Aer_Distrubited_1

September 15, 2021

```python
[1]: import numpy as np
```

```python
[2]: from qiskit import QuantumCircuit
```

```python
[3]: from qiskit import Aer
```

```python
[4]: from qiskit.tools.visualization import plot_histogram, plot_state_city
```

```python
[5]: Aer.backends()
```

```
[5]: [AerSimulator('aer_simulator'),
      AerSimulator('aer_simulator_statevector'),
      AerSimulator('aer_simulator_density_matrix'),
      AerSimulator('aer_simulator_stabilizer'),
      AerSimulator('aer_simulator_matrix_product_state'),
      AerSimulator('aer_simulator_extended_stabilizer'),
      AerSimulator('aer_simulator_unitary'),
      AerSimulator('aer_simulator_superop'),
      QasmSimulator('qasm_simulator'),
      StatevectorSimulator('statevector_simulator'),
      UnitarySimulator('unitary_simulator'),
      PulseSimulator('pulse_simulator')]
```

```python
[6]: simulator=Aer.get_backend('aer_simulator')
```

```python
[7]: from qiskit.circuit.random import random_circuit
```

```python
[8]: qc=[random_circuit(num_qubits=3, depth=4, measure=True) for _ in range(1,11)]
```
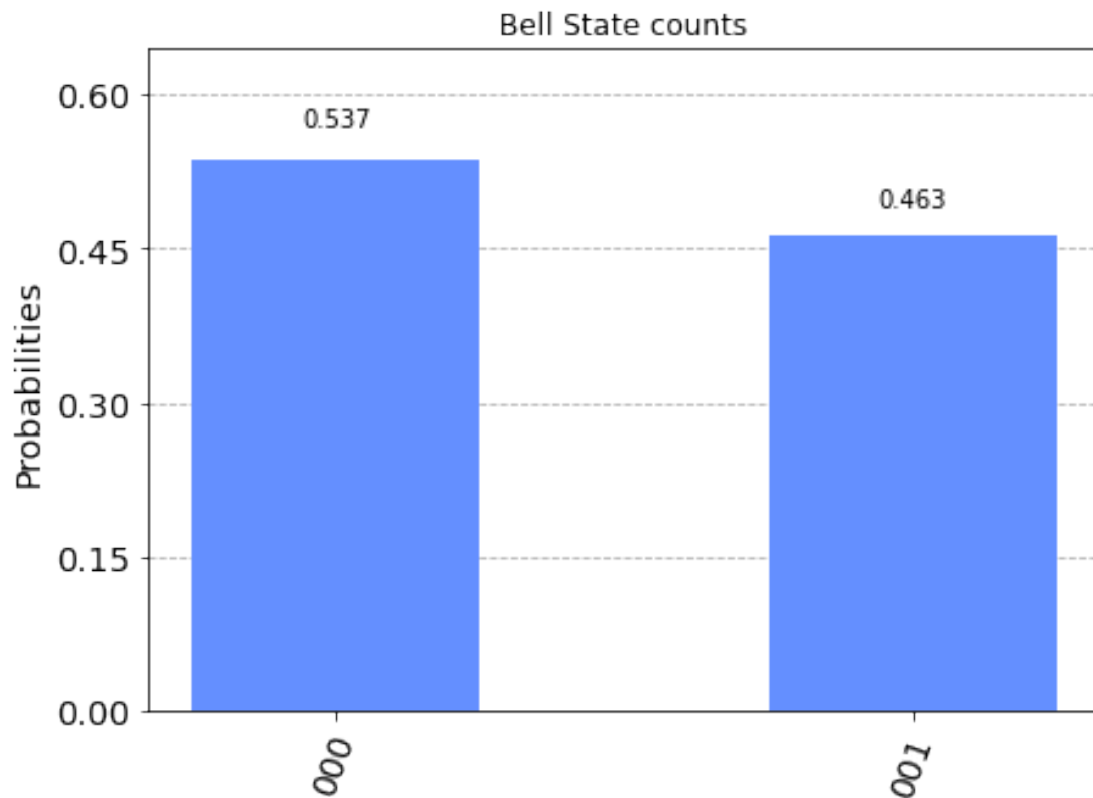
```python
[9]: from qiskit import transpile
```

```python
[10]: qc=transpile(qc, simulator)
```

```python
[11]: result=simulator.run(qc).result()
```

```python
[12]: counts=result.get_counts(qc[0])
```

```
[13]: plot_histogram(counts, title="Bell State counts");
```


Bell State counts

```
[ ]: ################################################################################################
```

```
[14]: from dask_kubernetes import KubeCluster
```

```
[15]: !cat ./worker-spec.yml
```

```
# worker-spec.yml

kind: Pod
metadata:
  labels:
    foo: bar
spec:
  restartPolicy: Never
  containers:
  - image: daskdev/dask:latest
    imagePullPolicy: IfNotPresent
    args: [dask-worker, --nthreads, '1', --no-dashboard, --memory-limit, 1G,
--death-timeout, '60']
```

```
        name: dask
        env:
          - name: EXTRA_PIP_PACKAGES
            value: git+https://github.com/dask/distributed
        resources:
          limits:
            cpu: "1"
            memory: 1G
          requests:
            cpu: "1"
            memory: 1G
```

[16]: `cluster_kube = KubeCluster('worker-spec.yml')`

```
Creating scheduler pod on cluster. This may take some time.
Forwarding from 127.0.0.1:62429 -> 8786
Forwarding from [::1]:62429 -> 8786
Handling connection for 62429
Handling connection for 62429
Handling connection for 62429
```

```
/home/red/.local/lib/python3.9/site-packages/distributed/client.py:1100:
VersionMismatchWarning: Mismatched versions found
```

```
+-------------+-----------+-----------------------+---------+
| Package     | client    | scheduler             | workers |
+-------------+-----------+-----------------------+---------+
| blosc       | None      | 1.10.2                | None    |
| cloudpickle | 2.0.0     | 1.6.0                 | None    |
| distributed | 2021.09.0 | 2021.09.0+16.g3f86e58f | None    |
| lz4         | None      | 3.1.3                 | None    |
+-------------+-----------+-----------------------+---------+
  warnings.warn(version_module.VersionMismatchWarning(msg[0]["warning"]))
```

[17]: `cluster_kube.get_logs()`

```
Handling connection for 62429
```

[17]: {'Cluster': 'Creating scheduler pod on cluster. This may take some time.',
    'Scheduler': 'distributed.scheduler - INFO -
    --\ndistributed.scheduler - INFO -
    Clear task state\ndistributed.scheduler - INFO -   Scheduler at:
    tcp://172.17.0.3:8786\ndistributed.scheduler - INFO -   dashboard at:
    :8787\ndistributed.scheduler - INFO - Receive client connection: Client-
    ccbc97e2-159d-11ec-a0f4-a09f10d41eae\ndistributed.scheduler - INFO - Remove
    client Client-ccbc97e2-159d-11ec-a0f4-a09f10d41eae\ndistributed.scheduler - INFO
    - Remove client Client-
    ccbc97e2-159d-11ec-a0f4-a09f10d41eae\ndistributed.scheduler - INFO - Close

                                       3
```

```
client connection: Client-ccbc97e2-159d-11ec-a0f4-a09f10d41eae'}
```

[18]:
```python
from dask.distributed import Client
```

[19]:
```python
client_kube = Client(cluster_kube)
```

```
Handling connection for 62429
Handling connection for 62429
```

[ ]:

[ ]:
```python
qbackend = Aer.get_backend('qasm_simulator')
```

[ ]:
```python
from qiskit import execute
```

[ ]:
```python
result_ideal = execute(qc, qbackend, executor=client_kube).result()
```

[ ]:

[ ]:

[32]:
```python
client_kube.close()
```

[ ]:
```python
cluster_kube.close()
```

[ ]:

[ ]:
```python
##############################################################################################
```

[ ]:

[ ]:

[ ]:
```python
from concurrent.futures import ThreadPoolExecutor
```

[ ]:
```python
exc_threadpool = ThreadPoolExecutor(max_workers=2)
```

[ ]:
```python
qbackend = Aer.get_backend('qasm_simulator')
```

[ ]:
```python
from qiskit import execute
```

[ ]:
```python
result_ideal = execute(qc, qbackend, executor=exc_threadpool).result()
```

[ ]:

[ ]:

```
[ ]:  #################################################################################
```

```
[ ]:
```

```
[ ]:
```

```
[20]:  from dask.distributed import Client
```

```
[21]:  from dask.distributed import LocalCluster
```

```
[22]:  exc_localcluster = Client(address=LocalCluster(n_workers=1, processes=True))
```

```
[23]:  exc_localcluster
```

```
[23]:  <Client: 'tcp://127.0.0.1:44407' processes=1 threads=16, memory=7.70 GiB>
```

```
[24]:  qbackend = Aer.get_backend('qasm_simulator')
```

```
[25]:  from qiskit import execute
```

```
[26]:  result_ideal = execute(qc, qbackend, executor=exc_localcluster).result()
```

```
WARNING:qiskit.providers.aer.backends.aerbackend:Simulation failed and returned
the following error message:
ERROR: Failed to load qobj: to_json not implemented for this type of object:
<class 'distributed.client.Client'>
```

```
[34]:  exc_localcluster.close()
```

```
[ ]:
```

```
[ ]:
```

```
[ ]:  #################################################################################
```

```
[ ]:
```

```
[28]:  from dask.distributed import Client
```

```
[31]:  exc=Client(n_workers=2, threads_per_worker=1, memory_limit='500MB')
```

```
/home/red/.local/lib/python3.9/site-packages/distributed/node.py:160:
UserWarning: Port 8787 is already in use.
Perhaps you already have a cluster running?
Hosting the HTTP server on port 44043 instead
  warnings.warn(
```

```python
[35]: qbackend = Aer.get_backend('qasm_simulator')
```

```python
[36]: from qiskit import execute
```

```python
[37]: result_ideal = execute(qc, qbackend, executor=exc).result()
```

```
WARNING:qiskit.providers.aer.backends.aerbackend:Simulation failed and returned
the following error message:
ERROR: Failed to load qobj: to_json not implemented for this type of object:
<class 'distributed.client.Client'>
```

```python
[38]: exc.close()
```

```python
[ ]:
```