1ae54950-bf16-42c2-83b4-284f35786dc/fastqc_clean.fastqc_clean.log)

**Authenticated URL**

[https://storage.cloud.google.com/fc-16e74a34-e85c-48e2-8145-d02c5d643350/h0733a2a-1a8b-4548-8205-0ba040162107/rtan\\_rumma\\_ga/2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29/call-read\\_QC\\_trim/read\\_QC\\_trim/1ae54950-bf16-42c2-83b4-284f35786dc/fastqc\\_clean.fastqc\\_clean.log?auth=gs://fc-16e74a34-e85c-48e2-8145-d02c5d643350/h0733a2a-1a8b-4548-8205-0ba040162107/rtan\\_rumma\\_ga/2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29/call-read\\_QC\\_trim/read\\_QC\\_trim/1ae54950-bf16-42c2-83b4-284f35786dc/fastqc\\_clean.fastqc\\_clean.log](https://storage.cloud.google.com/fc-16e74a34-e85c-48e2-8145-d02c5d643350/h0733a2a-1a8b-4548-8205-0ba040162107/rtan_rumma_ga/2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29/call-read_QC_trim/read_QC_trim/1ae54950-bf16-42c2-83b4-284f35786dc/fastqc_clean.fastqc_clean.log?auth=gs://fc-16e74a34-e85c-48e2-8145-d02c5d643350/h0733a2a-1a8b-4548-8205-0ba040162107/rtan_rumma_ga/2d5ce1a5-8ae0-4ae0-a13b-83fa53786d29/call-read_QC_trim/read_QC_trim/1ae54950-bf16-42c2-83b4-284f35786dc/fastqc_clean.fastqc_clean.log)

**Permissions**

- Public access: Not authorized
- Protection: —
- Hold status: None
- Retention policy: None
- Encryption type: Google-managed key

“fastqc\_clean.log” page

In the highlighted log, it shows “Failed to process file Test20210513\_1\_clean.fastqc.gz”, which indicates something might be wrong with the input fastq files.



search the accession number to get additional information. Navigate to the [SEQUENCE READ ARCHIVE \(SRA\) database](https://www.ncbi.nlm.nih.gov/sra/).

SRA home page search

Search for the SRA number ERR5089939.

SRA record for ERR5089939

Examining the SRA record, we see that **the library has a SINGLE layout** and therefore did not generate pair-end sequencing reads. This is the reason why fastq files were detected as not properly paired and failed the workflow. **The fastq files of this sample should be analyzed by another workflow that processes single end illumine sequencing data.**

**The workflow status is "Succeeded" for a sample, but it takes long time (>10 hours), why?**

- To troubleshoot the unusually long runtime for a succeeded sample, click on the 'JOB HISTORY' panel in the workspace page. It should bring you to the following page:



Submission (click for details)	Data entity	No. of Workflows	Status	Actions	Submitted	Submission ID
Titan_illumina_PE Submitted by	Titan_illumina_PE-resubmission...	165	✓	RELAUNCH FAILURES	May 18, 2021...	a5ca2853-02b3-4478...
Titan_illumina_PE Submitted by	Titan_illumina_PE-2021-05...	165	⚠ Aborted	RELAUNCH FAILURES	May 18, 2021...	d154753d-2cde-4c50...

Job History page

Click on the job submission that contains has some sample failures (red triangle) that has been running for a long time under the 'Submission' tile, and it will take you to a new page that shows a table.

Data Entity	Last Changed	Status	Run Cost	Messages	Workflow ID	Link
SSR14219269 (sample)	May 21, 2021, 6:25 PM	✓ Succeeded	N/A		a97ba3c8-924b-41a3-b50a-0547dd76e5b8	Link
SSR14064395 (sample)	May 21, 2021, 9:47 AM	✓ Succeeded	N/A		c6597f56-45d1-431e-b970-78becd9f195	Link
SSR14064380 (sample)	May 19, 2021, 4:10 AM	✓ Succeeded	N/A		88b43f15-3f7b-456a-9c2e-d0d9e4206c53	Link
SSR14028136 (sample)	May 20, 2021, 4:04 AM	✓ Succeeded	N/A		acbb6e42-d84c-49d7-909f-df9c82fd2c4	Link
SSR13958249 (sample)	May 21, 2021, 4:37 PM	✓ Succeeded	N/A		c8e25d04-33c5-432e-a559-a901c080d814	Link
SSR13958192 (sample)	May 19, 2021, 10:54 PM	✓ Succeeded	N/A		27e218f7-983a-4169-8788-4a020ea706af	Link
SSR13958189 (sample)	May 19, 2021, 7:46 PM	✓ Succeeded	N/A		1f52cc88-81e0-486a-bee0-21bca9630a38	Link
SSR13958186 (sample)	May 19, 2021, 1:57 PM	✓ Succeeded	N/A		db335f12-f3c1-4857-ae93-63629e11f041	Link

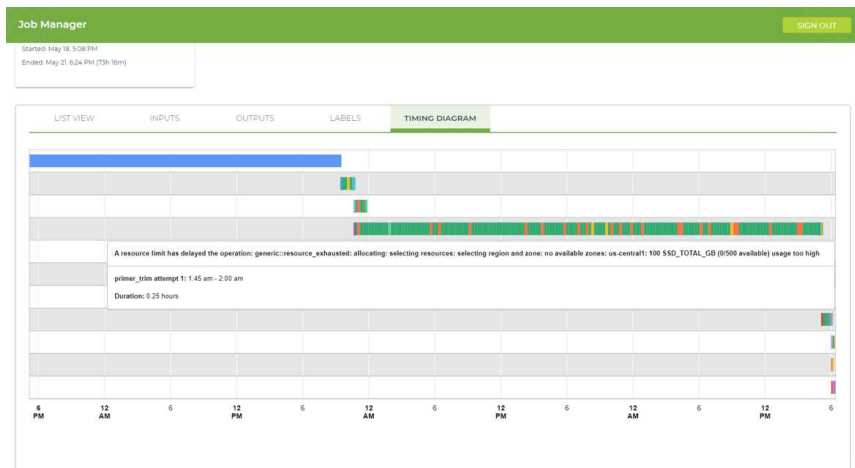
Workflow status of jobs

In the table, find the row that contains the failed sample (e.g. SRR14219269 as shown below), click on the “Job Manager” tile in the last column of the row, and it will take you to a new page. In this page we can see that the primer\_trim task had a run duration of 42h27min. To identify the possible reason, click on the “TIMING DIAGRAM” tab.

Task Name	Status	Start	Duration	Inputs	Outputs	Links	Attempts
readQC_trim	✓	May 18, 5:08 PM	38h 22m	1	1	Link	1
bowtie	✓	May 19, 9:30 PM	1h 12m	1	1	Link	1
status_coverage	✓	May 19, 10:43 PM	7h 4m	1	1	Link	1
primer_trim	✓	May 19, 10:43 PM	42h 27m	1	1	Link	1
bedtools_cov	✓	May 19, 10:43 PM	38h 19m	1	1	Link	1
status_coverage_printrim	✓	May 21, 5:10 PM	0h 54m	1	1	Link	1
variant_call	✓	May 21, 5:10 PM	0h 53m	1	1	Link	1
consensus	✓	May 21, 5:10 PM	0h 54m	1	1	Link	1
pangolin2	✓	May 21, 6:04 PM	0h 18m	1	1	Link	1
nextclade_virus_sample	✓	May 21, 6:04 PM	0h 20m	1	1	Link	1
vadr	✓	May 21, 6:04 PM	0h 18m	1	1	Link	1

List of tasks and their run times.

Under the “TIMING DIAGRAM” tab, move the mouse over the green/yellow/orange bars and you will see warning message like “The resource limit has delayed the operation: generic::resource\_exhausted:allocating: select resources: selecting region and zone: no available zones: us-central1:100 SSD\_TOTAL\_GB (0/500 available) usage too high”.

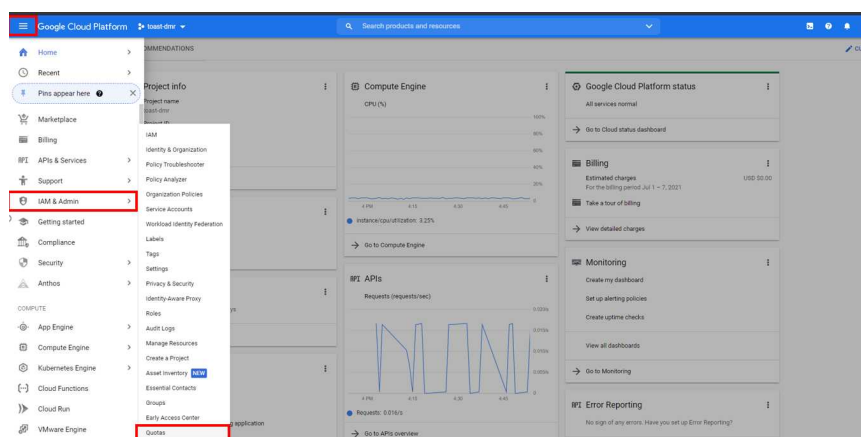


TIMING DIAGRAM tab

In the case here we are using the free google cloud credits and the default quotas, when you start a GCP [Google Cloud Platform] project are really, really low and not amendable to using Terra (8 CPUs and 500GB of memory). You need to request a quota increase from google and move a paid account to improve performance. You can make a quota increase request by sending a message to Terra support by click the "Contact Us" in the Terra UI, or by emailing [support@terra.bio](mailto:support@terra.bio).

For more information see [Terra's support page on the topic](#).

- 2.1 Please note that, according to the Google Cloud Platform (<https://cloud.google.com/iam/>), "**free trial accounts for Google Cloud Platform have limited quota during their trial period**. In order to increase your quota, please upgrade to a paid account by clicking "Upgrade my account" from the top of any page once logged in to Google Cloud Console."
- 2.2 If you have a paid account, you can check your quota limits if you are having issues with things taking too long. Log into the Google Cloud Platform and click the three dashes at the top left of the page. Then click "IAM & Admin" in the drop down menu. Another drop down menu will popup on the side and you can click on "Quotas".



Navigation to the quotas page.

On the next page, you will find all the quotas. While there is a lot here, only a few will commonly cause a problem.



API	Quota	Limit	Usage	Quota Type
Cloud Resource Manager API	Folder Creation per 100 seconds per user	1	0	ALL QUOTAS
Cloud Resource Manager API	Folder Moves per 100 seconds per user	1	0	ALL QUOTAS
Cloud Resource Manager API	List projects V1 per 100 seconds per user	1	0	ALL QUOTAS
Cloud Resource Manager API	List projects V2 per 100 seconds per user	1	0	ALL QUOTAS
Cloud Resource Manager API	Read requests per 100 seconds per user	1	0	ALL QUOTAS
Cloud Resource Manager API	Search requests per 100 seconds per user	1	0	ALL QUOTAS
Cloud Resource Manager API	Write requests per 100 seconds per user	1	0	ALL QUOTAS
Cloud Trace API	ingested spans per day	1	0	ALL QUOTAS
Cloud Trace API	Read configuration requests (Read) per minute	1	0	ALL QUOTAS
Cloud Trace API	Read requests (Read) per minute	1	0	ALL QUOTAS
Cloud Trace API	Write configuration requests (Write) per minute	1	0	ALL QUOTAS
Cloud Trace API	Write requests (Write) per minute	1	0	ALL QUOTAS
Compute Engine API	CPUs	All 111 quotas are within limit	0	ALL QUOTAS
Compute Engine API	Subnetworks	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Instance IP addresses	All 20 quotas are within limit	0	ALL QUOTAS
Compute Engine API	Networks	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Subnetwork ranges per VPC Network	All 4 quotas are within limit	0	ALL QUOTAS
Compute Engine API	Persistent Disk (SSD) (GB)	All 111 quotas are within limit	0	ALL QUOTAS
Compute Engine API	Heavyweight read requests per 100 seconds	One quota is within limit	0	ALL QUOTAS
Compute Engine API	VM instances	All 20 quotas are within limit	0	ALL QUOTAS
Compute Engine API	Firewall rules	One quota is within limit	0	ALL QUOTAS
Compute Engine API	CPUs (all regions)	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Persistent Disk Standard (GB)	All 111 quotas are within limit	0	ALL QUOTAS
Compute Engine API	Routes	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Queues per 100 seconds	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Instances per VPC Network	All 3 quotas are within limit	0	ALL QUOTAS
Compute Engine API	List requests per 100 seconds	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Instance List Refresh requests per 100 seconds	One quota is within limit	0	ALL QUOTAS
Compute Engine API	Read requests per 100 seconds	One quota is within limit	0	ALL QUOTAS

## Terra cares about the following Google Compute Engine API quotas:

- **CPUs:** how many CPUs you can use at once across all of your tasks
- **Preemptible CPUs:** the pool of CPUs that would only be used by preemptible instances. You can learn more about this quota [here](#) and about preemptible instances [here](#).
- **Persistent disk standard(GB):** how much total disk non-SSD you can have attached at once to your task VMs
- **Persistent disk SSD(GB):** how much total SSD disk you can have attached at once to your task VMs
- **Local SSD(GB):** how much SSD is attached directly to the server running the task VMs. You can learn more [here](#). Only applicable if you are using local SSD in your Task.