1. **Create a variable for projectID:**
   `export PROJECT_ID=bert-289322`

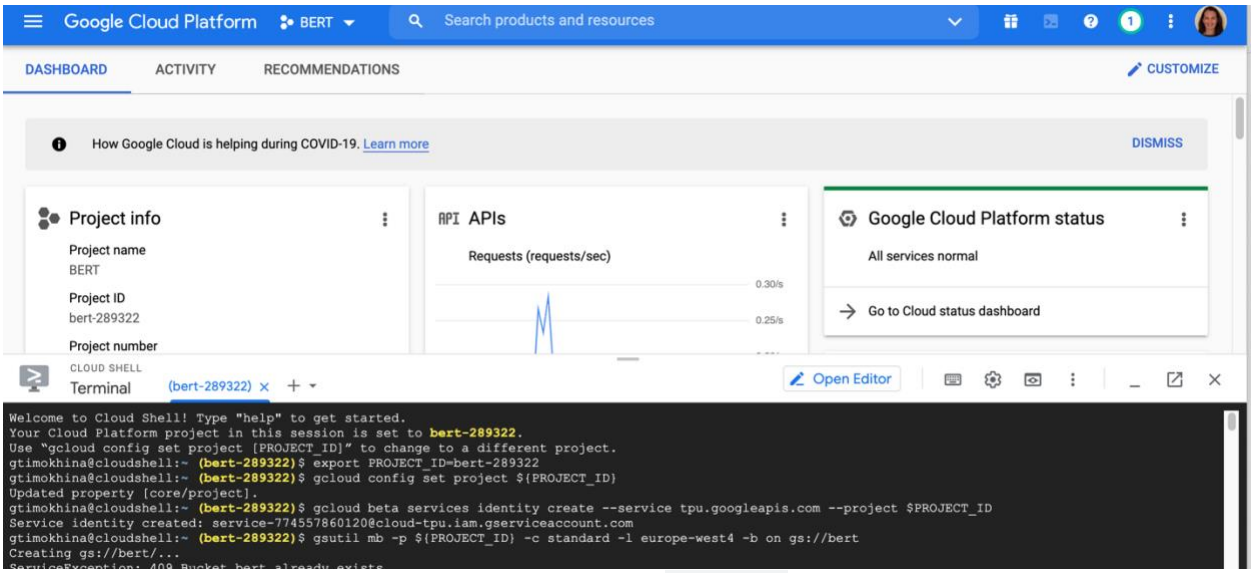
2. **Configure `gcloud` to use the project where you want to create Cloud TPU.**

   ```
   gcloud config set project ${PROJECT_ID}
   ```

3. **Create a Service Account for the Cloud TPU project.**

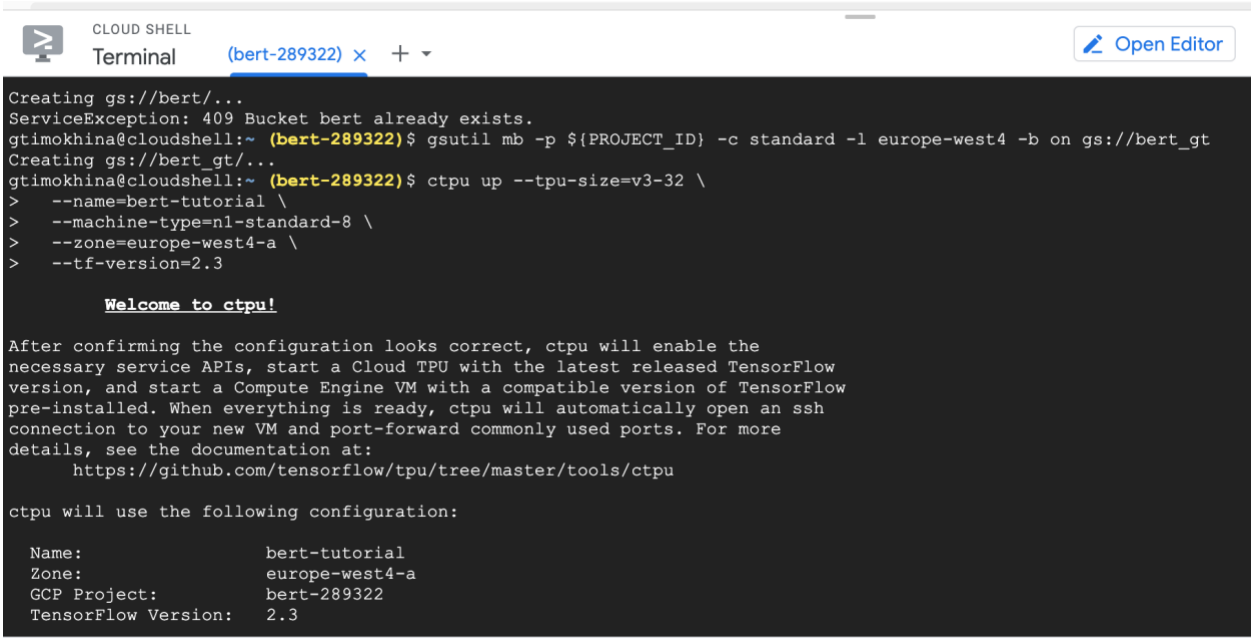
   ```
   gcloud beta services identity create --service tpu.googleapis.com --
   project $PROJECT_ID
   ```

4. **Create a Cloud Storage bucket:**
   `gsutil mb -p ${PROJECT_ID} -c standard -l europe-west4 -b on gs://bert_gt`



5. **Launch the Compute Engine VM resource using the `ctpu up` command.**

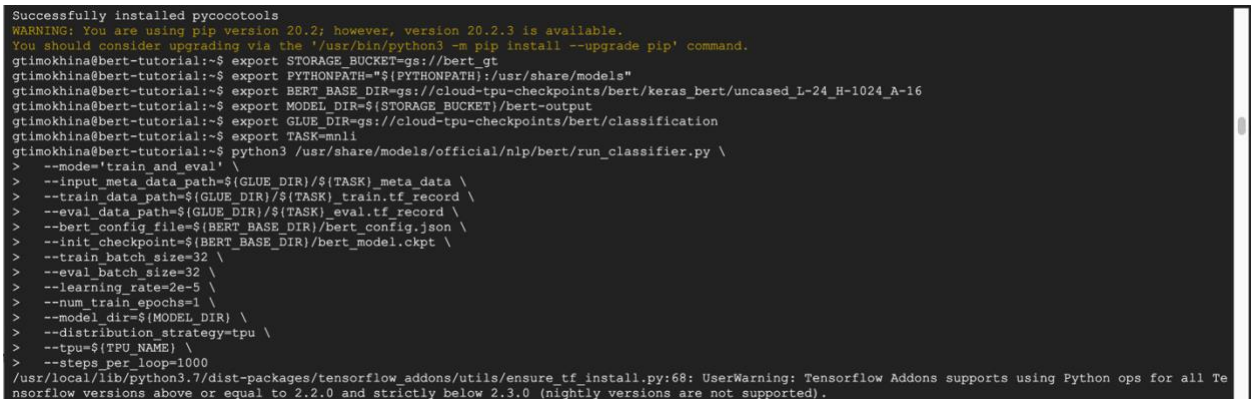
   ```
   ctpu up --tpu-size=v3-8 \
     --name=bert-tutorial \
     --machine-type=n1-standard-8 \
     --zone=europe-west4-a \
     --tf-version=2.3
   ```



6. **Set TPU name variables:**
   `export TPU_NAME=bert-tutorial`

7. **Install extra package.**
   `sudo pip3 install -r /usr/share/models/official/requirements.txt`

8. **Define additional variables:**
   ```
   export STORAGE_BUCKET=gs://bert_gt
   export PYTHONPATH="${PYTHONPATH}:/usr/share/models"
   export BERT_BASE_DIR=gs://cloud-tpu-checkpoints/bert/keras_bert/uncased_L-24_H-1024_A-16
   export MODEL_DIR=${STORAGE_BUCKET}/bert-output
   export GLUE_DIR=gs://cloud-tpu-checkpoints/bert/classification
   export TASK=mnli
   ```

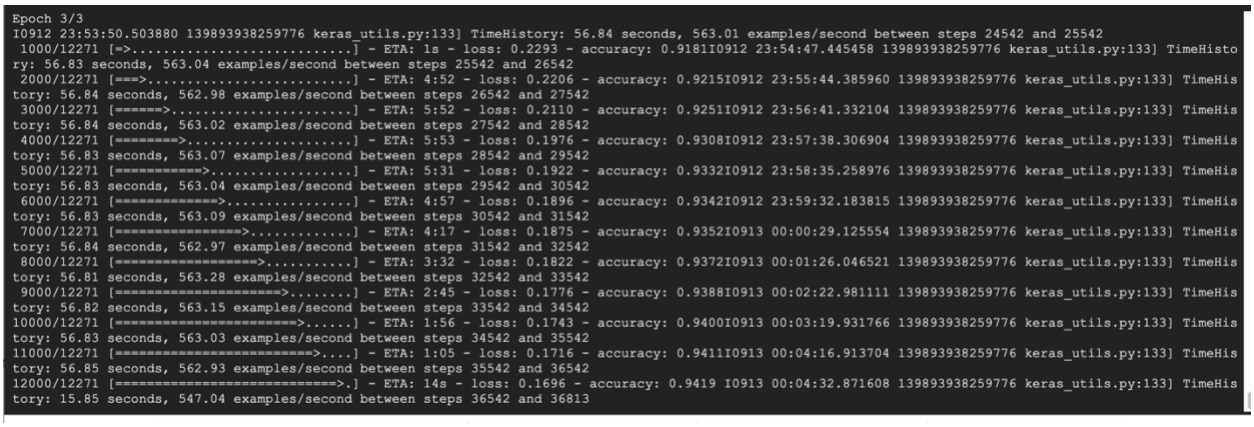


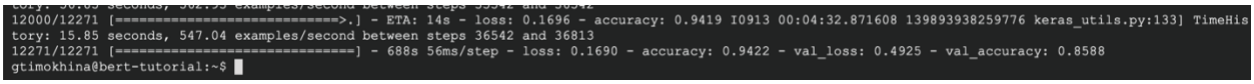
```
INFO:tensorflow:Found TPU system:
I0912 22:52:17.194361 139676113041216 tpu_system_metadata.py:159] Found TPU system:
INFO:tensorflow:*** Num TPU Cores: 8
I0912 22:52:17.194587 139676113041216 tpu_system_metadata.py:160] *** Num TPU Cores: 8
INFO:tensorflow:*** Num TPU Workers: 1
I0912 22:52:17.194823 139676113041216 tpu_system_metadata.py:161] *** Num TPU Workers: 1
INFO:tensorflow:*** Num TPU Cores Per Worker: 8
I0912 22:52:17.194924 139676113041216 tpu_system_metadata.py:163] *** Num TPU Cores Per Worker: 8
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:CPU:0, CPU, 0, 0)
I0912 22:52:17.195084 139676113041216 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:CPU:0, CPU
, 0, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:XLA_CPU:0, XLA_CPU, 0, 0)
I0912 22:52:17.195272 139676113041216 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:XLA_CPU:0,
 XLA_CPU, 0, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:CPU:0, CPU, 0, 0)
I0912 22:52:17.195361 139676113041216 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:CPU:0, CPU, 0
, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:TPU:0, TPU, 0, 0)
I0912 22:52:17.195478 139676113041216 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:TPU:0, TPU, 0
, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:TPU:1, TPU, 0, 0)
I0912 22:52:17.195535 139676113041216 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:TPU:1, TPU, 0
, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:TPU:2, TPU, 0, 0)
I0912 22:52:17.195587 139676113041216 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:TPU:2, TPU, 0
, 0)
```

9. **Run the training script for 3 epoch:**

```
python3 /usr/share/models/official/nlp/bert/run_classifier.py \
  --mode='train_and_eval' \
  --input_meta_data_path=${GLUE_DIR}/${TASK}_meta_data \
  --train_data_path=${GLUE_DIR}/${TASK}_train.tf_record \
  --eval_data_path=${GLUE_DIR}/${TASK}_eval.tf_record \
  --bert_config_file=${BERT_BASE_DIR}/bert_config.json \
  --init_checkpoint=${BERT_BASE_DIR}/bert_model.ckpt \
  --train_batch_size=32 \
  --eval_batch_size=32 \
  --learning_rate=2e-5 \
  --num_train_epochs=1 \
  --model_dir=${MODEL_DIR} \
  --distribution_strategy=tpu \
  --tpu=${TPU_NAME} \
  --steps_per_loop=1000
```

```
INFO:tensorflow:Initializing the TPU system: bert-tutorial
I0912 23:22:26.878622 139893938259776 tpu_strategy_util.py:73] Initializing the TPU system: bert-tutorial
INFO:tensorflow:Clearing out eager caches
I0912 23:22:32.124595 139893938259776 tpu_strategy_util.py:108] Clearing out eager caches
INFO:tensorflow:Finished initializing TPU system.
I0912 23:22:32.130125 139893938259776 tpu_strategy_util.py:131] Finished initializing TPU system.
W0912 23:22:32.132838 139893938259776 tpu_strategy.py:320] `tf.distribute.experimental.TPUStrategy` is deprecated, please use  the non experimental symbol
`tf.distribute.TPUStrategy` instead.
I0912 23:22:32.175255 139893938259776 transport.py:157] Attempting refresh to obtain initial access_token
I0912 23:22:32.287615 139893938259776 transport.py:157] Attempting refresh to obtain initial access_token
INFO:tensorflow:Found TPU system:
I0912 23:22:32.360162 139893938259776 tpu_system_metadata.py:159] Found TPU system:
INFO:tensorflow:*** Num TPU Cores: 8
I0912 23:22:32.360378 139893938259776 tpu_system_metadata.py:160] *** Num TPU Cores: 8
INFO:tensorflow:*** Num TPU Workers: 1
I0912 23:22:32.360579 139893938259776 tpu_system_metadata.py:161] *** Num TPU Workers: 1
INFO:tensorflow:*** Num TPU Cores Per Worker: 8
I0912 23:22:32.360660 139893938259776 tpu_system_metadata.py:163] *** Num TPU Cores Per Worker: 8
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:CPU:0, CPU, 0, 0)
I0912 23:22:32.360713 139893938259776 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:CPU:0, CPU
, 0, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:XLA_CPU:0, XLA_CPU, 0, 0)
I0912 23:22:32.360910 139893938259776 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:localhost/replica:0/task:0/device:XLA_CPU:0,
 XLA_CPU, 0, 0)
INFO:tensorflow:*** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:CPU:0, CPU, 0, 0)
I0912 23:22:32.360959 139893938259776 tpu_system_metadata.py:165] *** Available Device: _DeviceAttributes(/job:worker/replica:0/task:0/device:CPU:0, CPU, 0
```





10. Clean Up

```
exit
ctpu delete --name=bert-tutorial \
  --zone=europe-west4-a
  gsutil rm -r gs://bert_gt
```