

# Package ‘statnet’

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**Title** Software tools for the Statistical Modeling of Network Data

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**Depends** R (>= 2.11), network (>= 1.6), ergm (>= 2.3), latentnet (>= 2.4), degreeonet (>= 1.1), sna (>= 2.2), abind, shapes, tools,utils

**Suggests** relevent, networksis, hergm

**Description** An integrated set of tools for the representation, visualization, analysis and simulation of network data. For an introduction type: help(package='statnet')

**License** GPL-3 + file LICENSE

**URL** <http://statnet.org>

**Repository** CRAN

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## Description

**statnet** is a suite of software packages for statistical network analysis. The packages implement recent advances in network modeling based on exponential-family random graph models (ERGM). The components of the package provide a comprehensive framework for ERGM-based network modeling: tools for model estimation, for model evaluation, for model-based network simulation, and for network visualization. This broad functionality is powered by a central Markov chain Monte Carlo (MCMC) algorithm. The coding is optimized for speed and robustness.

## Details

Recent advances in the statistical modeling of random networks have had an impact on the empirical study of social networks. Statistical exponential family models (Strauss and Ikeda 1990) are a generalization of the Markov random network models introduced by Frank and Strauss (1986), which in turn derived from developments in spatial statistics (Besag, 1974). These models recognize the complex dependencies within relational data structures. To date, the use of stochastic network models for networks has been limited by three interrelated factors: the complexity of realistic models, the lack of simulation tools for inference and validation, and a poor understanding of the inferential properties of nontrivial models.

This manual introduces software tools for the representation, visualization, and analysis of network data that address each of these previous shortcomings. The package relies on the `network` package which allows networks to be represented in R. The `ergm` package allows maximum likelihood estimates of exponential random network models to be calculated using Markov Chain Monte Carlo. The package also provides tools for plotting networks, simulating networks and assessing model goodness-of-fit.

For other detailed information on how to download and install the software, go to the `ergm` website: <http://statnet.org>. A tutorial, support newsgroup, references and links to further resources are provided there.

## Overview of statnet components

**statnet** is written in a combination of R and (ANSI standard) C. It is usually used interactively from within the R graphical user interface via a command line. It can also be used in non-interactive (or “batch”) mode to allow longer or multiple tasks to be processed without user interaction. The suite of packages are available on the Comprehensive R Archive Network (CRAN) at <http://www.r-project.org/> and also on the **statnet** project website at <http://statnet.org/>

The **statnet** suite of packages includes two required interdependent components and several optional components that provide additional functionality. Currently, there are four optional components available on CRAN, and another that is available from the author.

Required component packages: **ergm** and **network**

- **ergm** is a collection of functions to fit, simulate from, plot and evaluate exponential random graph models. The main functions within the **ergm** package are `ergm`, a function to fit linear

exponential random graph models in which the probability of a graph is dependent upon a vector of graph statistics specified by the user; `simulate`, a function to simulate random graphs using an ERGM; and `gof`, a function to evaluate the goodness of fit of an ERGM to the data. `ergm` contains many other functions as well.

- **network** is a package to create, store, modify and plot the data in network objects. The `network` object class, defined in the `network` package, can represent a range of relational data types and it supports arbitrary vertex / edge /graph attributes. Data stored as `network` objects can then be analyzed using all of the component packages in the `statnet` suite.

Optional components, available on CRAN: `sna`, `degreenet`, `latentnet`, `netperm`, `degreenet` and `networksis`

- **sna**: A set of tools for traditional social network analysis.
- **degreenet**: A package for the statistical modeling of degree distributions of networks. It includes power-law models such as the Yule and Waring, as well as a range of alternative models that have been proposed in the literature.
- **latentnet**: A package to fit and evaluate latent position and cluster models for statistical networks. The probability of a tie is expressed as a function of distances between these nodes in a latent space as well as functions of observed dyadic level covariates.
- **netperm**: A package for permutation Models for relational data. It provides simulation and inference tools for exponential families of permutation models on relational structures.
- **degreenet**: A package to fit, simulate and diagnose models for skewed count distributions relevant to networks. It was developed for the degree distributions of networks. It implements likelihood-based inference, bootstrapping, model selection, etc.
- **networksis**: A package to simulate bipartite graphs with fixed marginals through sequential importance sampling

Available on request: `dynamicnetwork` and `rSonia`

- **dynamicnetwork**: A set of tools for visualizing dynamically changing networks.
- **rSonia**: provides a set of methods to facilitate exporting data and parameter settings and launching SoNIA (Social Network Image Animator). SoNIA facilitates interactive browsing of dynamic network data and exporting animations as a QuickTime movies.

The entire `statnet` can be installed and/or updated while in R using the `update.statnet` command. This gives the users options to install the component packages.

Each of these components is described in detail in the references below. Loading this base `statnet` package into R automatically loads the `network` and `ergm` packages. The optional packages can be loaded while in `statnet` using the `library` command. Each package has associated help files and internal documentation that is supported by the information on the website (<http://statnet.org/>).

When publishing results obtained using this package the original authors are to be cited as:

Mark S. Handcock, David R. Hunter, Carter T. Butts, Steven M. Goodreau, and Martina Morris.  
2003 *statnet: Software tools for the Statistical Modeling of Network Data*  
<http://statnet.org>.

We have invested a lot of time and effort in creating the `statnet` suite of packages for use by other researchers. please cite it in all papers where it is used.

For complete citation information, use  
`citation(package="statnet")`.

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update\_statnet

*Updates or Installs the Component Packages of statnet*

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## Description

Updates or, if necessary, installs the component packages of **statnet**. Many of the packages are on CRAN. The rest are on the **statnet** webpage (<http://statnet.org>). This command can be used immediately after installing **statnet** from CRAN to install the component packages. It also can be used at any subsequent point to update the packages to their latest versions. Consult the webpage for more information.

## Usage

```
update_statnet(object, ...,
               contriburl = "http://statnet.org",
               repos = getOption("repos"), type = getOption("pkgType"),
               ask=TRUE)
```

## Arguments

object	an optional vector of the names of the packages to install. By default it updates or installs all the component packages of <b>statnet</b> .
...	Additional arguments (currently none).
contriburl	URL of the contrib section of the repositories. By default this is the URL of the <b>statnet</b> webpage ( <a href="http://statnet.org">http://statnet.org</a> ). Overrides argument repos. Can be NULL to install from local '.tar.gz' files.
repos	character vector, the base URL(s) of the repositories to use, i.e., the URL of the CRAN master such as "http://cran.r-project.org" or its Statlib mirror, "http://lib.stat.cmu.edu/R/CRAN". Can be NULL to install from local '.tar.gz' files.
type	character, indicating the type of <b>statnet</b> package to download and install. Possible values are "base" (for packages essential to <b>statnet</b> ), "recommended" (for packages needed for a significant part of <b>statnet</b> functionality) and "optional" (for packages with specialized <b>statnet</b> functionality).
ask	logical indicating whether to ask user which packages in <b>statnet</b> to update or install. The default is ask = TRUE. If ask = FALSE then all packages are updated and/or installed.

## Details

While this function has a number of options, few users will change the defaults and they are not intended to be altered except in rare circumstances.

The main function is to install a functional set of **statnet** packages. First a list of all packages found in the default library (the first directory in `.libPaths()`)

is created and compared with those available at the **statnet** repositories (CRAN and <http://statnet.org>). If ask = TRUE (the default for "recommended" and "optional", but not for "base") packages with a newer version are reported and for each one the user can specify if it should be updated.

## Value

`update_statnet` has no return value.

## Warning

This function may fail in rare circumstances. If so, send email to the **statnet** Users Group at [statnet\\_help@u.washington.edu](mailto:statnet_help@u.washington.edu). See the link on <http://statnet.org> for how to join it.

## See Also

[install.packages](#).

## Examples

```
## Not run:
update_statnet()

## End(Not run)
```

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