Assuring Connectivity in an Electric Utility GIS Distribution Model

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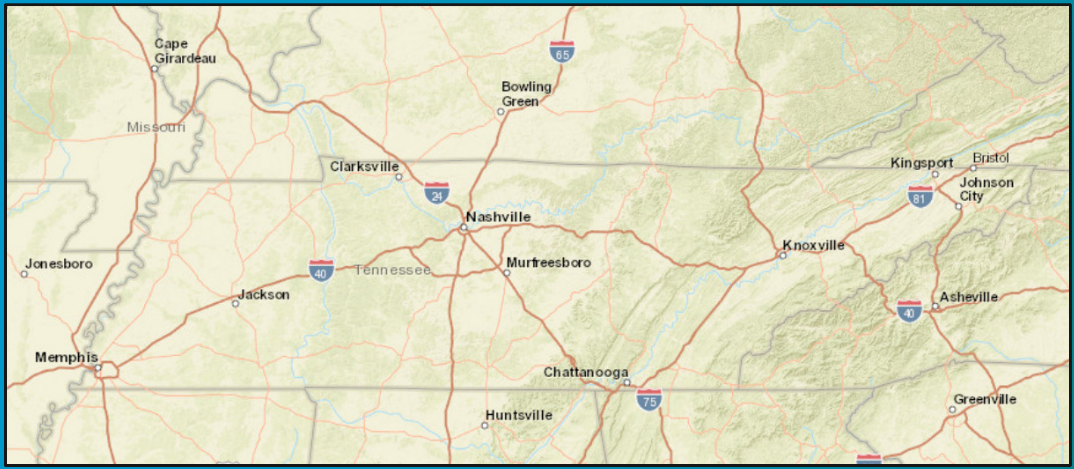
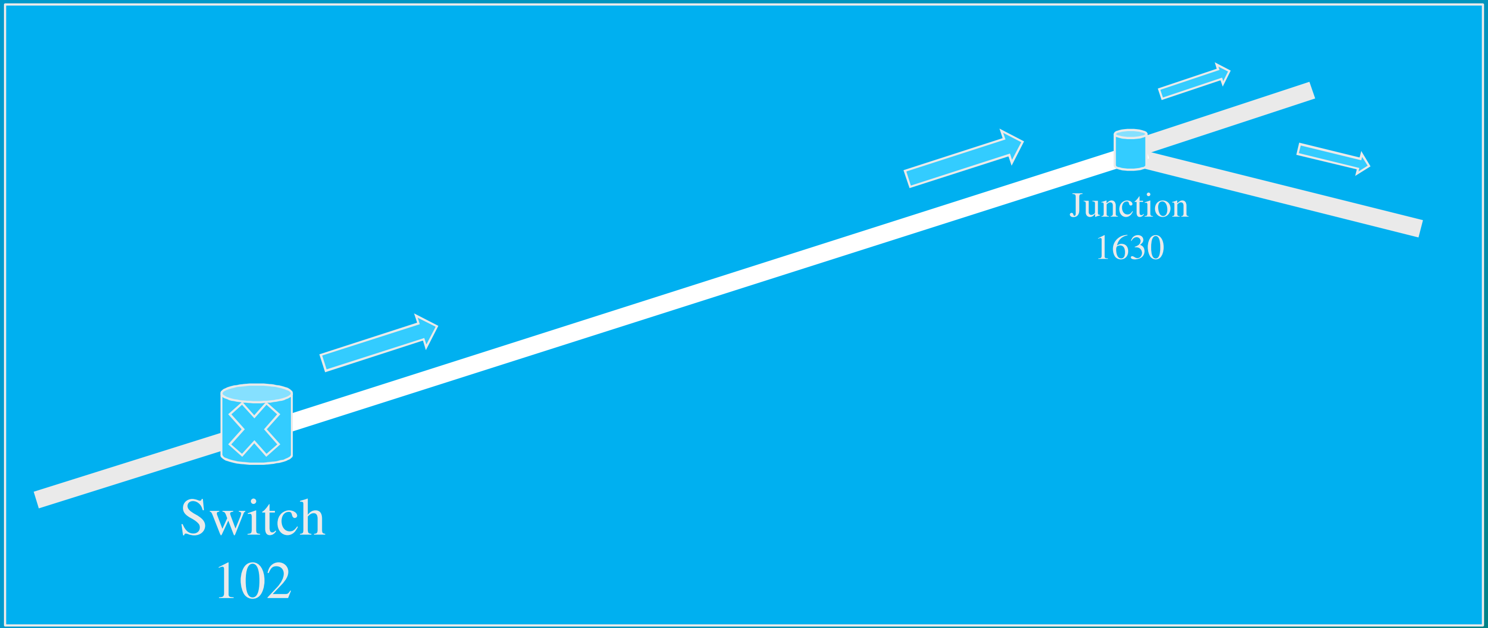
Murfreesboro Electric Department

- Primary responsibilities include server configuration, maintenance of the GIS model, and posting of work orders



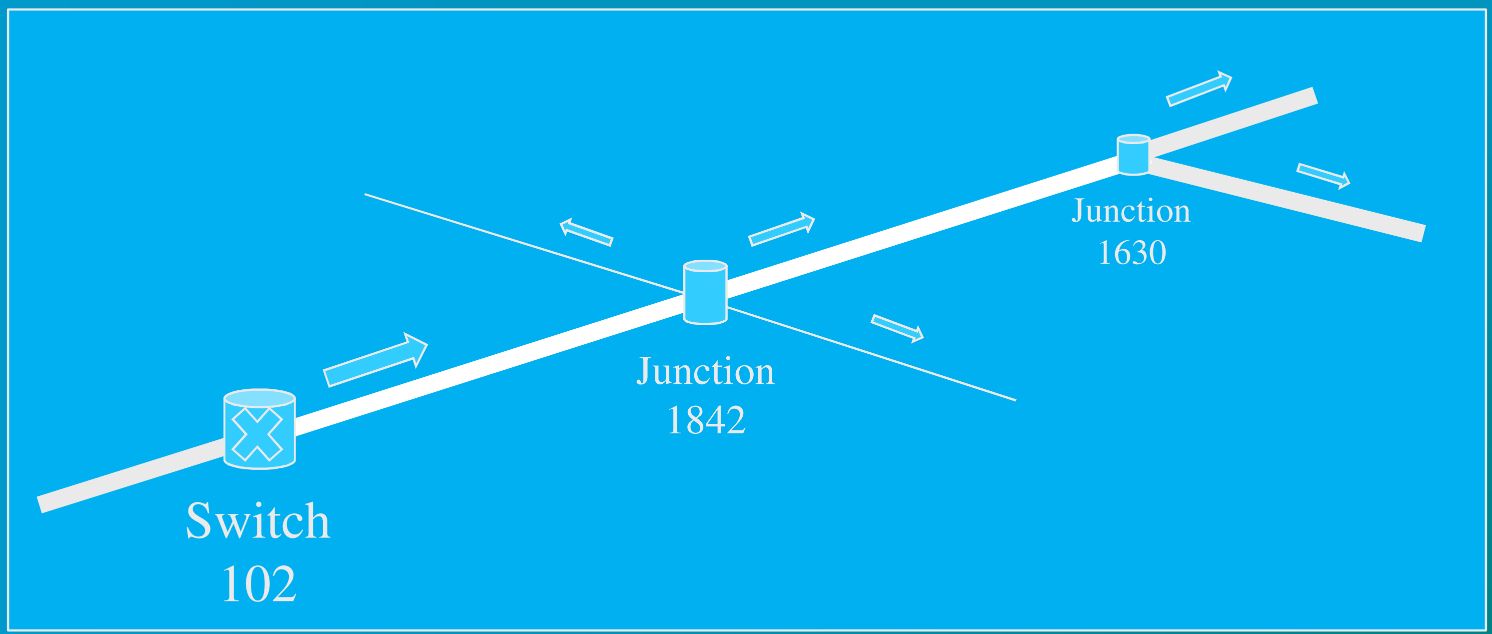
Spans and Edges

- Example of Simple Edge



Spans and Edges

- Example of Complex Edge



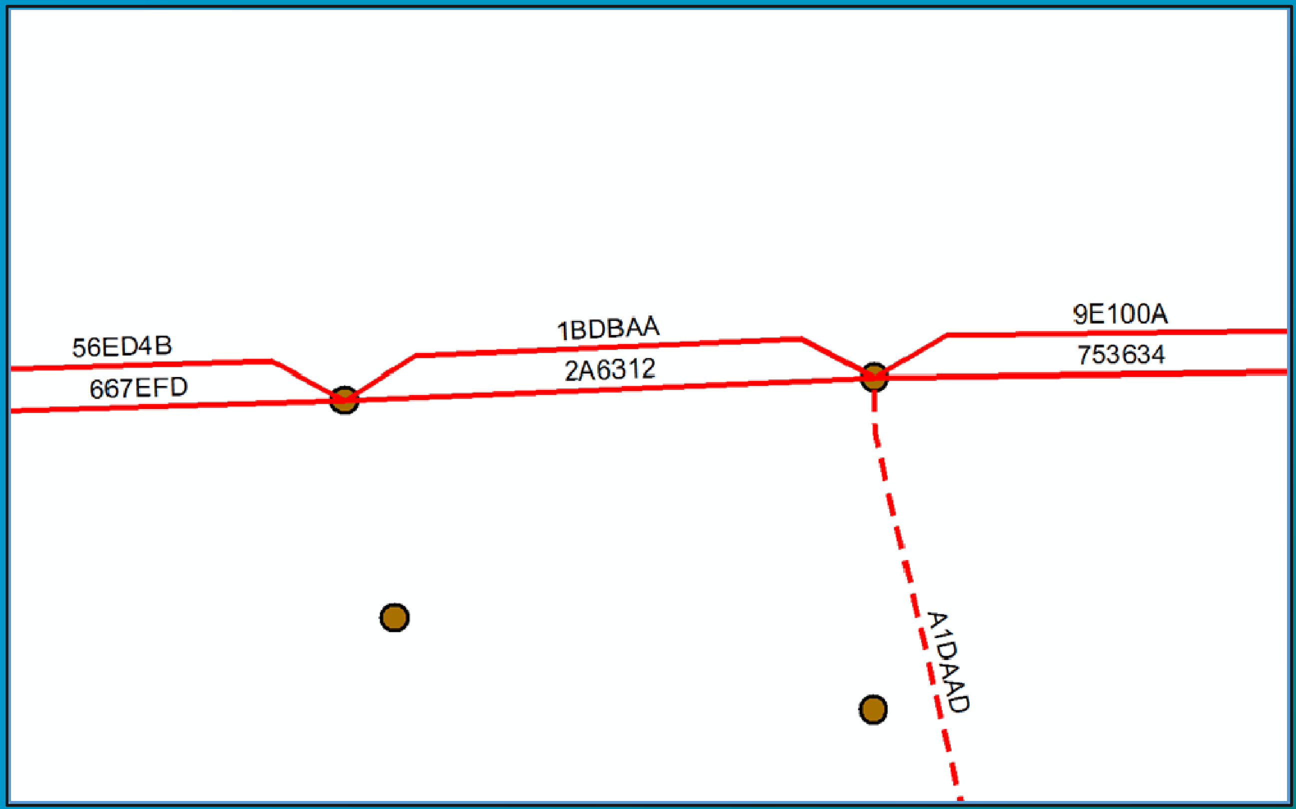
Background

- Traditional GIS used an attribute-based numbering system for electrical lines
- Newer systems have moved toward a GUID-based approach
- Database tables are designed to be normalized and to help prevent unwanted data changes

Conversion

- Legacy GIS used non-intersecting spans
- ESRI-based system requires spans to be snapped together
- Connectivity is our focus
- Other systems rely on GIS data, so accuracy is key

Connectivity



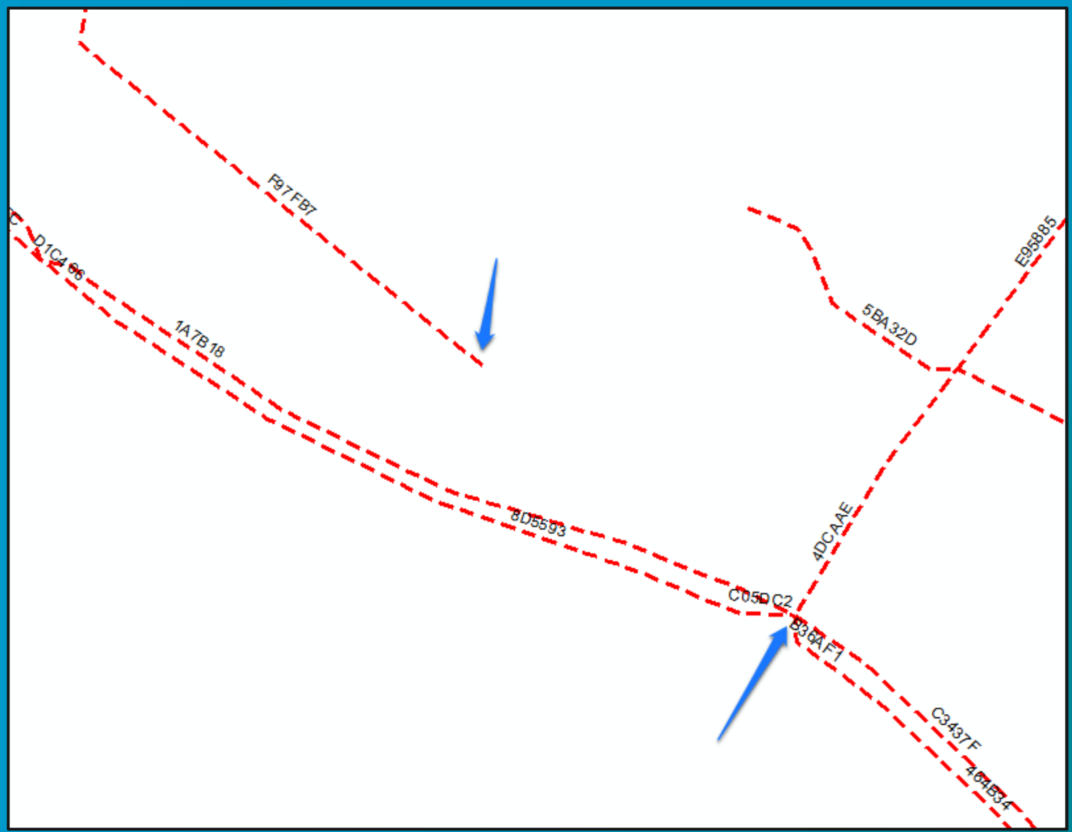
Connectivity

- Relationships, endpoints, and insertion points are important
- Feature dataset table with a related stand-alone table which governs connectivity
- Two sources must be in agreement for connectivity to work properly

Dilemma

- Many instances of disagreement between two data sources
- Occurred during the Transformation phase of the ETL (Conversion) process
- Difficult to detect until each instance is found through editing
- Span endpoints may be inches or feet apart

Application Operation - Example



Application Operation - Example

- all_relationships table indicates no issues with the connectivity

all_relationships

Abbrev_span_id	Abbrev_upstream_relationship_id	Abbrev_relationship_id	Start_X_Coordinate	Start_Y_Coordinate	End_X_Coordinate	End_Y_Coordinate
F97FB7	6365C4	F46AB7	1820287.91995342	556884.480061933	1820005.02998437	557063.130041575
C05DC2	802960	6365C4	1820372.51429072	556741.041913141	1820412.91995342	556736.480061933

Record: 3 of 3 No Filter Search

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Record: 3 of 3 No Filter Search

Application Operation - Example

- End point of the upstream line does not match the start point of the downstream line

all_relationships

Abbrev_span_id	Abbrev_upstream_relationship_id	Abbrev_relationship_id
F97FB7	6365C4	F46AB7
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*		

Record: 3 of 3 No Filter Search

Start_X_Coordinate	Start_Y_Coordinate	End_X_Coordinate	End_Y_Coordinate
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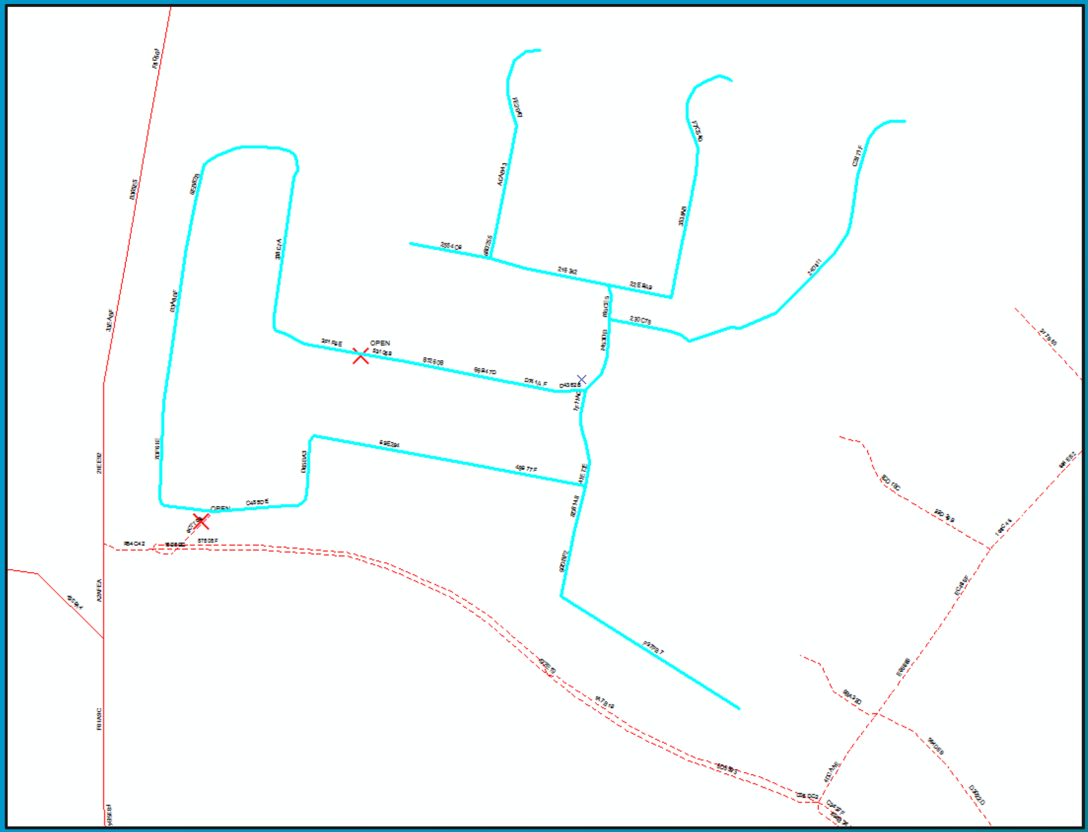


Custom Application

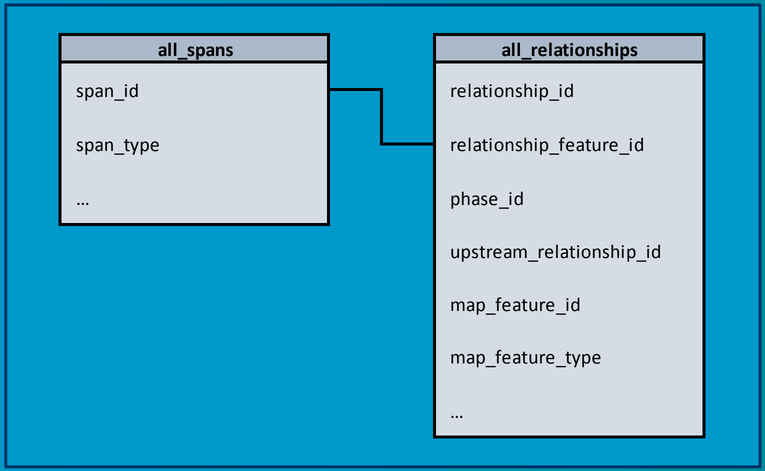
- Custom solution is needed to identify issues
- Secondary network issues may potentially be identified as application is developed
- Exported data will be operated upon and return a separate feature dataset for Overlay Analysis in GIS

Custom Application

- Use of vendor-supplied tools to correct broken connectivity
- New dataset to have attribute for tracking when corrections have taken place

Custom Application

- Entity Relationship Diagram (ERD)
- Relates the all_spans feature dataset to the all_relationships connectivity table



Application Operation

- Begins at the substation (source)
- Junctions with multiple downstream spans must be remembered
- At the end of each branch, program begins on next unprocessed branch
- Program continues until each branch has been checked, then starts on next circuit

Application Goals

- Detect issues with connectivity
- Mark those errors for manual correction
- Facilitate correction and minimal tracking for editor convenience
- Increase confidence in the OMS
- Increase confidence in the Engineering Model to accurately predict growth

Application – Return on Investment

- Errors of this type cannot be automatically detected without the application
- Estimates
  - Manual correction (after research) can take between 5 and 10 minutes
  - Number of system-wide errors may range from 500 to 1,000

Application – Return on Investment

- Research per Primary spans
  - ((0.5 min * 22,500 spans) / 60 min per hour) = 187.5 work hours
- Error Repair for Primary spans
  - ((10 min * 1,000 errors) / 60 min per hour) = 166.67 work hours
- Total of 354.17 work hours or approximately 8.8 work weeks (10 – 12 weeks more realistic?)

Application – What's down the road?

- Conversion from Microsoft Access' Visual Basic for Applications (VBA) to C# (.NET)
- Possible move from storage of data in MS Access to MS SQL Server
- Improved tracking in program development
- Increased execution speed
- Ability to interact with the map document

Questions?

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