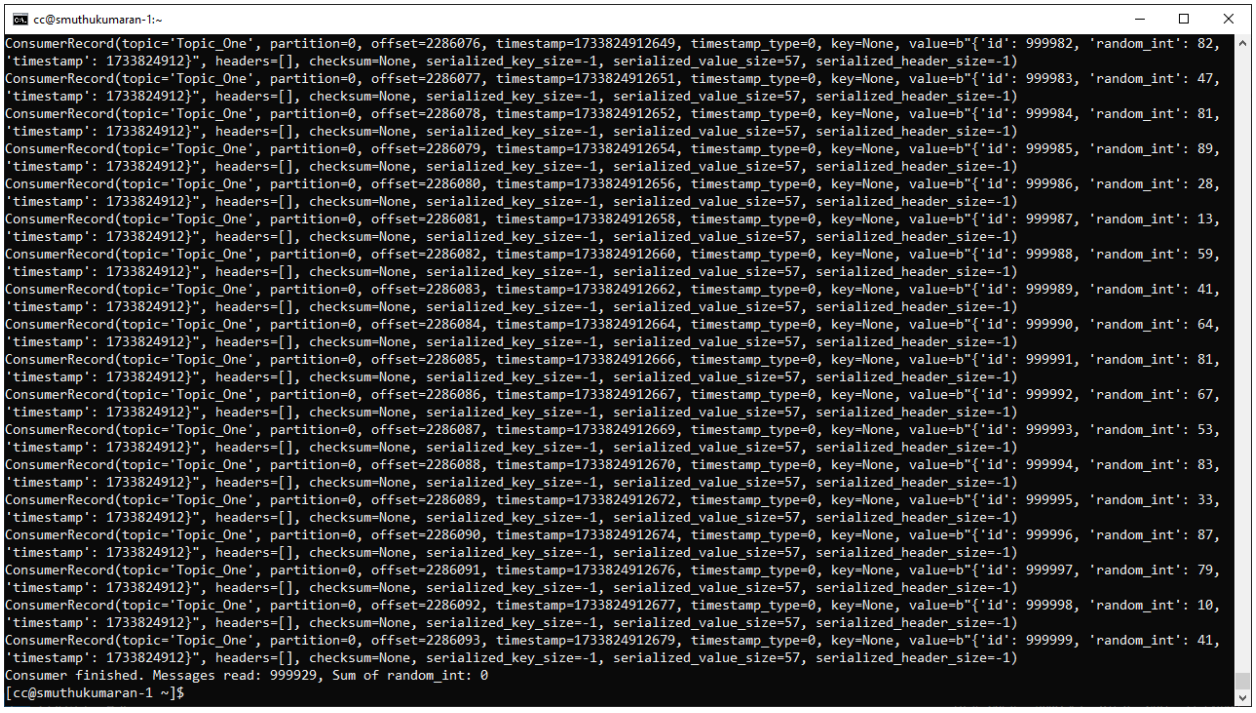
CS 451
Fall 2024
Assignment 3

Part 2

Producer Output:

```
[cc@smuthukumaran-1 ~]$ vi producer1.py
[cc@smuthukumaran-1 ~]$ python3 producer1.py Topic_One
start producer
Producer finished. Last message id: 999999
[cc@smuthukumaran-1 ~]$
```

Consumer Output:



Part 1, 17d:

```
[root@smuthukumaran-1 kafka]# ./bin/kafka-topics.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf --describe
Topic: Topic_Three      TopicId: 1dgLmQwFRvSrlXFy6E4Emw PartitionCount: 3       ReplicationFactor: 2    Configs: min.insync.replicas=2,flush.ms=1000,segment.bytes=10737
41824,retention.ms=36000000,flush.messages=10000
        Topic: Topic_Three      Partition: 0    Leader: 1       Replicas: 1,3   Isr: 1,3
        Topic: Topic_Three      Partition: 1    Leader: 3       Replicas: 3,4   Isr: 4,3
        Topic: Topic_Three      Partition: 2    Leader: 4       Replicas: 4,1   Isr: 4,1
Topic: Topic_One        TopicId: 0mKZXuCDQdKwXxAY6oKXsQ PartitionCount: 1       ReplicationFactor: 2    Configs: min.insync.replicas=2,flush.ms=1000,segment.bytes=10737
41824,retention.ms=36000000,flush.messages=10000
        Topic: Topic_One        Partition: 0    Leader: 1       Replicas: 1,3   Isr: 1,3
Topic: Topic_Four       TopicId: RyOtZVKhRwKz_yBw-sx_7w PartitionCount: 4       ReplicationFactor: 3    Configs: min.insync.replicas=2,flush.ms=1000,segment.bytes=10737
41824,retention.ms=36000000,flush.messages=10000
        Topic: Topic_Four       Partition: 0    Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: Topic_Four       Partition: 1    Leader: 3       Replicas: 3,4,1 Isr: 4,3,1
        Topic: Topic_Four       Partition: 2    Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: Topic_Four       Partition: 3    Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
Topic: __consumer_offsets       TopicId: 9ZYDwFWeRYq48YUS8grJ0A PartitionCount: 50      ReplicationFactor: 3    Configs: compression.type=producer,min.insync.replicas=2
,cleanup.policy=compact,flush.ms=1000,segment.bytes=104857600,flush.messages=10000
        Topic: __consumer_offsets       Partition: 0    Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 1    Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 2    Leader: 3       Replicas: 3,4,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 3    Leader: 3       Replicas: 3,4,1 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 4    Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 5    Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 6    Leader: 1       Replicas: 1,4,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 7    Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 8    Leader: 3       Replicas: 3,1,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 9    Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 10   Leader: 3       Replicas: 3,1,4 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 11   Leader: 1       Replicas: 1,4,3 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 12   Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 13   Leader: 3       Replicas: 3,1,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 14   Leader: 1       Replicas: 1,4,3 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 15   Leader: 3       Replicas: 3,4,1 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 16   Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 17   Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 18   Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 19   Leader: 1       Replicas: 1,3,4 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 20   Leader: 3       Replicas: 3,4,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 21   Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 22   Leader: 3       Replicas: 3,1,4 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 23   Leader: 1       Replicas: 1,4,3 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 24   Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 25   Leader: 3       Replicas: 3,4,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 26   Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 27   Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 28   Leader: 3       Replicas: 3,4,1 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 29   Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 30   Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 31   Leader: 3       Replicas: 3,4,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 32   Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 33   Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 34   Leader: 1       Replicas: 1,3,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 35   Leader: 3       Replicas: 3,4,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 36   Leader: 3       Replicas: 3,1,4 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 37   Leader: 1       Replicas: 1,4,3 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 38   Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 39   Leader: 1       Replicas: 1,4,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 40   Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 41   Leader: 3       Replicas: 3,1,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 42   Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 43   Leader: 3       Replicas: 3,1,4 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 44   Leader: 1       Replicas: 1,4,3 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 45   Leader: 3       Replicas: 3,1,4 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 46   Leader: 1       Replicas: 1,4,3 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 47   Leader: 4       Replicas: 4,3,1 Isr: 4,1,3
        Topic: __consumer_offsets       Partition: 48   Leader: 3       Replicas: 3,1,4 Isr: 4,3,1
        Topic: __consumer_offsets       Partition: 49   Leader: 1       Replicas: 1,4,3 Isr: 4,1,3
[root@smuthukumaran-1 kafka]#
```

Part 3

1. Screenshots of Your Working Cluster

Step 16. Show the status of the Kafka metadata quorum (describe --status command).

```
[root@smuthukumaran-1 kafka]# ./bin/kafka-metadata-quorum.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf describe --status
ClusterId:              AkjTcumdRaeMwFLEyVp1Pw
LeaderId:               4
LeaderEpoch:            104
HighWatermark:          408
MaxFollowerLag:         409
MaxFollowerLagTimeMs:   -1
CurrentVoters:          [1,2,3,4]
CurrentObservers:       []
[root@smuthukumaran-1 kafka]#
```

Step 17. Verify that the partitions are in sync after loading messages.

```
[root@smuthukumaran-1 kafka]# ./bin/kafka-topics.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf --replication-factor 3 --crea
te --topic Topic_Four --partitions 4 --config retention.ms=36000000
WARNING: Due to limitations in metric names, topics with a period ('.') or underscore ('_') could collide. To avoid issues it is best to use either, but not both.
Created topic Topic_Four.
[root@smuthukumaran-1 kafka]# ./bin/kafka-topics.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf --replication-factor 2 --crea
te --topic Topic_Three --partitions 3 --config retention.ms=36000000
WARNING: Due to limitations in metric names, topics with a period ('.') or underscore ('_') could collide. To avoid issues it is best to use either, but not both.
Created topic Topic_Three.
[root@smuthukumaran-1 kafka]# ./bin/kafka-topics.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf --replication-factor 2 --crea
te --topic Topic_One --partitions 1 --config retention.ms=36000000
WARNING: Due to limitations in metric names, topics with a period ('.') or underscore ('_') could collide. To avoid issues it is best to use either, but not both.
Created topic Topic_One.
[root@smuthukumaran-1 kafka]# ./bin/kafka-topics.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf --describe
Topic: Topic_Four       TopicId: RyOtZVKhRwKz_y8w-sx_7w PartitionCount: 4       ReplicationFactor: 3    Configs: min.insync.replicas=2,flush.ms=1000,segment.bytes=10737
41824,retention.ms=36000000,flush.messages=10000
        Topic: Topic_Four       Partition: 0    Leader: 1       Replicas: 1,3,4 Isr: 1,3,4
        Topic: Topic_Four       Partition: 1    Leader: 3       Replicas: 3,4,1 Isr: 3,4,1
        Topic: Topic_Four       Partition: 2    Leader: 4       Replicas: 4,1,3 Isr: 4,1,3
        Topic: Topic_Four       Partition: 3    Leader: 1       Replicas: 1,3,4 Isr: 1,3,4
Topic: Topic_Three      TopicId: 1dgLmQwFRvSr1XFy6E4Emw PartitionCount: 3       ReplicationFactor: 2    Configs: min.insync.replicas=2,flush.ms=1000,segment.bytes=10737
41824,retention.ms=36000000,flush.messages=10000
        Topic: Topic_Three      Partition: 0    Leader: 1       Replicas: 1,3   Isr: 1,3
        Topic: Topic_Three      Partition: 1    Leader: 3       Replicas: 3,4   Isr: 3,4
        Topic: Topic_Three      Partition: 2    Leader: 4       Replicas: 4,1   Isr: 4,1
Topic: Topic_One        TopicId: 0mWZXuCDQdKwXxAY6oKKsQ PartitionCount: 1       ReplicationFactor: 2    Configs: min.insync.replicas=2,flush.ms=1000,segment.bytes=10737
41824,retention.ms=36000000,flush.messages=10000
        Topic: Topic_One        Partition: 0    Leader: 1       Replicas: 1,3   Isr: 1,3
[root@smuthukumaran-1 kafka]#
```

Step 20. Show ACL verification for your user.

```
[root@smuthukumaran-1 kafka]# ./bin/kafka-acls.sh --bootstrap-server smuthukumaran-1.novalocal:9092 --command-config ./config/admin.conf --list
Current ACLs for resource `ResourcePattern(resourceType=TOPIC, name=Topic_Four, patternType=LITERAL)`:
        (principal=User:usercc, host=*, operation=CREATE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=READ, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=WRITE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=DESCRIBE, permissionType=ALLOW)

Current ACLs for resource `ResourcePattern(resourceType=TOPIC, name=Topic_One, patternType=LITERAL)`:
        (principal=User:usercc, host=*, operation=WRITE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=DESCRIBE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=CREATE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=READ, permissionType=ALLOW)

Current ACLs for resource `ResourcePattern(resourceType=TOPIC, name=Topic_Three, patternType=LITERAL)`:
        (principal=User:usercc, host=*, operation=DESCRIBE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=READ, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=WRITE, permissionType=ALLOW)
        (principal=User:usercc, host=*, operation=CREATE, permissionType=ALLOW)

Current ACLs for resource `ResourcePattern(resourceType=GROUP, name=*, patternType=LITERAL)`:
        (principal=User:usercc, host=*, operation=READ, permissionType=ALLOW)
```

2. Explain the write process when the producer wrote a message

The producer sends a message to the Kafka broker specified in the bootstrap-servers configuration. The broker determines the partition for the message based on the topic and partitioning strategy. The message is appended to the corresponding partition's log and replicated to other nodes based on the topic's replication factor. An acknowledgment is sent back to the producer when the message is committed.

3. Why Did We Enable SSL?

We enabled SSL to encrypt communication between Kafka clients (producers/consumers) and brokers. It helps authenticate clients and brokers using certificates, ensuring only trusted entities interact with the cluster. Ultimately, it protects against man-in-the-middle attacks and ensures data integrity.

4. Who and What Is the Principal?

The principal is the identity of a user or service interacting with Kafka, authenticated via SSL. It represents who has permissions like read or write on a particular topic.

5. Shutdown 1 of the 4 Nodes

```
[cc@smuthukumaran-1 ~]$ ssh -i ~/.ssh/id_rsa cc@10.56.3.227
Last login: Tue Dec  3 00:34:25 2024 from 10.56.2.2
[cc@smuthukumaran-4 ~]$ sudo -i
[root@smuthukumaran-4 ~]# sudo systemctl stop kafka
[root@smuthukumaran-4 ~]# exit
logout
[cc@smuthukumaran-4 ~]$ exit
logout
Connection to 10.56.3.227 closed.
```

Topic_One:

```
ConsumerRecord(topic='Topic_One', partition=0, offset=2386085, timestamp=1733827533616, timestamp_type=0, key=None, value=b"{'id': 99991, 'random_int': 64, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386086, timestamp=1733827533618, timestamp_type=0, key=None, value=b"{'id': 99992, 'random_int': 29, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386087, timestamp=1733827533620, timestamp_type=0, key=None, value=b"{'id': 99993, 'random_int': 64, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386088, timestamp=1733827533622, timestamp_type=0, key=None, value=b"{'id': 99994, 'random_int': 43, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386089, timestamp=1733827533624, timestamp_type=0, key=None, value=b"{'id': 99995, 'random_int': 60, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386090, timestamp=1733827533626, timestamp_type=0, key=None, value=b"{'id': 99996, 'random_int': 99, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386091, timestamp=1733827533628, timestamp_type=0, key=None, value=b"{'id': 99997, 'random_int': 91, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386092, timestamp=1733827533629, timestamp_type=0, key=None, value=b"{'id': 99998, 'random_int': 49, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_One', partition=0, offset=2386093, timestamp=1733827533631, timestamp_type=0, key=None, value=b"{'id': 99999, 'random_int': 95, 'timestamp': 1733827533}",
 headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
Consumer finished. Messages read: 100000, Sum of random_int: 0
[cc@smuthukumaran-1 ~]$
```

Topic_Three:

```
ConsumerRecord(topic='Topic_Three', partition=1, offset=33536, timestamp=1733826926792, timestamp_type=0, key=None, value=b"{'id': 99974, 'random_int': 83, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33537, timestamp=1733826926800, timestamp_type=0, key=None, value=b"{'id': 99979, 'random_int': 54, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33538, timestamp=1733826926807, timestamp_type=0, key=None, value=b"{'id': 99984, 'random_int': 16, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33539, timestamp=1733826926811, timestamp_type=0, key=None, value=b"{'id': 99986, 'random_int': 67, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33540, timestamp=1733826926814, timestamp_type=0, key=None, value=b"{'id': 99987, 'random_int': 11, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33541, timestamp=1733826926827, timestamp_type=0, key=None, value=b"{'id': 99993, 'random_int': 31, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33542, timestamp=1733826926835, timestamp_type=0, key=None, value=b"{'id': 99997, 'random_int': 82, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33543, timestamp=1733826926837, timestamp_type=0, key=None, value=b"{'id': 99998, 'random_int': 44, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Three', partition=1, offset=33544, timestamp=1733826926839, timestamp_type=0, key=None, value=b"{'id': 99999, 'random_int': 14, 'timestamp': 1733826926}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
Consumer finished. Messages read: 100000, Sum of random_int: 0
```

Topic_Four:

```
ConsumerRecord(topic='Topic_Four', partition=2, offset=24952, timestamp=1733827205805, timestamp_type=0, key=None, value=b"{'id': 99962, 'random_int': 33, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24953, timestamp=1733827205807, timestamp_type=0, key=None, value=b"{'id': 99963, 'random_int': 35, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24954, timestamp=1733827205811, timestamp_type=0, key=None, value=b"{'id': 99966, 'random_int': 83, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24955, timestamp=1733827205812, timestamp_type=0, key=None, value=b"{'id': 99967, 'random_int': 40, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24956, timestamp=1733827205818, timestamp_type=0, key=None, value=b"{'id': 99971, 'random_int': 69, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24957, timestamp=1733827205835, timestamp_type=0, key=None, value=b"{'id': 99980, 'random_int': 51, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24958, timestamp=1733827205837, timestamp_type=0, key=None, value=b"{'id': 99982, 'random_int': 28, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24959, timestamp=1733827205848, timestamp_type=0, key=None, value=b"{'id': 99987, 'random_int': 66, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
ConsumerRecord(topic='Topic_Four', partition=2, offset=24960, timestamp=1733827205863, timestamp_type=0, key=None, value=b"{'id': 99995, 'random_int': 76, 'timestamp': 1733827205}",
headers=[], checksum=None, serialized_key_size=-1, serialized_value_size=56, serialized_header_size=-1)
Consumer finished. Messages read: 100000, Sum of random_int: 0
[cc@smuthukumaran-1 ~]$
```

Topic_Four did not perform as expected and had issues.

6. Shutdown 2 of the 4 Nodes

```
[cc@smuthukumaran-1 ~]$ ssh -i ~/.ssh/id_rsa cc@10.56.1.109
Last login: Tue Dec 10 05:50:42 2024 from 10.56.2.2
[cc@smuthukumaran-3 ~]$ sudo -i
[root@smuthukumaran-3 ~]# systemctl stop kafka
[root@smuthukumaran-3 ~]#
```

Topic_One:

```
[cc@smuthukumaran-1 ~]$ python3 producer1.py Topic_One
start producer
Producer finished. Last message id: 99999
[cc@smuthukumaran-1 ~]$ python3 consumer1.py Topic_One
start consumer
^CTraceback (most recent call last):
  File "/home/cc/consumer1.py", line 46, in <module>
    main()
  File "/home/cc/consumer1.py", line 43, in main
    consume_messages(topic)
  File "/home/cc/consumer1.py", line 34, in consume_messages
    for message in consumer:
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/consumer/group.py", line 1193, in __next__
    return self.next_v2()
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/consumer/group.py", line 1201, in next_v2
    return next(self._iterator)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/consumer/group.py", line 1116, in _message_generator_v2
    record_map = self.poll(timeout_ms=timeout_ms, update_offsets=False)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/consumer/group.py", line 655, in poll
    records = self._poll_once(remaining, max_records, update_offsets=update_offsets)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/consumer/group.py", line 675, in _poll_once
    self._coordinator.poll()
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/coordinator/consumer.py", line 289, in poll
    self.ensure_active_group()
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/coordinator/base.py", line 407, in ensure_active_group
    self._client.poll(future=future)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/client_async.py", line 602, in poll
    self._poll(timeout / 1000)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/client_async.py", line 634, in _poll
    ready = self._selector.select(timeout)
  File "/usr/lib64/python3.9/selectors.py", line 469, in select
    fd_event_list = self._selector.poll(timeout, max_ev)
KeyboardInterrupt
```

Topic_Three:

```
[cc@smuthukumaran-1 ~]$ python3 producer1.py Topic_Three
start producer
^CTraceback (most recent call last):
  File "/home/cc/producer1.py", line 47, in <module>
    main()
  File "/home/cc/producer1.py", line 43, in main
    producer.flush()
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/producer/kafka.py", line 649, in flush
    self._accumulator.await_flush_completion(timeout=timeout)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/producer/record_accumulator.py", line 528, in await_flush_completion
    if not batch.produce_future.wait(timeout=timeout):
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/producer/future.py", line 28, in wait
    return self._latch.wait(timeout) or self._latch.is_set()
  File "/usr/lib64/python3.9/threading.py", line 581, in wait
    signaled = self._cond.wait(timeout)
  File "/usr/lib64/python3.9/threading.py", line 312, in wait
    waiter.acquire()
KeyboardInterrupt
```

Topic_Four:

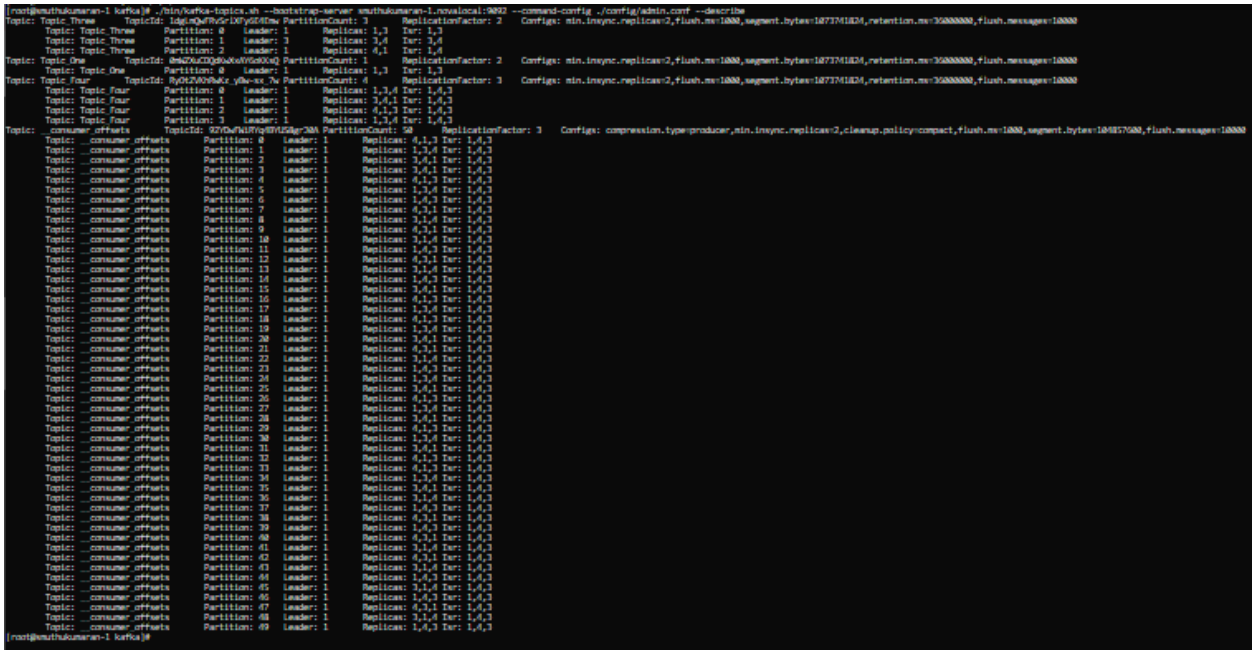
```
[cc@smuthukumaran-1 ~]$ python3 producer1.py Topic_Four
start producer
^CTraceback (most recent call last):
  File "/home/cc/producer1.py", line 47, in <module>
    main()
  File "/home/cc/producer1.py", line 43, in main
    producer.flush()
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/producer/kafka.py", line 649, in flush
    self._accumulator.await_flush_completion(timeout=timeout)
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/producer/record_accumulator.py", line 528, in await_flush_completion
    if not batch.produce_future.wait(timeout=timeout):
  File "/home/cc/.local/lib/python3.9/site-packages/kafka/producer/future.py", line 28, in wait
    return self._latch.wait(timeout) or self._latch.is_set()
  File "/usr/lib64/python3.9/threading.py", line 581, in wait
    signaled = self._cond.wait(timeout)
  File "/usr/lib64/python3.9/threading.py", line 312, in wait
    waiter.acquire()
KeyboardInterrupt
```

Topic three and four did not even perform Producer's task properly while Topic one failed on the consumer portion.

7. Restart the Two Stopped Nodes

```
[cc@smuthukumaran-1 ~]$ ssh -i ~/.ssh/id_rsa cc@10.56.1.109
Last login: Tue Dec 10 05:53:42 2024 from 10.56.2.2
[cc@smuthukumaran-3 ~]$ sudo -i
[root@smuthukumaran-3 ~]# systemctl start kafka
[root@smuthukumaran-3 ~]# exit
logout
[cc@smuthukumaran-3 ~]$ exit
logout
Connection to 10.56.1.109 closed.
[cc@smuthukumaran-1 ~]$ ssh -i ~/.ssh/id_rsa cc@10.56.3.227
Last login: Tue Dec 10 05:28:24 2024 from 10.56.2.2
[cc@smuthukumaran-4 ~]$ sudo -i
[root@smuthukumaran-4 ~]# sudo systemctl start kafka
[root@smuthukumaran-4 ~]# exit
logout
[cc@smuthukumaran-4 ~]$ exit
logout
Connection to 10.56.3.227 closed.
[cc@smuthukumaran-1 ~]$
```

8. Verify Partition Sync (Rerun 17.d)



9. Why Is Kafka Running as the User Kafka and not root?

Running Kafka as root is a security risk because it could expose the entire system to potential vulnerabilities. Operating Kafka under a dedicated user minimizes permissions, allowing Kafka to only access what it needs.