

# Package ‘skynet’

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**Type** Package

**Version** 1.4.0

**Title** Generates Networks from BTS Data

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**URL** <https://github.com/ropensci/skynet>

**Description** A flexible tool that allows generating bespoke air transport statistics for urban studies based on publicly available data from the Bureau of Transport Statistics (BTS) in the United States <[https://www.transtats.bts.gov/databases.asp?Mode\\_ID=1&Mode\\_Desc=Aviation&Subject\\_ID2=0](https://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0)>.

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**BugReports** <https://github.com/ropensci/skynet/issues>

**Encoding** UTF-8

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**Collate** 'PowerLaw.R' 'createNodes.R' 'data\_ODsample.R' 'data\_airports.R' 'data\_carriers.R' 'data\_metro.R' 'disparityfilter.R' 'findAirport.R' 'fromto.R' 'netImport.R' 'netDir.R' 'netUnd.R' 'netInt.R' 'netPath.R' 'make\_net\_trip.R' 'skynet.R' 'nodeStats.R' 'import\_t100.R' 'import\_db1b.R' 'import\_ontime.R' 'findCarrier.R' 'plotMap.R' 'skynet\_example.R' 'bootnet.R' 'summary.R' 'download\_db1b.R' 'download\_t100.R' 'download\_t100\_int.R' 'download\_ontime.R'

**Depends** R (>= 3.1.2)

**Imports** data.table, igraph, dplyr, ggplot2, ggrepel, stringr, maps, httr, geosphere, leaflet

**Suggests** knitr, rmarkdown, testthat, kableExtra, covr

**VignetteBuilder** knitr

**NeedsCompilation** no

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aircraft_type	<i>Aircraft type data</i>
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**Description**

This data comes from the RITA/Transtats database

**Format**

A dataframe with 422 observations and 2 variables

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airportCode	<i>Airport Data - clean</i>
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**Description**

USA airport data from the RITA/Transtats database

**Format**

A dataframe with 6435 observations and 5 variables

---

airportCodeFull	<i>Airport Data - full</i>
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---

**Description**

USA airport data from the RITA/Transtats database

**Format**

A dataframe with 6435 observations and 9 variables

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airportMaster	<i>Airport Data - master</i>
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---

**Description**

World airport data from the RITA/Transtats database

**Format**

A dataframe with 13555 observations and 28 variables

---

boot_network	<i>Network bootstrapping</i>
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**Description**

Bootstraps a network and returns output containing three network statistics: Average Path Length, Transitivity, Mean Betweenness.

**Usage**

```
boot_network(g, n = 500, left_ci = 0.005, right_ci = 0.995)
```

**Arguments**

g	iGraph graph or skynet object.
n	Number of bootstraps to run. (500 default)
left_ci	Confidence interval left limit. (0.005 default)
right_ci	Confidence interval left limit (0.995 default)

**Examples**

```
## Not run:  
boot_net(g, n = 500)  
  
## End(Not run)
```

---

carriers	<i>Carrier data</i>
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---

**Description**

This data comes from the RITA/Transtats database

**Format**

A dataframe with 1738 observations and 2 variables

---

createNodes	<i>Create Nodes</i>
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**Description**

Creates nodes for SKYNET's functions. Despite being possible to use it individually, it's mainly meant to be used as a complimentary function.

**Usage**

```
createNodes(y)
```

**Arguments**

y	Data Frame
---	------------

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disparity_filter	<i>Disparity Filter</i>
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---

**Description**

Uses the Serrano's disparity filter ([https://en.wikipedia.org/wiki/Disparity\\_filter\\_algorithm\\_of\\_weighted\\_network](https://en.wikipedia.org/wiki/Disparity_filter_algorithm_of_weighted_network)) to extract the backbone of the network in "Extracting the multiscale backbone of complex weighted networks"

**Usage**

```
disparity_filter(g, alpha = 0.003)
```

**Arguments**

g	igraph object
alpha	Alpha value. Default 0.003

**Examples**

```
## Not run:  
netDir <- make.netDir(OD_Sample)  
disparity_filter(netDir$gDir, alpha = 0.003)  
  
## End(Not run)
```

---

download_db1b	<i>Download Data from DB1B files</i>
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---

**Description**

Downloads data from BTS/RITA/Transtats and imports it into R

**Usage**

```
download_db1b(y = NULL, q = NULL)
```

**Arguments**

y	year to be imported
q	quarter to be imported

**Details**

Coupon files are downloaded from [https://www.transtats.bts.gov/DL\\_SelectFields.asp?Table\\_ID=289](https://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=289). Ticket files are downloaded from [https://www.transtats.bts.gov/DL\\_SelectFields.asp?Table\\_ID=272](https://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=272).

Note: The BTS often changes the way we can access these files. So please be warned that this is still an experimental feature.

**Examples**

```
## Not run:

download_db1b(2010, 1)

## End(Not run)
```

---

download_ontime	<i>Download On-Time</i>
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---

**Description**

Download On-Time Performance Data directly from BTS/RITA/Transtats website raw data (prezipped file), for SKYNET's import function.

**Usage**

```
download_ontime(y, m, auto = TRUE)
```

**Arguments**

y	year to be imported
m	month to be imported
auto	Automatically assigns object

**Examples**

```
## Not run:  
  
import_ontime(skynet_example("Ontime.csv"))  
  
## End(Not run)
```

---

download_t100	<i>Download Data from T100 files</i>
---------------	--------------------------------------

---

**Description**

Downloads data from BTS/RITA/Transtats and imports it into R

**Usage**

```
download_t100(y = NULL, type = NULL)
```

**Arguments**

y	year to be imported
type	"mkt" for Market, "seg" for Segment databases respectively

**Details**

Note: The BTS often changes the way we can access these files. So please be warned that this is still an experimental feature.

**Examples**

```
## Not run:  
  
download_t100(2010, "mkt")  
  
## End(Not run)
```

---

download\_t100\_int      *Download Data from T100 international files*

---

**Description**

Downloads data from BTS/RITA/Transtats and imports it into R

**Usage**

```
download_t100_int(y = NULL, type = NULL)
```

**Arguments**

y                      year to be imported  
type                    "mkt" for Market, "seg" for Segment databases respectively

**Details**

Note: The BTS often changes the way we can access these files. So please be warned that this is still an experimental feature.

**Examples**

```
## Not run:  
  
download_t100_int(2010, "mkt")  
  
## End(Not run)
```

---

find\_airport              *Find Airport function*

---

**Description**

Searches for airport information based on its IATA code or city name It will display multiple airports as it works with partial names.

**Usage**

```
find_airport(x)
```

**Arguments**

x                      airport IATA code or city name



**Examples**

```
## Not run:
find_airport("Atlanta")

find_airport("ATL")

## End(Not run)
```

---

find_carrier	<i>Find Carrier function</i>
--------------	------------------------------

---

**Description**

Searches for airport information based on its IATA code or city name

**Usage**

```
find_carrier(x)
```

**Arguments**

x	Carrier
---	---------

**Examples**

```
## Not run:
find_carrier("United")

find_carrier("UA")

## End(Not run)
```

---

fit_power	<i>Power Law</i>
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---

**Description**

Plots power law fit

**Usage**

```
fit_power(graph)
```

**Arguments**

graph	iGraph object
-------	---------------

**Examples**

```
## Not run:
netDir <- make.netDir(OD_Sample)
fit_power(netDir$gDir)

## End(Not run)
```

---

from_to_stats	<i>From To function</i>
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---

**Description**

Calculate edges weight from IATA Code

**Usage**

```
from_to_stats(x, y, orig)
```

**Arguments**

x	igraph object to query
y	origin airport IATA code
orig	"from" or "to" options

**Examples**

```
## Not run:
netDir <- make.netDir(OD_Sample)
from_to_stats(netDir$gDir, "JFK", orig = "from")

from_to_stats(netDir$gDir, "JFK", orig = "to")

## End(Not run)
```

---

import_db1b	<i>Import Data from DB1B files</i>
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---

**Description**

Imports data from BTS/RITA/Transtats files

**Usage**

```
import_db1b(c, t, zip = FALSE, auto = TRUE)
```

**Arguments**

c	Coupon csv file to be imported, in case of DB1B database
t	Ticket csv file to be imported, in case of DB1B database
zip	Should equal TRUE if original file comes from the BTS prezzipped option.
auto	Automatically assigns object

**Details**

Coupon files can be found at [https://www.transtats.bts.gov/DL\\_SelectFields.asp?Table\\_ID=289](https://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=289). Ticket files can be found at [https://www.transtats.bts.gov/DL\\_SelectFields.asp?Table\\_ID=272](https://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=272). Both files should belong to the same year and same quarter. **Note:** We do recommend sparklyr to be used for larger sets of data. More information on variables to select and type of files to use can be found [here](#)

**Examples**

```
## Not run:

import_db1b(skynet_example("Coupon_2001Q1.csv"), skynet_example("Ticket_2001Q1.csv"))

## End(Not run)
```

---

import_ontime	<i>Import on-time Data</i>
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---

**Description**

Imports on-time Data directly from BTS/RITA/Transtats website raw data (prezzipped file), for SKYNET's import function.

**Usage**

```
import_ontime(x, auto = TRUE)
```

**Arguments**

x	On-time csv (from zipped file)
auto	Automatically assigns object

**Details**

Files can be found here [https://www.transtats.bts.gov/DL\\_SelectFields.asp?Table\\_ID=236](https://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=236). More information on variables to select and type of files to use can be found [here](#)

**Examples**

```
## Not run:  
  
import_ontime(skynet_example("Ontime_2011_1.csv"))  
  
## End(Not run)
```

---

import_t100	<i>Import T-100 Data</i>
-------------	--------------------------

---

**Description**

Imports T-100 Data directly from BTS/RITA/Transtats website raw data (prezipped file), for SKYNET's import function.

**Usage**

```
import_t100(x, nonsch = FALSE, auto = TRUE)
```

**Arguments**

x	T-100 csv
nonsch	Should equal TRUE to include non-scheduled flights
auto	Automatically assigns object

**Details**

Files can be found here [https://www.transtats.bts.gov/Tables.asp?DB\\_ID=111](https://www.transtats.bts.gov/Tables.asp?DB_ID=111). More information on variables to select and type of files to use can be found [here](#)

**Examples**

```
## Not run:  
  
import_t100(skynet_example("T100_2011_mkt.csv"))  
  
## End(Not run)
```

---

make.netInt	<i>International Data</i>
-------------	---------------------------

---

### Description

Imports International data to complement to the DB1B data set. NOTE: When using this function, certain variables will be skewed as the T100 dataset does not contain all the data the DB1B dataset contains.

### Usage

```
make.netInt(x = NULL, m = NULL, Q = NULL)
```

### Arguments

x	T-100 International Segment csv file
m	Data set to merge with
Q	Desired T-100 Quarter. Should be equal to 1, 2, 3 or 4.

### Examples

```
## Not run:  
  
make.netInt(skynet_example("T100_2011_int.csv"), OD_Sample, 1)  
  
## End(Not run)
```

---

make_net_dir	<i>Directed network</i>
--------------	-------------------------

---

### Description

Generates Directed Network with an iGraph **gDir** object, a Data Frame **netDir** and a Data Frame with Airport/Nodes statistics **nodes**.

### Usage

```
make_net_dir(  
  x,  
  disp = FALSE,  
  alpha = 0.003,  
  cap = FALSE,  
  pct = 10,  
  carrier = FALSE,  
  metro = FALSE  
)
```

**Arguments**

x	Data frame
disp	Uses the Serrano's disparity filter ( <a href="https://en.wikipedia.org/wiki/Disparity_filter_algorithm_of_weighted_network">https://en.wikipedia.org/wiki/Disparity_filter_algorithm_of_weighted_network</a> ) to extract the backbone of the network.
alpha	Argument for disparity filter.
cap	Filters original data based on the edge weight.
pct	Argument for cap filter. Value should be input as percentage.
carrier	Groups data per carrier and OD
metro	Groups data by metropolitan area

**Examples**

```
## Not run:
make_net_dir(OD_Sample)

# Apply Disparity Filter
make_net_dir(OD_Sample, disp = TRUE, alpha = 0.05)

# Apply Percentage Cap
make_net_dir(OD_Sample, cap = TRUE, pct = 20)

## End(Not run)
```

---

make_net_path	<i>Path and OD Network</i>
---------------	----------------------------

---

**Description**

Generates an OD network and a Leg Count data frame(on demand)

**Usage**

```
make_net_path(x, leg = FALSE, zero = FALSE, carrier = FALSE)
```

**Arguments**

x	Data frame
leg	Generates Leg Count Data frame, based on Path taken.
zero	Displays percentage of 0 used tickets
carrier	Groups data per airline For example, all passengers doing the BOS-ATL-LAX path, are summed by Air Carrier.

**Examples**

```
## Not run:
make_net_path(OD_Sample)

# Generate Leg Count
make_net_path(OD_Sample, leg = TRUE)

## End(Not run)
```

---

make_net_trip	<i>Trip directed network</i>
---------------	------------------------------

---

**Description**

Generates Trip/Route based Directed Network with an iGraph **gDir** object, a Data Frame **netDir** and a Data Frame with Airport/Nodes statistics **nodes**. Returns type of trip: OD = Origin/Destination pair, OT = Origin/Transfer pair, TT = Transfer/Transfer pair, TD = Transfer/Destination pair

**Usage**

```
make_net_trip(x, carrier = FALSE)
```

**Arguments**

x	Data frame
carrier	Groups data per carrier and OD

**Examples**

```
## Not run:
make_net_trip(OD_Sample)

## End(Not run)
```

---

make_net_und	<i>Undirected Network</i>
--------------	---------------------------

---

**Description**

Generates Undirected Network with an iGraph **gUnd** object, a Data Frame **netUnd** and a Data Frame with Airport/Nodes statistics **nodes**.

**Usage**

```
make_net_und(
  x,
  disp = FALSE,
  alpha = 0.003,
  cap = FALSE,
  pct = 10,
  merge = TRUE,
  carrier = FALSE,
  metro = FALSE
)
```

**Arguments**

x	Data frame
disp	Uses the Serrano's disparity filter ( <a href="https://en.wikipedia.org/wiki/Disparity_filter_algorithm_of_weighted_network">https://en.wikipedia.org/wiki/Disparity_filter_algorithm_of_weighted_network</a> ) to extract the backbone of the network.
alpha	Argument for disparity filter.
cap	Filters original data based on the edge weight.
pct	Argument for cap filter. Value should be input as percentage.
merge	When set to FALSE, it keeps parallel edges instead of collapsing them and summing their weights.
carrier	Groups data per carrier and OD
metro	Groups data by metropolitan area

**Examples**

```
## Not run:
make_net_und(OD_Sample)

# Apply Disparity Filter
make_net_und(OD_Sample, disp = TRUE, alpha = 0.05)

# Apply Percentage Cap
make_net_und(OD_Sample, cap = TRUE, pct = 20)

## End(Not run)
```

---

 MetroFull

*Metro (Full) Data*


---

**Description**

This data comes from the RITA/Transtats database



**Format**

A dataframe with 5802 observations and 5 variables

---

MetroLookup

*Metro Data*

---

**Description**

This data comes from the RITA/Transtats database

**Format**

A dataframe with 5802 observations and 2 variables

---

netImport

*Import Data*

---

**Description**

Imports data from BTS/RITA/Transtats website File order doesn't matter, but it is recommended to name the files using the following syntax: "*Coupon YearQuarter.csv*", "*Ticket YearQuarter.csv*", "*T100 Year*". Note: We do recommend sparklyr to be used for larger sets of data.

**Usage**

```
netImport(x = NULL, y = NULL)
```

**Arguments**

x                    First csv file to be imported, in case of DB1B database, or in case of using the T-100 database, the only file to be included.

y                    Second csv file to be imported.

**Examples**

```
## Not run:  
  
netImport(skynet_example("Coupon_2001Q1.csv"), skynet_example("Ticket_2001Q1.csv"))  
  
## End(Not run)
```

---

net_map	<i>Plot Skynet</i>
---------	--------------------

---

**Description**

Creates OD ggplot2 generated maps from make.net functions Shows sample of 60

**Usage**

```
net_map(x, pct = 60)
```

**Arguments**

x	Skynet Object (generated by make_net_dir,make_net_und or make_net_path)
pct	percentage of edges to include

**Examples**

```
## Not run:  
network <- make.netDir(OD_Sample)  
net_map(network, pct = 10)  
  
## End(Not run)
```

---

nodeStatsMetro	<i>Create Metro Nodes</i>
----------------	---------------------------

---

**Description**

Create Metro Nodes

**Usage**

```
nodeStatsMetro(y)
```

**Arguments**

y	Data Frame
---	------------

**Examples**

```
## Not run:  
  
nodeStatsMetro(OD_Sample)  
  
## End(Not run)
```

---

node_stats	<i>Get node info</i>
------------	----------------------

---

**Description**

Creates node statistics Generates Number of Passenger Arrivals, Departures and Transfers

**Usage**

```
node_stats(x)
```

**Arguments**

x                    Data Frame to extract information from

**Examples**

```
## Not run:  
node_stats(OD_Sample)  
  
## End(Not run)
```

---

OD_Sample	<i>Sample OD data</i>
-----------	-----------------------

---

**Description**

Sample data to use with SKYNET functions

**Format**

A dataframe with 500.000 observations and 19 variables

skynet\_example      *Get path to skynet examples*

---

**Description**

To access csv examples from SKYNET

**Usage**

```
skynet_example(path = NULL)
```

**Arguments**

path                  File name.

**Examples**

```
## Not run:  
skynet_example()  
skynet_example("Coupon 2001Q1.csv")  
  
## End(Not run)
```

---

summary.skynet      *Displays a summary of a skynet object*

---

**Description**

Displays a summary of a skynet object

**Usage**

```
## S3 method for class 'skynet'  
summary(object, ...)
```

**Arguments**

object                skynet object to summarise  
...                    other arguments ignored (for compatibility with generic)

**Examples**

```
net <- make_net_dir(OD_Sample)  
summary(net)
```

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