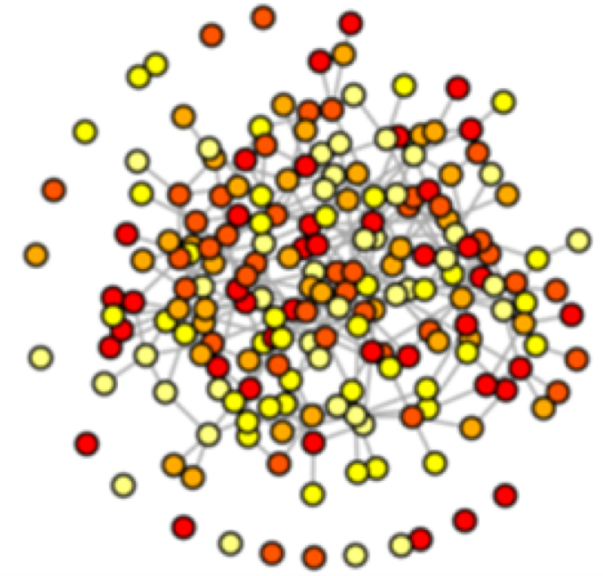# Networks in R

Kelsey Andersen, Robin Choudhury, & James Fulton
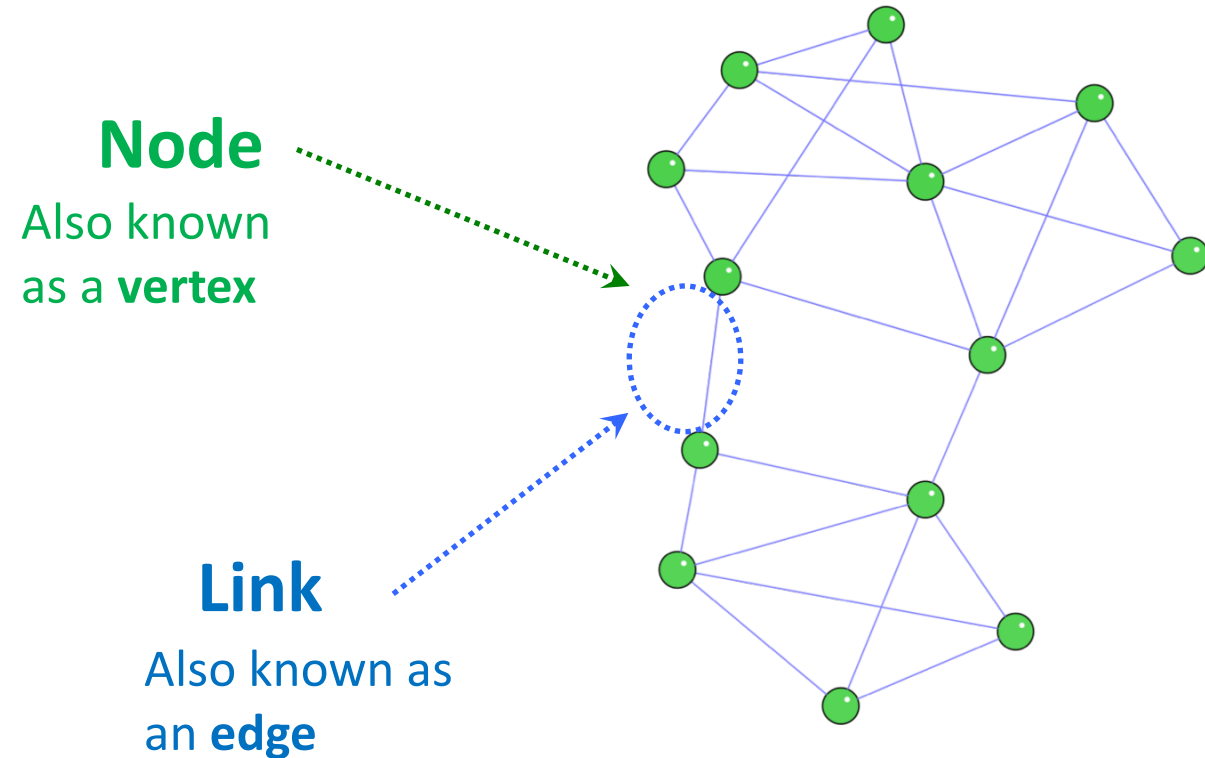
garrettlab.com

What is a network? Some key terms

- **Nodes**
- **Edges**

- **Dyads** – two nodes

- **Triads** – three nodes

Node
Also known
as a **vertex**

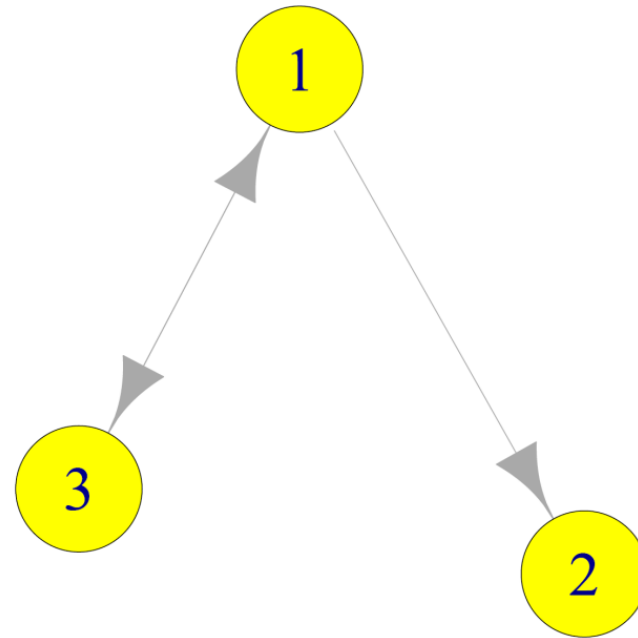**Link**
Also known as
an **edge**

A network is basically an adjacency matrix

- An adjacency matrix is a square matrix that describes a network, where each element of the matrix indicates whether a link exists between two nodes (and potentially also includes information about the weight associated with that link)
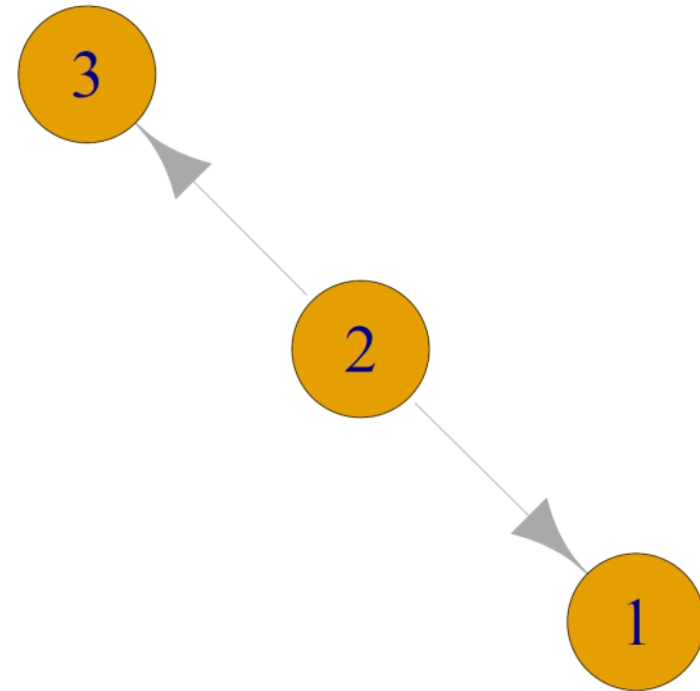
To

$$\begin{array}{ccc} N1 & N2 & N3 \end{array}$$

From

$$\begin{array}{c} \text{Node1} \\ \text{Node2} \\ \text{Node3} \end{array} \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

=

1

3

2

Can you draw what this network would look like?

To

N1 N2 N3

From

	N1	N2	N3
N1	0	0	0
N2	1	0	1
N3	0	0	0

How about this adjacency matrix?

To

N1 N2 N3

From

$$\begin{array}{c} \text{N1} \\ \text{N2} \\ \text{N3} \end{array} \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$
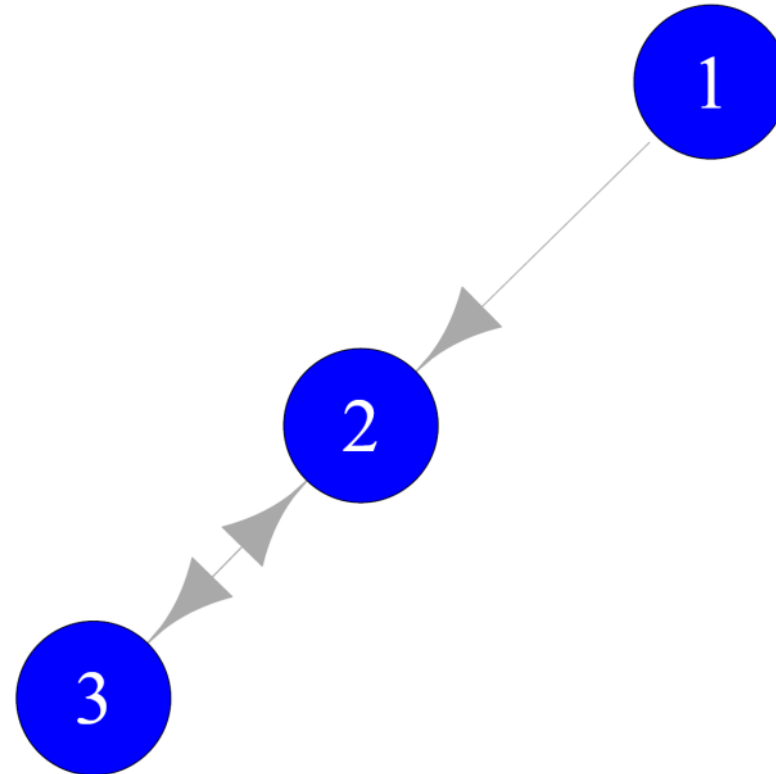
Network example 3

To

N1 N2 N3 N4

From

$$\begin{array}{c} N1 \\ N2 \\ N3 \\ N4 \end{array} \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$
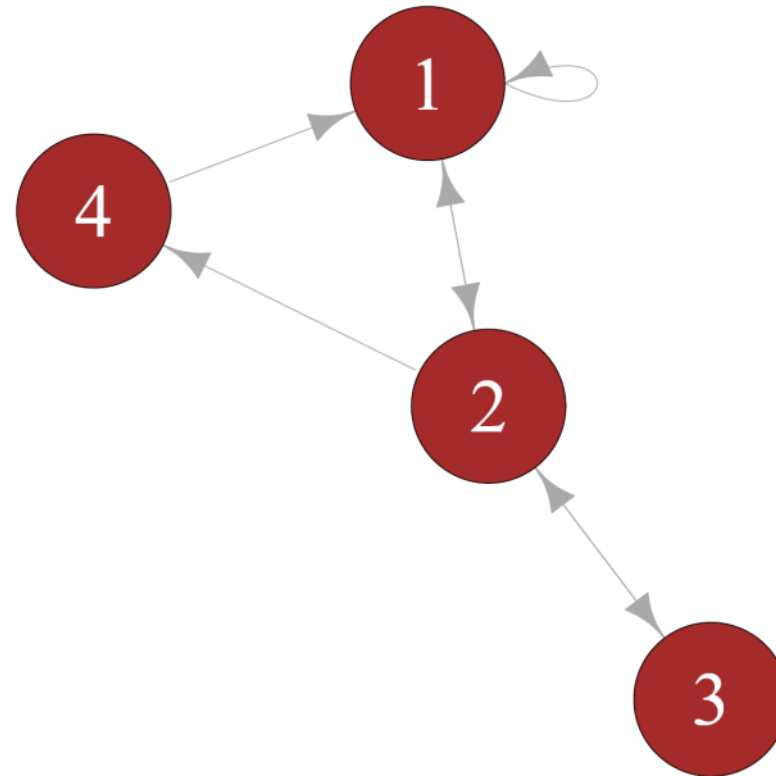
Directed or undirected network?

To

N1 N2 N3

From

N1 $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$
N2
N3

To

N1 N2 N3

From

N1 $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$
N2
N3

Symmetric!

Examples of general questions to ask with networks
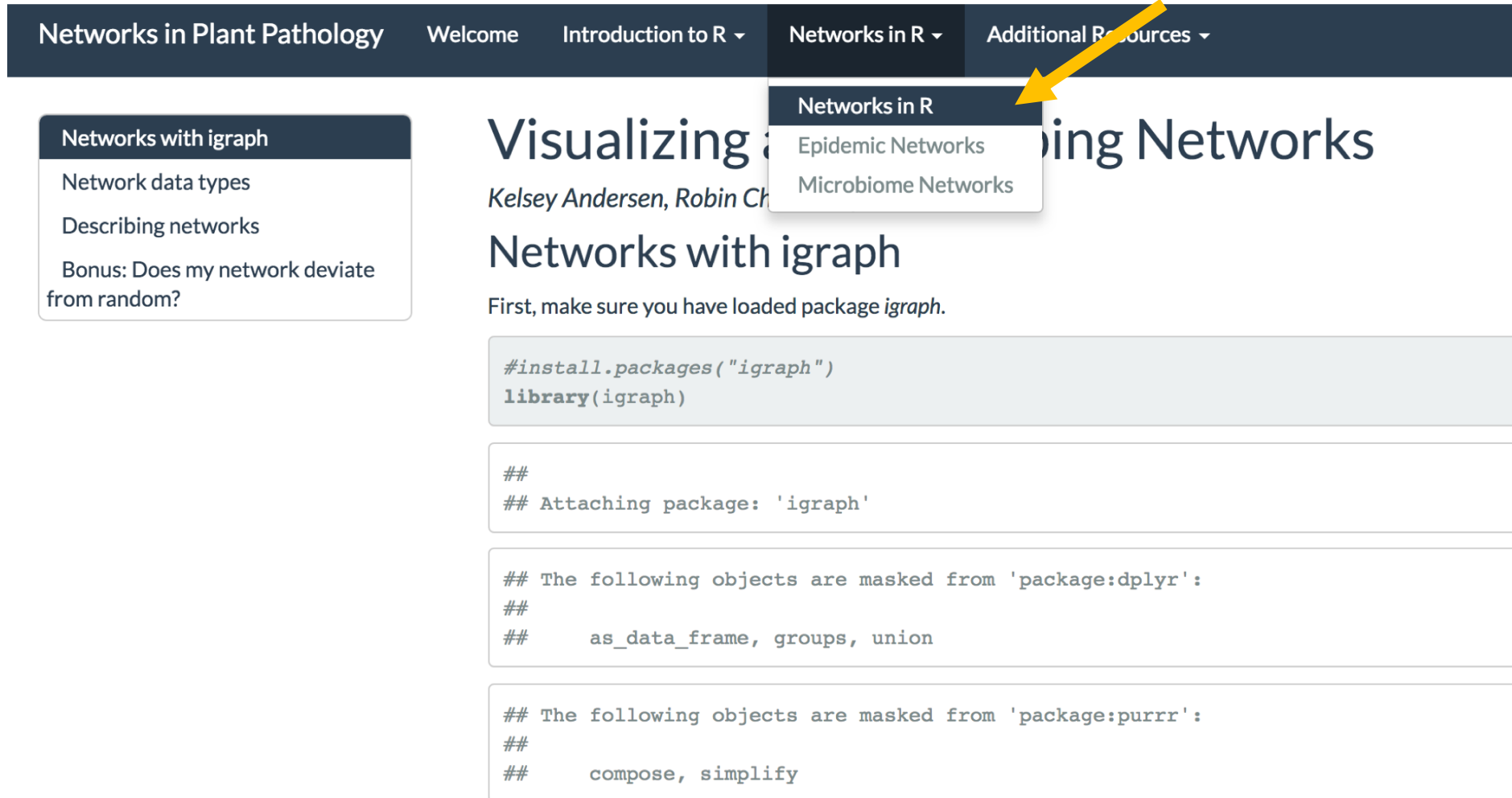
- What nodes and links have particularly important roles in the network?

- Are there clusters of nodes?

- How "complex" is the network?

- What would strengthen or weaken the network?

Today we will do most of our work in the igraph package in R

- igraph reference manual
  - http://igraph.org/c/doc/igraph-introduction.html
  - Definitely a reference – more detail than you might want to read through for a first try
- Katya Ognyanova has prepared some user friendly introductions
  - Network visualization: http://kateto.net/network-visualization
  - igraph in R: http://kateto.net/networks-r-igraph

Let's move to the markdown!
kelseyandersen.github.io/NetworksPlantPathology/