

<https://flightaware.com/live/fleet/LAN> (https://flightaware.com/live/fleet/LAN)

```
In [ ]: 1 from robobrowser import RoboBrowser
        2 import plotly.plotly as py
        3 import pandas as pd
        4 import networkx as nx
        5 from cachier import cachier
        6 import geocoder
        7 browser = RoboBrowser(history=True, parser='html5lib')
```

```
In [30]: 1 url = 'https://flightaware.com/live/fleet/LAN'
        2 browser.open(url)
        3 table=browser.select('.prettyTable')[0]
        4 table_code=table.__str__()
        5 table_code[:1000]
```

```
Out[30]: '<table class="prettyTable fullWidth" style="background-color: white;"><thead><tr><th class="mainHeader" colspan="8">Airborne LAN Airlines "LAN Chile" (LAN) Aircraft</th></tr><tr><th><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=ident">Ident</a><a href="http://flightaware.com/live/fleet/LAN?;offset=0;order=ident;sort=DESC"></a></th><th><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=aircrafttype">Type</a></th><th><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=origin">Origin</a></th><th><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=destination">Destination</a></th><th><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=actualdeparturetime">Departure</a></th><th><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=estimatedarrivaltime">Estimated<br/>Arrival Time</a></th></tr></thead><tbody><tr><td><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=ident">Ident</a><a href="http://flightaware.com/live/fleet/LAN?;offset=0;order=ident;sort=DESC"></a></td><td><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=aircrafttype">Type</a></td><td><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=origin">Origin</a></td><td><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=destination">Destination</a></td><td><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=actualdeparturetime">Departure</a></td><td><a href="http://flightaware.com/live/fleet/LAN?;offset=0;sort=ASC;order=estimatedarrivaltime">Estimated<br/>Arrival Time</a></td></tr></tbody></table>'
```

```
In [31]: 1 tdf=pd.read_html(table_code, header=1)[0]
        2 tdf
```

Out[31]:

	Ident	Type	Origin	Destination	Departure	EstimatedArrival Time
0	LAN137	A321	Cerro Moreno Int'l (ANF / SCFA)	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:47PM -03	Mon 07:18PM -03
1	LAN138	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Cerro Moreno Int'l (ANF / SCFA)	Mon 05:21PM -03	Mon 06:52PM -03
2	LAN155	A320	El Loa (CJC / SCCF)	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:28PM -03	Mon 07:07PM -03
3	LAN156	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	El Loa (CJC / SCCF)	Mon 05:33PM -03	Mon 07:13PM -03
4	LAN168	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Diego Aracena Int'l (IQQ / SCDA)	Mon 05:39PM -03	Mon 07:33PM -03
5	LAN188	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Chacalluta Int'l (ARI / SCAR)	Mon 06:08PM -03	Mon 08:28PM -03
6	LAN433	A320	Governor Francisco Gabrielli Int'l (El Plumeri...	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:45PM -03	Mon 06:24PM -03
7	LAN443	A320	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Ministro Pistarini Int'l (EZE / SAEZ)	Mon 05:06PM -03	Mon 06:47PM -03
8	LAN461	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Jorge Newbery (AEP / SABE)	Mon 05:24PM -03	Mon 07:04PM -03
9	LAN486	A320	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Ingeniero Ambrosio L.V. Taravella Int'l (COR / ...)	Mon 05:42PM -03	Mon 06:47PM -03
10	LAN576	B788	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	El Dorado Int'l (BOG / SKBO)	Mon 03:35PM -03	Mon 06:48PM -05
11	LAN600	B788	Jorge Chavez Int'l (LIM / SPJC)	Los Angeles Intl (KLAX)	Mon 12:46PM -05	Mon 06:57PM PDT
12	LAN632	A320	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Jorge Chavez Int'l (LIM / SPJC)	Mon 04:37PM -03	Mon 06:02PM -05
13	LAN642	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Jorge Chavez Int'l (LIM / SPJC)	Mon 03:54PM -03	Mon 05:00PM -05
14	LAN702	B789	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	São Paulo-Guarulhos Int'l (GRU / SBGR)	Mon 04:04PM -03	Mon 08:49PM -02
15	LAN703	B789	Barajas Int'l (MAD / LEMD)	São Paulo-Guarulhos Int'l (GRU / SBGR)	Mon 09:55PM CET	Tue 05:55AM -02

Ident		Type	Origin	Destination	Departure	EstimatedArrival Time
16	LAN751	B789	São Paulo-Guarulhos Int'l (GRU / SBGR)	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 04:37PM -02	Mon 07:13PM -03
17	LAN801	B789	Auckland (AKL / NZAA)	Sydney (SYD / YSSY)	Tue 07:28AM NZDT	Tue 08:22AM AEDT
18	LAN805	B789	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Melbourne Tullamarine (MEL / YMML)	Mon 12:57PM -03	Tue 04:23PM AEDT

```
In [32]: 1 browser = RoboBrowser(history=True, parser='html5lib')
2 base_url = 'https://flightaware.com/live/fleet/'
3 query = 'JAL' ##
4 airlines = "LAN", "JAL", "DLH", "AAL", "CCA", 'AFR', 'IGO', 'MSR'
5 df = pd.DataFrame()
6
7 for query in airlines:
8     print()
9     print(query)
10    for i in range(2):
11        url = base_url + query + "?;offset=" + str(i*20)
12        browser.open(url)
13        table=browser.select('.prettyTable')[0]
14        t=table.__str__()
15        if 'Sorry' in t:
16            break
17        tdf=pd.read_html(t, header=1)[0]
18        df = df.append(tdf)
19        print(tdf.head(3))
```

LAN

	Ident	Type	Origin \
0	LAN137	A321	Cerro Moreno Int'l (ANF / SCFA)
1	LAN138	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)
2	LAN155	A320	El Loa (CJC / SCCF)

	Destination	Departure \
0	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:47PM -03
1	Cerro Moreno Int'l (ANF / SCFA)	Mon 05:21PM -03
2	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:28PM -03

	EstimatedArrival Time
0	Mon 07:18PM -03
1	Mon 06:52PM -03
2	Mon 07:07PM -03

JAL

	Ident	Type	Origin	Destination \
0	JAL11	B788	Dallas-Fort Worth Intl (KDFW)	Narita Int'l (NRT / RJAA)
1	JAL17	B788	Vancouver Int'l (CYVR)	Narita Int'l (NRT / RJAA)
2	JAL3	B77W	John F Kennedy Intl (KJFK)	Narita Int'l (NRT / RJAA)

		Departure	EstimatedArrival	Time
0	Mon	12:38PM CDT	Tue	03:46PM JST
1	Mon	02:21PM PDT	Tue	03:50PM JST
2	Mon	12:26PM EDT	Tue	02:39PM JST

	Ident	Type		Origin	\
0	JAL726	B789	Jakarta-Soekarno-Hatta Int'l	(CGK / WIII)	
1	JAL727	B788	Kansai Int'l	(KIX / RJBB)	
2	JAL738	B788	Suvarnabhumi Bangkok Int'l	(BKK / VTBS)	

		Destination	Departure	\
0		Narita Int'l (NRT / RJAA)	Mon 09:54PM WIB	
1		Suvarnabhumi Bangkok Int'l (BKK / VTBS)	Tue 01:03AM JST	
2		Chubu Centrair Int'l (Centrair) (NGO / RJGG)	Tue 01:15AM +07	

	EstimatedArrival	Time
0	Tue 06:36AM JST	
1	Tue 04:29AM +07	
2	Tue 08:08AM JST	

DLH

	Ident	Type	Origin	Destination	\
0	DLH1068	A320	Frankfurt Int'l (FRA / EDDF)	Nice Cote d'Azur (NCE / LFMN)	
1	DLH1082	A319	Frankfurt Int'l (FRA / EDDF)	Lyon (LYS / LFLN)	
2	DLH1120	A321	Frankfurt Int'l (FRA / EDDF)	Barajas Int'l (MAD / LEMD)	

		Departure	EstimatedArrival	Time
0	Mon	09:23PM CET	Mon	10:43PM CET
1	Mon	10:06PM CET	Mon	11:04PM CET
2	Mon	08:58PM CET	Mon	11:04PM CET

	Ident	Type	Origin	\
0	DLH1792	A320	Munich Int'l (MUC / EDDM)	
1	DLH1864	A319	Munich Int'l (MUC / EDDM)	
2	DLH1930	A320	Munich Int'l (MUC / EDDM)	

		Destination	Departure	\
0	Lisbon / Lisboa,Portela (Lisbon)	(LIS / LPPT)	Mon 08:36PM CET	
1		Malpensa Int'l (MXP / LIMC)	Mon 10:17PM CET	
2		Naples Int'l (Capodichino) (NAP / LIRN)	Mon 09:36PM CET	

	EstimatedArrival	Time
0	Mon 10:14PM WET	
1	Mon 11:05PM CET	
2	Mon 10:50PM CET	

AAL

	Ident	Type	Origin \	Destination	Departure	EstimatedArrival Time
0	AAL1005	A319	Miami Intl (KMIA)		Mon 03:52PM EDT	Mon 05:55PM EDT
1	AAL101	B738	John F Kennedy Intl (KJFK)		Mon 05:02PM EDT	Mon 06:30PM EDT
2	AAL1014	MD83	Detroit Metro Wayne Co (KDTW)		Mon 05:19PM EDT	Mon 06:50PM CDT
	Ident	Type	Origin	Destination \		
0	AAL1095	A321	San Diego Intl (KSAN)	Dallas-Fort Worth Intl (KDFW)		
1	AAL1109	B738	Miami Intl (KMIA)	Chicago O'Hare Intl (KORD)		
2	AAL1112	A321	LaGuardia (KLGA)	Dallas-Fort Worth Intl (KDFW)		
					Departure	EstimatedArrival Time
0	Mon 12:51PM PDT				Mon 05:19PM CDT	
1	Mon 05:05PM EDT				Mon 06:55PM CDT	
2	Mon 02:50PM EDT				Mon 05:19PM CDT	

CCA

	Ident	Type	Origin \	Destination	Departure \	EstimatedArrival Time
0	CCA173	B77W	Beijing Capital Int'l (PEK / ZBAA)			
1	CCA177	A332	Shanghai Pudong Int'l (PVG / ZSPD)			
2	CCA430	A332	Sydney (SYD / YSSY)			
				Destination	Departure \	EstimatedArrival Time
0				Sydney (SYD / YSSY)	Tue 02:11AM CST	
1				Melbourne Tullamarine (MEL / YMLL)	Mon 07:51PM CST	
2				Chengdu Shuangliu Int'l (CTU / ZUUU)	Mon 09:38PM AEDT	
						EstimatedArrival Time
0						Tue 03:25PM AEDT
1						Tue 08:57AM AEDT
2						Tue 05:28AM CST

	Ident	Type	Origin \
0	CCA862	A330	Geneva Cointrin Int'l (GVA / LSGG)
1	CCA906	B738	Yangon Int'l (RGN / VYYY)
2	CCA910	A333	Sheremetyevo Int'l (SVO / UUEE)

	Destination	Departure	EstimatedArrival Time
0	Beijing Capital Int'l (PEK / ZBAA)	Mon 08:02PM CET	Tue 01:04PM CST

1	Beijing Capital Int'l (PEK / ZBAA)	Tue 12:38AM +0630	Tue 06:24AM CST
2	Beijing Capital Int'l (PEK / ZBAA)	Mon 09:17PM MSK	Tue 08:10AM CST

AFR

	Ident	Type	Origin \	Destination	Departure \
0	AFR1004	A321	Charles de Gaulle/Roissy (CDG / LFPG)		
1	AFR1016	A318	Charles de Gaulle/Roissy (CDG / LFPG)		
2	AFR1028	A318	Charles de Gaulle/Roissy (CDG / LFPG)		
0	Leonardo da Vinci Int'l (Fiumicino Int'l)	(FCO...)	Mon 09:26PM CET		
1		Dublin Int'l (DUB / EIDW)	Mon 09:01PM CET		
2		Bologna (Guglielmo Marconi) (BLQ / LIPE)	Mon 09:22PM CET		

EstimatedArrival Time

0	Mon 11:13PM CET
1	Mon 09:32PM GMT
2	Mon 10:42PM CET

	Ident	Type	Origin \
0	AFR166	B77W	Charles de Gaulle/Roissy (CDG / LFPG)
1	AFR1694	A320	Charles de Gaulle/Roissy (CDG / LFPG)
2	AFR178	A388	Charles de Gaulle/Roissy (CDG / LFPG)

	Destination	Departure \
0	Suvarnabhumi Bangkok Int'l (BKK / VTBS)	Mon 04:32PM CET
1	Budapest Ferenc Liszt International Airport (B...)	Mon 09:12PM CET
2	Lic. Benito Juarez Int'l (MEX / MMMX)	Mon 11:00AM CET

EstimatedArrival Time

0	Tue 09:07AM +07
1	Mon 11:03PM CET
2	Mon 04:27PM CST

IGO

	Ident	Type	Origin \
0	IGO1304	A320	Seeb Int'l (MCT / OOMS)
1	IGO154	A320	Chatrapati Shivaji Int'l (BOM / VABB)
2	IGO164	A320	Bengaluru Int'l (BLR / VOBL)

	Destination	Departure	EstimatedArrival Time
0	Calicut Int'l (Karipur) (CCJ / VOCL)	Mon 11:00PM +04	Tue 03:35AM IST
1	Indira Gandhi Int'l (DEL / VIDP)	Tue 02:12AM IST	Tue 03:47AM IST
2	Jaipur (Sanganer) (JAI / VIJP)	Tue 12:40AM IST	Tue 02:45AM IST

	Ident	Type	Origin \
0	IGO948	A320	Dabolim (Goa) / Dabolim Navy Airbase (GOI / VOGO)

	Destination	Departure \
0	Sardar Vallabhbhai Patel Int'l (Ahmadabad) (AM...	Tue 02:00AM IST

	EstimatedArrival Time
0	Tue 03:35AM IST

MSR

	Ident	Type	Origin	Destination \
0	MSR20	B738	Cairo Int'l (CAI / HECA)	Sharm El Sheikh (SSH / HESH)
1	MSR364	E170	Luxor Int'l (LXR / HELX)	Cairo Int'l (CAI / HECA)
2	MSR42	B738	Cairo Int'l (CAI / HECA)	Hurghada (HRG / HEGN)

	Departure	EstimatedArrival Time
0	Mon 10:37PM EET	Mon 11:30PM EET
1	Mon 10:30PM EET	Mon 11:35PM EET
2	Mon 10:53PM EET	Mon 11:33PM EET

In [23]:

```
1 from joblib import Memory
2 memory = Memory(cachedir='tmp', verbose=0)
3
4 @memory.cache
5 def get_latlng(query):
6     g=geocoder.google(query)
7     if g:
8         return g.latlng
9     else:
10        return None, None
11
12 great_lines = []
13 airports = []
14 airport_data = []
15 seen=[]
16 great_lines_2=[]
17 airports = pd.DataFrame(columns=['label','lat','lon','size'])
18
19
20 i=0
21 for index,row in df.iterrows():
22     origin = row.Origin
23     destination = row.Destination
24     olat, olon = get_latlng(origin)
25     dlat, dlon = get_latlng(destination)
26     if olat and dlat:
27         if origin not in seen:
28             seen.append(origin)
29             print(origin, olat, olon)
30         if destination not in seen:
31             seen.append(destination)
32             print(destination, dlat, dlon)
33         great_lines.append(dict(
34             type = 'scattergeo',
35             lat = [ olat, dlat ],
36             lon = [ olon, dlon ],
37             hoverinfo = 'Ident',
38             text = 'Ident',
39             mode = 'lines',
40             line = dict(
41                 width = 1,
42                 color = 'rgba(255,0,0,0.2)',
```

```

43         ),
44         )
45     )
46     airports.loc[i]=[origin, olat, olon, 0.0]
47     airports.loc[i+1]= [destination, dlat, dlon, 0.0]
48     i+=2
49

```

```

Cerro Moreno Int'l (ANF / SCFA) -23.4486944 -70.4409348
Comodoro Arturo Merino Benitez Int'l (SCL / SCEL) -33.3911894 -70.79723539999999
El Loa (CJC / SCCF) -22.4989612 -68.90696609999999
Diego Aracena Int'l (IQQ / SCDA) -20.5364084 -70.1805181
Governor Francisco Gabrielli Int'l (El Plumerillo Int'l) (MDZ / SAME) -32.8278642 -68.7984902
Ministro Pistarini Int'l (EZE / SAEZ) -34.8150044 -58.53482839999999
Jorge Newbery (AEP / SABE) -34.5580305 -58.4170088
El Dorado Int'l (BOG / SKBO) 4.7014128 -74.1444969
Jorge Chavez Int'l (LIM / SPJC) -12.0240527 -77.112036
Melbourne Tullamarine (MEL / YMLL) -37.6690123 144.8410273
Dallas-Fort Worth Intl (KDFW) 32.8998091 -97.0403352
Narita Int'l (NRT / RJAA) 35.7719867 140.3928501
Tokyo Int'l (Haneda) (HND / RJTT) 35.5493932 139.7798386
Suvarnabhumi Bangkok Int'l (BKK / VTBS) 13.6899991 100.7501124
London Heathrow (LHR / EGLL) 51.4700223 -0.4542955
Helsinki-Vantaa (HEL / EFHK) 60.32104159999999 24.9528604
Charles de Gaulle/Roissy (CDG / LFPG) 49.0096906 2.5479245
San Diego Intl (KSAN) 32.7338006 -117.1933038
Boston Logan Intl (KBOS) 42.3656132 -71.0095602
Tan Son Nhat Int'l (SGN / VVTS) 10.8184631 106.6588245
Kuala Lumpur Int'l (KUL / WMKK) 2.7350439 101.7010435
Kansai Int'l (KIX / RJBB) 34.4320024 135.2303939
Chubu Centrair Int'l (Centrair) (NGO / RJGG) 34.8590935 136.8146005
Indira Gandhi Int'l (DEL / VIDP) 28.5561624 77.0999578
Daniel K Inouye Intl (PHNL) 21.3324959 -157.9210801
Chicago O'Hare Intl (KORD) 41.9741625 -87.9073214
Munich Int'l (MUC / EDDM) 48.3536621 11.7750279
Athens Int'l, Eleftherios Venizelos (ATH / LGAV) 37.9356467 23.9484156
Naples Int'l (Capodichino) (NAP / LIRN) 40.8829943 14.2865792
Dusseldorf Int'l (DUS / EDDL) 51.2876146 6.7667912
Tegel Int'l (TXL / EDDT) 52.5588327 13.2884374
Hamburg (HAM / EDDH) 53.633622 9.9974128
Hanover/Langenhagen Int'l (HAJ / EDDV) 52.4618486 9.6889919
Bremen (BRE / EDDW) 53.0479741 8.7858793
Brussels (BRU / EBBR) 50.900999 4.4855744

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Geneva Cointrin Int'l (GVA / LSGG) 46.23700969999999 6.1091564
Stockholm-Arlanda (ARN / ESSA) 59.6497622 17.9237807
Oslo, Gardermoen (OSL / ENGM) 60.1975501 11.1004152
Pittsburgh Intl (KPIT) 40.4957722 -80.24131129999999
McCarran Intl (KLAS) 36.0839998 -115.1537389
San Jose Int'l (KSJC) 37.3639472 -121.9289375
Los Cabos Int'l (SJD / MMSD) 23.1455358 -109.7182665
LaGuardia (KLGA) 40.7769271 -73.8739659
Indianapolis Intl (KIND) 39.7168593 -86.2955952
Tampa Intl (KTPA) 27.9834776 -82.5370781
Vancouver Int'l (CYVR) 49.1966913 -123.1815123
John Glenn Columbus Intl Airport (KCMH) 39.9999399 -82.8871767
Sacramento Intl (KSMF) 38.6950854 -121.5900648
Shanghai Pudong Int'l (PVG / ZSPD) 31.1443439 121.808273
Dubai Int'l (DXB / OMDB) 25.2531745 55.3656728
Chongqing Jiangbei Int'l (CKG / ZUCK) 29.7191667 106.6416667
Chengdu Shuangliu Int'l (CTU / ZUUU) 30.567456 103.9492936
Budapest Ferenc Liszt International Airport (BUD / LHBP) 47.4384587 19.2522958
Beijing Capital Int'l (PEK / ZBAA) 40.0798573 116.6031121
Zurich (Kloten) (ZRH / LSZH) 47.4582165 8.5554755
Washington Dulles Intl (KIAD) 38.9531162 -77.45653879999999
Phuket Int'l (HKT / VTSP) 8.1110951 98.3064646
Barcelona Int'l (BCN / LEBL) 41.297445 2.0832941
Vienna Int'l (Schwechat) (VIE / LOWW) 48.1158333 16.5665751
Yangon Int'l (RGN / VYYY) 16.9028408 96.13546339999999
Jinnah Int'l (KHI / OPKC) 24.9008297 67.16808259999999
Malpensa Int'l (MXP / LIMC) 45.6300625 8.7255307
Leonardo da Vinci Int'l (Fiumicino Int'l) (FCO / LIRF) 41.7998868 12.2462384
Bologna (Guglielmo Marconi) (BLQ / LIPE) 44.5345216 11.2878593
Ben Gurion Int'l (TLV / LLBG) 32.005532 34.8854112
Amerigo Vespucci (Florence) (FLR / LIRQ) 43.8086534 11.2012247
Wuhan Tianhe (WUH / ZHHH) 30.7766171 114.2124495
Marco Polo Int'l (Marco Polo Venice) (VCE / LIPZ) 45.5034546 12.3446927
Houari Boumedienne (ALG / DAAG) 36.6981425 3.2067834
Lic. Benito Juarez Int'l (MEX / MMMX) 19.4360762 -99.07190829999999
Chatrapati Shivaji Int'l (BOM / VABB) 19.0895595 72.8656144
Incheon Int'l (ICN / RKSI) 37.4601908 126.4406957
Pune / Lohegaon Air Force Base (PNQ / VAPO) 18.579343 73.9089168
Jaipur (Sanganer) (JAI / VIJP) 26.8286281 75.7642025
Seeb Int'l (MCT / OOMS) 23.6012845 58.29072859999999
Calicut Int'l (Karipur) (CCJ / VOCL) 11.1396508 75.9517496
Bengaluru Int'l (BLR / VOBL) 13.1986348 77.7065928
Hamad Int'l (DOH / OTHH) 25.2605946 51.6137665

Chennai Int'l (MAA / VOMM) 12.994112 80.1708668
Cochin Int'l (Kochi Int'l) (COK / VOCI) 10.1517834 76.392958
Dabolim (Goa) / Dabolim Navy Airbase (GOI / VOGO) 15.3803485 73.8349952
Netaji Subhash Chandra Bose Int'l (CCU / VECC) 22.6520429 88.4463299
Sardar Vallabhbhai Patel Int'l (Ahmadabad) (AMD / VAAH) 23.0734262 72.626571
Cairo Int'l (CAI / HECA) 30.1123632 31.4002893
Sharm El Sheikh (SSH / HESH) 27.9768276 34.3935273
Luxor Int'l (LXR / HELX) 25.6738827 32.7014938
Hurghada (HRG / HEGN) 27.180494 33.807566
Prince Nayef bin Abdulaziz Regional Airport (ELQ / OEGS) 26.3051734 43.7686247
King Khalid Int'l (RUH / OERK) 24.9597126 46.7029144
King Abdulaziz Int'l (JED / OEJN) 21.6658971 39.1717627
Asmara Int'l (ASM / HHAS) 15.285 38.901667
OR Tambo Int'l (JNB / FAOR) -26.1366728 28.2411459
Jomo Kenyatta Int'l (NBO / HKJK) -1.3227102 36.9260693
Daraw (ASW / HESN) 23.9664425 32.8244756
Toronto Pearson Int'l (CYYZ) 43.67771760000001 -79.6248197

In [24]: 1 airports.head(20)

Out[24]:

		label	lat	lon	size
0		Cerro Moreno Int'l (ANF / SCFA)	-23.448694	-70.440935	0.0
1		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
2		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
3		Cerro Moreno Int'l (ANF / SCFA)	-23.448694	-70.440935	0.0
4		El Loa (CJC / SCCF)	-22.498961	-68.906966	0.0
5		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
6		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
7		El Loa (CJC / SCCF)	-22.498961	-68.906966	0.0
8		Diego Aracena Int'l (IQQ / SCDA)	-20.536408	-70.180518	0.0
9		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
10		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
11		Diego Aracena Int'l (IQQ / SCDA)	-20.536408	-70.180518	0.0
12		Governor Francisco Gabrielli Int'l (El Plumeri...	-32.827864	-68.798490	0.0
13		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
14		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
15		Ministro Pistarini Int'l (EZE / SAEZ)	-34.815004	-58.534828	0.0
16		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
17		Jorge Newbery (AEP / SABE)	-34.558031	-58.417009	0.0
18		Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	0.0
19		El Dorado Int'l (BOG / SKBO)	4.701413	-74.144497	0.0

In [35]:

```
1 df.head()
```

Out[35]:

	Ident	Type	Origin	Destination	Departure	EstimatedArrival Time
0	LAN137	A321	Cerro Moreno Int'l (ANF / SCFA)	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:47PM -03	Mon 07:18PM -03
1	LAN138	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Cerro Moreno Int'l (ANF / SCFA)	Mon 05:21PM -03	Mon 06:52PM -03
2	LAN155	A320	El Loa (CJC / SCCF)	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Mon 05:28PM -03	Mon 07:07PM -03
3	LAN156	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	El Loa (CJC / SCCF)	Mon 05:33PM -03	Mon 07:13PM -03
4	LAN168	A321	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	Diego Aracena Int'l (IQQ / SCDA)	Mon 05:39PM -03	Mon 07:33PM -03

In [37]:

```
1 import networkx as nx
2 G = nx.from_pandas_dataframe(df, 'Origin', 'Destination')
```

...

In [42]:

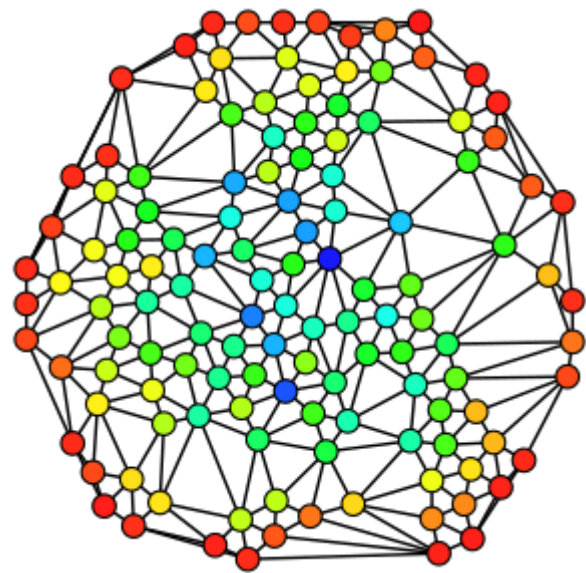
```
1 for node in G.nodes():  
2     print(node)
```

```
Cerro Moreno Int'l (ANF / SCFA)  
Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)  
El Loa (CJC / SCCF)  
Diego Aracena Int'l (IQQ / SCDA)  
Chacalluta Int'l (ARI / SCAR)  
Governor Francisco Gabrielli Int'l (El Plumerillo Int'l) (MDZ / SAME)  
Ministro Pistarini Int'l (EZE / SAEZ)  
Jorge Newbery (AEP / SABE)  
Ingeniero Ambrosio L.V. Taravella Int'l (COR / SACO)  
El Dorado Int'l (BOG / SKBO)  
Jorge Chavez Int'l (LIM / SPJC)  
Los Angeles Intl (KLAX)  
São Paulo-Guarulhos Int'l (GRU / SBGR)  
Barajas Int'l (MAD / LEMD)  
Auckland (AKL / NZAA)  
Sydney (SYD / YSSY)  
Melbourne Tullamarine (MEL / YMLL)  
Dallas-Fort Worth Intl (KDFW)  
Narita Int'l (NRT / RJAA)  
Managua Intl (MGA)
```

```
In [41]: 1 for edge in G.edges():
        2     print(edge)

("Cerro Moreno Int'l (ANF / SCFA)", "Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", 'El Loa (CJC / SCCF)')
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "Diego Aracena Int'l (IQQ / SCDA)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "Chacalluta Int'l (ARI / SCAR)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "Governor Francisco Gabrielli Int'l (El Plumerillo Int'l) (MDZ / SAME)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "Ministro Pistarini Int'l (EZE / SAEZ)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", 'Jorge Newbery (AEP / SABE)')
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "Ingeniero Ambrosio L.V. Taravella Int'l (COR / SACO)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "El Dorado Int'l (BOG / SKBO)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "Jorge Chavez Int'l (LIM / SPJC)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", "São Paulo-Guarulhos Int'l (GRU / SBGR)")
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", 'Melbourne Tullamarine (MEL / YMML)')
("Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)", 'Charles de Gaulle/Roissy (CDG / LFPG)')
("Ministro Pistarini Int'l (EZE / SAEZ)", 'Charles de Gaulle/Roissy (CDG / LFPG)')
("Jorge Chavez Int'l (LIM / SPJC)", 'Los Angeles Intl (KLAX)')
('Los Angeles Intl (KLAX)', "Narita Int'l (NRT / RJAA)")
('Los Angeles Intl (KLAX)', "Kansai Int'l (KIX / RJBB)")
('Los Angeles Intl (KLAX)', "Miami Intl (MIA)")
```

Betweenness Centrality



```
In [33]: 1 centrality=nx.betweenness_centrality(G)
        2 centrality
```

```
Out[33]: {'Amerigo Vespucci (Florence) (FLR / LIRQ)': 0.0,
'Amsterdam Schiphol (AMS / EHAM)': 0.0,
"Asmara Int'l (ASM / HHAS)": 0.0,
"Athens Int'l, Eleftherios Venizelos (ATH / LGAV)": 0.0017515193211787641,
'Auckland (AKL / NZAA)': 0.0,
'Austin-Bergstrom Intl (KAUS)': 0.0,
'Baltimore/Washington Intl (KBWI)': 0.0,
"Barajas Int'l (MAD / LEMD)": 0.01087442065254244,
"Barcelona Int'l (BCN / LEBL)": 0.0034168469797984753,
"Beijing Capital Int'l (PEK / ZBAA)": 0.25379995175565756,
"Belgrade Nikola Tesla Int'l (BEG / LYBE)": 0.0,
"Bengaluru Int'l (BLR / VOBL)": 0.014668752491249909,
'Bilbao (BIO / LEBB)': 0.0,
'Bologna (Guglielmo Marconi) (BLQ / LIPE)': 0.0,
'Borg El Arab (HBE / HEBA)': 0.0,
'Boston Logan Intl (KBOS)': 0.03514041094020452,
'Bremen (BRE / EDDW)': 0.0,
'Brussels (BRU / EBBR)': 0.0,
"Bucharest Henri Coandă Int'l (OTP / LROP)": 0.0,
'Budapest Ferenc Liszt International Airport (BUD / LHBP)': 0.008876221845031259,
"Cairo Int'l (CAI / HECA)": 0.16094707269005243,
"Calicut Int'l (Karipur) (CCJ / VOCL)": 0.0004069647604762482,
"Cerro Moreno Int'l (ANF / SCFA)": 0.0,
"Chacalluta Int'l (ARI / SCAR)": 0.0,
'Charles de Gaulle/Roissy (CDG / LFPG)': 0.4260613387436343,
'Charlotte/Douglas Intl (KCLT)': 0.0,
"Chatrapati Shivaji Int'l (BOM / VABB)": 0.04609349442804987,
"Chengdu Shuangliu Int'l (CTU / ZUUU)": 0.006422045160435256,
"Chennai Int'l (MAA / VOMM)": 0.0032300932068733894,
"Chicago O'Hare Intl (KORD)": 0.07764018508342552,
"Chongqing Jiangbei Int'l (CKG / ZUCK)": 0.0,
"Chubu Centrair Int'l (Centrair) (NGO / RJGG)": 0.0,
"Cochin Int'l (Kochi Int'l) (COK / VOIC)": 0.0005575622061690176,
'Cologne Bonn (CGN / EDDK)': 0.0,
"Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)": 0.10802728139578395,
'Copenhagen (CPH / EKCH)': 0.0,
'Dabolim (Goa) / Dabolim Navy Airbase (GOI / VOGO)': 0.007655849864312194,
'Dallas-Fort Worth Intl (KDFW)': 0.0957362655118074,
'Daniel K Inouye Intl (PHNL)': 0.0017249197291020102,
'Daraw (ASW / HESN)': 0.0,
```

'Detroit Metro Wayne Co (KDTW)': 0.009509612811986388,
"Diego Aracena Int'l (IQQ / SCDA)": 0.0,
"Diori Hamani Int'l (NIM / DRRN)": 0.0,
"Domodedovo Int'l (DME / UUDD)": 0.0,
"Dubai Int'l (DXB / OMDB)": 0.043916970843808044,
"Dublin Int'l (DUB / EIDW)": 0.0,
"Dusseldorf Int'l (DUS / EDDL)": 0.0,
"El Dorado Int'l (BOG / SKBO)": 0.0,
"El Loa (CJC / SCCF)": 0.0,
"Frankfurt Int'l (FRA / EDDF)": 0.17598721987300833,
"Geneva Cointrin Int'l (GVA / LSGG)": 0.00370785554405401,
"Governor Francisco Gabrielli Int'l (El Plumerillo Int'l) (MDZ / SAME)": 0.0,
"Grantley Adams Int'l (BGI / TBPB)": 0.0,
"Guangzhou Baiyun Int'l (CAN / ZGGG)": 0.01673003390251231,
"Hamad Int'l (DOH / OTHH)": 0.004842170786443232,
"Hamburg (HAM / EDDH)": 0.0,
"Hanover/Langenhagen Int'l (HAJ / EDDV)": 0.0,
"Helsinki-Vantaa (HEL / EFHK)": 0.00432709108534702,
"Hong Kong Int'l (HKG / VHHH)": 0.0,
"Houari Boumedienne (ALG / DAAG)": 0.0,
"Hurghada (HRG / HEGN)": 0.0,
"Incheon Int'l (ICN / RKSI)": 0.0,
"Indianapolis Intl (KIND)": 0.0,
"Indira Gandhi Int'l (DEL / VIDP)": 0.0994521502784226,
"Ingeniero Ambrosio L.V. Taravella Int'l (COR / SACO)": 0.0,
"Istanbul Ataturk Int'l (IST / LTBA)": 0.0,
"Jaipur (Sanganer) (JAI / VIJP)": 0.0003368306386882238,
"Jakarta-Soekarno-Hatta Int'l (CGK / WIII)": 0.0,
"Jinnah Int'l (KHI / OPKC)": 0.0,
"John F Kennedy Intl (KJFK)": 0.043169015088316026,
"John Glenn Columbus Intl Airport (KCMH)": 0.0,
"John Wayne (KSNA)": 0.0,
"Jomo Kenyatta Int'l (NBO / HKJK)": 0.0,
"Jorge Chavez Int'l (LIM / SPJC)": 0.004699862401100792,
"Jorge Newbery (AEP / SABE)": 0.0,
"Jose Maria Cordova Int'l (MDE / SKRG)": 0.0,
"Kansai Int'l (KIX / RJBB)": 0.0018138346956716395,
"King Abdulaziz Int'l (JED / OEJN)": 0.0,
"King Fahd Int'l (DMM / OEDF)": 0.0,
"King Khalid Int'l (RUH / OERK)": 0.0,
"Krakow Int'l (KRK / EPKK)": 0.0017515193211787641,
"Kuala Lumpur Int'l (KUL / WMKK)": 0.0,
"LaGuardia (KLGA)": 0.0,

'Leipzig/Halle (LEJ / EDDP)': 0.0,
"Leonardo da Vinci Int'l (Fiumicino Int'l) (FCO / LIRF)": 0.0034168469797984753,
"Lic. Benito Juarez Int'l (MEX / MMMX)": 0.0,
"Lisbon / Lisboa,Portela (Lisbon) (LIS / LPPT)': 0.005168366300977242,
'Lome (LFW / DXXX)': 0.0,
'London Heathrow (LHR / EGLL)': 0.014965740389400161,
'Los Angeles Intl (KLAX)': 0.04767130340123385,
"Los Cabos Int'l (SJD / MMSD)": 0.0006535947712418299,
'Luis Munoz Marin Intl (SJU / TJSJ)': 0.0,
"Luxor Int'l (LXR / HELX)": 0.0,
'Lyon (LYS / LFLI)': 0.0,
"Malpensa Int'l (MXP / LIMC)": 0.0,
"Marco Polo Int'l (Marco Polo Venice) (VCE / LIPZ)": 0.0,
'Marseille Provence (MRS / LFML)': 0.0,
'McCarran Intl (KLAS)': 0.0,
'Melbourne Tullamarine (MEL / YMLL)': 0.00816750639377058,
'Miami Intl (KMIA)': 0.0874238477953648,
"Ministro Pistarini Int'l (EZE / SAEZ)": 0.0,
'Montreal-Trudeau (CYUL)': 0.0,
"Munich Int'l (MUC / EDDM)": 0.1255905537174209,
"Munster Osnabruck Int'l (FMO / EDDG)": 0.0,
"Naples Int'l (Capodichino) (NAP / LIRN)": 0.0,
"Narita Int'l (NRT / RJAA)": 0.18768695843270816,
"Netaji Subhash Chandra Bose Int'l (CCU / VECC)": 0.0,
'Newark Liberty Intl (KEWR)': 0.0,
"Nice Cote d'Azur (NCE / LFMN)": 0.0,
"Noi Bai Int'l (HAN / VVNB)": 0.0,
'Norfolk Intl (KORF)': 0.0,
"OR Tambo Int'l (JNB / FAOR)": 0.0,
'Orlando Intl (KMCO)': 0.0,
'Oslo, Gardermoen (OSL / ENGM)': 0.0,
'Phoenix Sky Harbor Intl (KPHX)': 0.0,
"Phuket Int'l (HKT / VTSP)": 0.0,
'Porto / Oporto (OPO / LPPR)': 0.0,
'Prince Nayef bin Abdulaziz Regional Airport (ELQ / OEGS)': 0.0,
'Pune / Lohegaon Air Force Base (PNQ / VAPQ)': 0.004412378986682393,
"Queen Beatrix Int'l (AUA / TNCA)": 0.0,
'Reagan National (KDCA)': 0.0,
'Sacramento Intl (KSMF)': 0.0,
'Sale (RBA / GMME)': 0.0,
'San Diego Intl (KSAN)': 0.0,
'San Francisco Intl (KSFO)': 0.0003567016918410107,
"San Jose Int'l (KSJC)": 0.0006535947712418299,

"Sardar Vallabhbhai Patel Int'l (Ahmadabad) (AMD / VAAH)": 0.0001719986240110079,
"Seeb Int'l (MCT / OOMS)": 0.0021256163284027055,
"Shanghai Pudong Int'l (PVG / ZSPD)": 0.015130584085285066,
'Sharm El Sheikh (SSH / HESH)': 0.0,
"Shenzhen Bao'an Int'l (SZX / ZGSZ)": 0.0,
"Sheremetyevo Int'l (SVO / UUEE)": 0.0,
'Singapore Changi (SIN / WSSS)': 0.001087891296869624,
'Stockholm-Arlanda (ARN / ESSA)': 0.00370785554405401,
"Suvarnabhumi Bangkok Int'l (BKK / VTBS)": 0.04023684496703343,
'Sydney (SYD / YSSY)': 0.0006980277491113403,
"São Paulo-Guarulhos Int'l (GRU / SBGR)": 0.0012828230707487675,
'Tampa Intl (KTPA)': 0.0006535947712418299,
"Tan Son Nhat Int'l (SGN / VVTS)": 0.0,
"Tegel Int'l (TXL / EDDT)": 0.0017515193211787641,
"Thiruvananthapuram Int'l (TRV / VOTV)": 0.0,
"Tianjin Binhai Int'l (TSN / ZBTJ)": 0.0,
"Tokyo Int'l (Haneda) (HND / RJTT)": 0.015379416430758007,
"Toronto Pearson Int'l (CYYZ)": 0.0,
'Tucson Intl (KTUS)': 0.0,
'Valencia (VLC / LEVC)': 0.0,
"Vancouver Int'l (CYVR)": 0.02217695937618809,
"Vienna Int'l (Schwechat) (VIE / LOWW)": 0.0,
'Václav Havel Airport (PRG / LKPR)': 0.0,
'Warsaw Frederic Chopin (WAW / EPWA)': 0.0,
'Washington Dulles Intl (KIAD)': 0.0,
'Wuhan Tianhe (WUH / ZHHH)': 0.0,
"Yangon Int'l (RGN / VYYY)": 0.0,
'Zurich (Kloten) (ZRH / LSZH)': 0.0}

```
In [34]: 1 for key, item in centrality.items():
2         airports.loc[airports.label==key, 'size'] = (item*100)+10
3 airports.head(20)
```

```
Out[34]:
```

	label	lat	lon	size
0	Cerro Moreno Int'l (ANF / SCFA)	-23.448694	-70.440935	10.000000
1	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
2	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
3	Cerro Moreno Int'l (ANF / SCFA)	-23.448694	-70.440935	10.000000
4	El Loa (CJC / SCCF)	-22.498961	-68.906966	10.000000
5	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
6	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
7	El Loa (CJC / SCCF)	-22.498961	-68.906966	10.000000
8	Diego Aracena Int'l (IQQ / SCDA)	-20.536408	-70.180518	10.000000
9	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
10	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
11	Diego Aracena Int'l (IQQ / SCDA)	-20.536408	-70.180518	10.000000
12	Governor Francisco Gabrielli Int'l (El Plumeri...	-32.827864	-68.798490	10.000000
13	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
14	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
15	Ministro Pistarini Int'l (EZE / SAEZ)	-34.815004	-58.534828	10.000000
16	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
17	Jorge Newbery (AEP / SABE)	-34.558031	-58.417009	10.000000
18	Comodoro Arturo Merino Benitez Int'l (SCL / SCEL)	-33.391189	-70.797235	20.802728
19	El Dorado Int'l (BOG / SKBO)	4.701413	-74.144497	10.000000

<https://plot.ly/> (<https://plot.ly/>)

```

In [28]: 1 import plotly.plotly as py
          2
          3 airport_markers = [ dict(
          4     type = 'scattergeo',
          5     lon = airports['lon'],
          6     lat = airports['lat'],
          7     hoverinfo = 'label',
          8     text = airports['label'],
          9     mode = 'markers',
         10     marker = dict(
         11         size=airports['size'],
         12         color='red',
         13     ) )]
         14
         15 layout = dict(
         16     title = 'Great lines over globe<br>(Click and drag to rotate)',
         17     showlegend = False,
         18     width = 800,
         19     height = 800,
         20     geo = dict(
         21         showland = True,
         22         showcountries = True,
         23         showocean = True,
         24         countrywidth = 0.5,
         25         landcolor = '#fff',
         26         oceancolor = '#eee',
         27         projection = dict(
         28             type = 'orthographic',
         29             rotation = dict(
         30                 lon = -100,
         31                 lat = 40,
         32                 roll = 0
         33             )
         34         ),
         35
         36     )
         37 )
         38
         39 fig = dict( data=great_lines+airport_markers, layout=layout )
         40 py.iplot( fig, validate=False, filename='d3-globe' )

```

Out[28]:

