ArcGIS Network Analyst:
Setting Network Dataset Connectivity, Part 1
Transcript

Welcome. I am Colin Childs from Educational Services at ESRI in Redlands, California, and I teach a host of ArcGIS classes ranging from geodatabase design to working with Spatial Analyst.

Today, in Part 1, I will be exploring the network dataset, the data structure of Network Analyst, and you'll hear about what it is and how it is created and what it consists of. More specifically, I'll be concentrating on discussing connectivity, connectivity groups, and elevations in the network dataset.

This discussion is tailored to users of the network analyst extension who want to get started and need to learn more about creating and setting up a network dataset.

So, network datasets are designed for ArcGIS Network Analyst. They're built from simple features, and they're built to support transportation modeling. Network datasets can be sourced from geodatabase feature classes, shapefiles, or street map data, which really do have pre-built network datasets. Network dataset properties you need to be aware of are that the network datasets support and harness modern capabilities, the user-controlled connectivity model (which we will be talking about later), and advanced attribute model (which again, we'll be talking about later), support for turns and maneuvers, and support for multimodal networks. Keep in mind that features that are part of a network dataset may also participate in a topology, and versioned feature classes may also be used as inputs. Network datasets themselves, however, are not versioned.

Let's take a look at network connectivity in more detail. Network connectivity is a property that defines how line and point features connect to each other. The connectivity, of course, is determined by spatial coincidence. Keep in mind that turns do not participate in network dataset connectivity; turns determine traversability but not connectivity. By traversability, we mean they determine the method or mechanism of getting from one edge to another.

There are two connectivity options in a network dataset: connectivity groups and policies (which is required), and elevation fields (which is optional). When modeling network connectivity, the network connectivity can be based either on the network sources or on sub-types of features within a source (if we wanted to).

Let’s take a look at connectivity groups and policies in more detail. So, a network connectivity group is a logical grouping of line or point features that control which network elements are connected to each other. By default, a network dataset always has one connectivity group, but could have more if we’re supporting a multimodal network. A connectivity policy is a property of the network source that defines how network elements connect to each other within a connectivity group. When working with multiple connectivity groups, we can define more than one group in a network dataset for advanced network modeling. This really forms the basis of multimodal networks. So, essentially more than one connectivity group can be defined, and a transfer point is used to link, or to traverse from, one group into another.

Next, we need to be aware of coincident geometry for the line features, so network connectivity can only exist at points of coincident between line features. Network connectivity can also only exist at points of coincident between line and point features when working with these.

Let’s take an overview of the connectivity policies. For line features, there are two connectivity policies: a policy known as “endpoint” and a policy known as “any vertex.” For point features, there are two policies as well: a policy known as an “honor policy” and a policy known as an “override policy.” Point feature connectivity policies, honor and override, are always with respect to the line feature policy: honor the line policy or override the line policy.

Let’s take a look at line feature connectivity in more detail. So, line features may only participate in one connectivity group per sub-type, and lines can connect to other line features within the same group. By default, lines in different connectivity groups are not connected. They use points (transfer points, that is) to connect lines across groups. The two connectivity policies which are applied only where line features intersect each other are therefore called the “endpoint” and “any vertex” policies.

- Endpoint connectivity: In this case, in endpoint connectivity, two line features are treated as overlapping but not connected, if they cross each other and there is a vertex at the intersection.
- The “any vertex” policy: If there’s no vertex, there’s of course no connectivity established.

With point feature connectivity, point features may participate in multiple connectivity groups, and they connect to line features in the same connectivity group or in different ones. Remember,

the two connectivity policies are honor and override: override the line policy, or honor the line policy. Those line policies again are endpoint or any vertex.

So in summary, endpoint represents an edge where an edge may only connect to another edge or junction at the source feature's endpoint, and the edge spans the entire length of the source feature. In any vertex connectivity policy, in this case an edge, may connect to another edge or junction at any of the source feature's vertices. Multiple edges may be created for a single source feature based on connected elements. With point feature connectivity policies, the honor policy maintains that a junction connects to an edge based on the edge's connectivity policy. The junction therefore honors the edge's connectivity policy of endpoint or any vertex. The override policy for point features connectivity, in this case a junction, may connect to an edge at any of the vertexes of the edge's source feature regardless of the edge's connectivity policy. The junction overrides the edge's connectivity policy so that it may connect to any vertex along the source's feature.

Next we'll take a look at elevation fields. This is another method that we can use to establish connectivity. So, elevation fields are attributes that enable network datasets to represent multiple levels for line features. These are applied to line features with coincident endpoints. Both planar and non-planar features are supported with elevation fields. Commonly, these fields are attributes of the source features and feature classes, and the attribute fields may have names such as "Z Elev" or "Z Elevation" or "Z Level."" Any of these fields could be used to model the connectivity between features that may have different elevations assigned to them.

So in review, connectivity defines how line and point features connect to each other. Network dataset connectivity can only exist in points of coincidence. Two methods of connectivity can be established; connectivity groups and policies, or elevation fields, can be used. With connectivity groups and policies, we specify these connectivities for either lines or point features. Our edge policies are endpoint or any vertex, and our junction policies are honor or override. For elevation fields, we specify for line features with coincident endpoints only and elevation value.

For further resources, please check out our instructor-led training courses at www.esri.com/training. This discussion touched on topics that are covered in our two-day instructor-led class entitled *Working with ArcGIS Network Analyst*. I'd like to thank you for tuning into this session of our ESRI Instructional Podcast Series. Stay tuned for future broadcasts.