In [2]:

```
from urllib.request import urlopen
import time
import json
import pandas as pd
import matplotlib.pyplot as plt
from shapely.geometry import Point
import geopandas as gpd
from geopandas import GeoDataFrame
```

In [2]:

```
time_position = []
latitude      = []
longitude     = []

end_time = time.time() + 60 * 60 # End time is set for current time + 60 * 60 (60 mints=3600 seconds whi
while time.time() < end_time:
    #This loop runs for 1 hour and extracts the time in seconds and
    #latitude and longitude coordinates of the satellite provided by NASA
    with urlopen("http://api.open-notify.org/iss-now.json") as response:
        body = response.read()
    co_ordinates = json.loads(body.decode('utf-8'))  #converts bytes format to dictionary format
    longitude.append(co_ordinates['iss_position']['longitude']) # appends longitude value
    latitude.append(co_ordinates['iss_position']['latitude'])   # appends latitude value
    time_position.append(co_ordinates['timestamp'])             # appends timestamp value
```

In [108]:

```
#creating the dataframe from the values of time, latitude and longitude
satellite_data = pd.DataFrame(list(zip(time_position,latitude,longitude)),columns = ['time','latitude','
```

In [109]:

```
satellite_data.tail()
```

Out[109]:

	time	latitude	longitude
7133	1681032298	-20.9390	-46.8187
7134	1681032298	-20.9149	-46.7978
7135	1681032298	-20.9149	-46.7978
7136	1681032300	-20.8425	-46.7353
7137	1681032300	-20.8184	-46.7145

It can be observed from the above data that time is not in the interval of 5 seconds. Hence, we must extract the rows for every 5 seconds of time values.

In [110]:

```python
time_interval_5 = []
a = list(satellite_data['time'])[0]
time_interval_5.append(a)
for i in list(satellite_data['time']):
    # This loop runs through every time value in satellite data from second to last value
    # This checks with the previous time value and if the difference between them is >=5
    # then appends the time value to list time_interval_5
    # Note - We might not find value at exact interval of 5 seconds
    # therefore considering time difference value of greater than 5 which can be 6 at times.
    if i-a>=5 :
        time_interval_5.append(i)
        a = i
    else:
        continue
```

In [111]:

```python
#filtering the data with the time values with an time interval of 5 seconds
satellite_data_5seconds = satellite_data[satellite_data.time.isin(time_interval_5)].groupby('time').heac
```

In [112]:

```python
# converting the string datatype to numeric datatypes for latitude and longitude columns
satellite_data_5seconds["latitude"] = pd.to_numeric(satellite_data_5seconds["latitude"])
satellite_data_5seconds["longitude"] = pd.to_numeric(satellite_data_5seconds["longitude"])
```

In [113]:

```python
#printing last 5 records of dataframe
satellite_data_5seconds.tail()
```

Out[113]:

	time	latitude	longitude
7097	1681032280	-21.8054	-47.5746
7107	1681032285	-21.5651	-47.3636
7117	1681032290	-21.3246	-47.1534
7127	1681032295	-21.0837	-46.9440
7136	1681032300	-20.8425	-46.7353

Here, it can be observed that the time values are having the difference of 5 seconds.

In [114]:

```
#saving the dataframe to a pickle file
satellite_data_5seconds.to_pickle('satellite_data_5seconds.pkl')
```

In [3]:

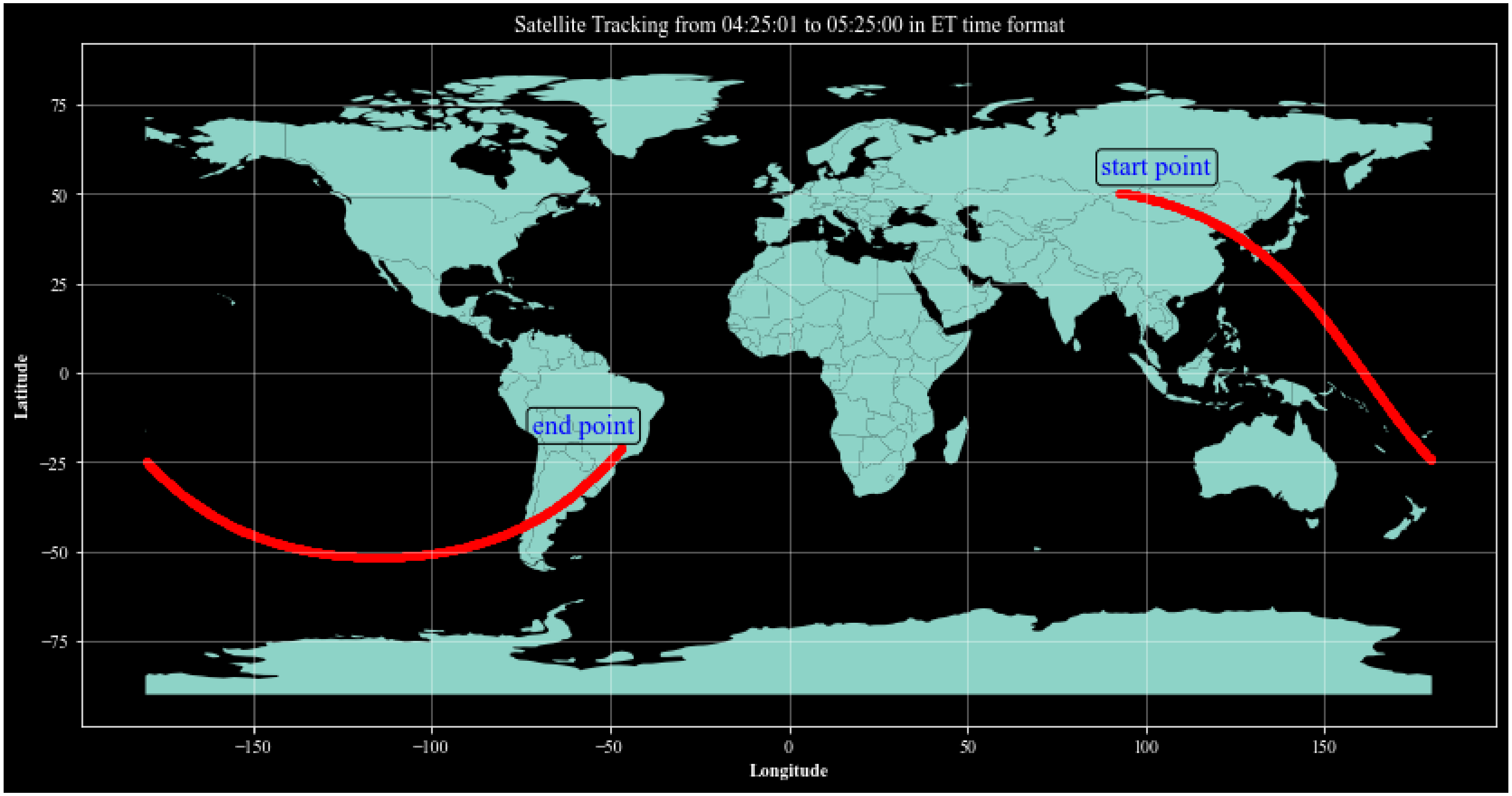
```
#loading the pickle data
satellite_data_5seconds = pd.read_pickle('satellite_data_5seconds.pkl')
```

In [4]:

```
#converting the latitude and longitude values to Points
geometry = [Point(xy) for xy in zip(satellite_data_5seconds['longitude'], satellite_data_5seconds['latit
gdf = GeoDataFrame(satellite_data_5seconds, geometry=geometry)
```

In [41]:

```
plt.style.use('dark_background')
plt.rcParams["font.family"] = "Times New Roman"

world = gpd.read_file(gpd.datasets.get_path('naturalearth_lowres'))
gax   = gdf.plot(ax=world.plot(figsize=(14, 8)), marker='o', color='red', markersize=15)

start = time.strftime('%H:%M:%S', time.gmtime(list(satellite_data_5seconds['time'])[0]-4*3600)) # start
end   = time.strftime('%H:%M:%S', time.gmtime(list(satellite_data_5seconds['time'])[-1]-4*3600))# end t

start_x,start_y = satellite_data_5seconds['longitude'].tolist()[0],satellite_data_5seconds['latitude'].t
end_x,end_y     = satellite_data_5seconds['longitude'].tolist()[-1],satellite_data_5seconds['latitude'].

plt.text(x=start_x-5,y=start_y+5,s='start point',fontsize=15,color='blue',
        bbox=dict(facecolor='none', edgecolor='black', boxstyle='round,pad=0.2'))
plt.text(x=end_x-25,y=end_y+4,s='end point',fontsize=15,color='blue',
        bbox=dict(facecolor='none', edgecolor='black', boxstyle='round,pad=0.2'))

plt.title('Satellite Tracking from '+start+' to '+end+' in ET time format')
plt.xlabel('Longitude',fontweight='bold')
plt.ylabel('Latitude',fontweight='bold')
plt.grid(True,alpha=0.4)
plt.show()
```


Satellite Tracking from 04:25:01 to 05:25:00 in ET time format
start point
end point
Latitude
75
50
25
0
−25
−50
−75
Longitude
−150
−100
−50
0
50
100
150