A network is a special type of vector dataset made up of line features and points. Lines describe the routes along which things move, also called edges or links. Points join all the edges that make up a network, also called nodes, describing how the network is connected.

**What is a Network?**

Edges and nodes have:
- Rules
- Directions
- Restrictions
- Impedance values
- Time
- Distance
- Cost

These variables can change from edge to edge, node to node, or over time.

**How Networks Work**
Built from linear features
  » Existing roads, pipelines, power lines, water lines, etc.
 » Topology should be created and rules established, errors identified and resolved
 » Attribute values added to indicated distance, time, cost, and/or direction
 » Create a “turn” feature class (optional)
 » Run “New Network Dataset” wizard
 » Edit/modify network characteristics

How Networks are Created

Network datasets are created to solve problems
Once a network dataset is created 6 different “solvers” can be used to answer questions like:

» What is the shortest path/best route?
» Where is the closest facility?
» What is the service area of those facilities?
» What is the best allocation of services?

Types of Network Analysis

Quickest vs. Shortest Path

Route Solver
Uses raster data

The cost raster defines “cost” of moving across each cell
- Cost may refer to effort, impact, monetary cost, or other impedances
- Usually a combination of raster datasets each representing a “cost”
- Can be rescaled and weighted, ranked values or real data values

Also requires a source raster
- Defines the source cell(s) (aka origin)
- All other cells are nodata
- Red area in figure below indicates source area
» Result is an accumulated cost raster

» Each output cell is assigned value that represents least accumulated cost of reaching that cell from source area (nearest source cell)

» Because many paths are possible, this is an iterative process that spreads outward from source area(s)

**Least Cost Path Analysis**

» Accumulated cost raster can be used to produce the following outputs using distance analysis toolset (and others)

1. Direction raster – direction to source cell
2. Allocation raster – which source cell
3. Least Cost raster - path from source to destination

**Least Cost Path Analysis**