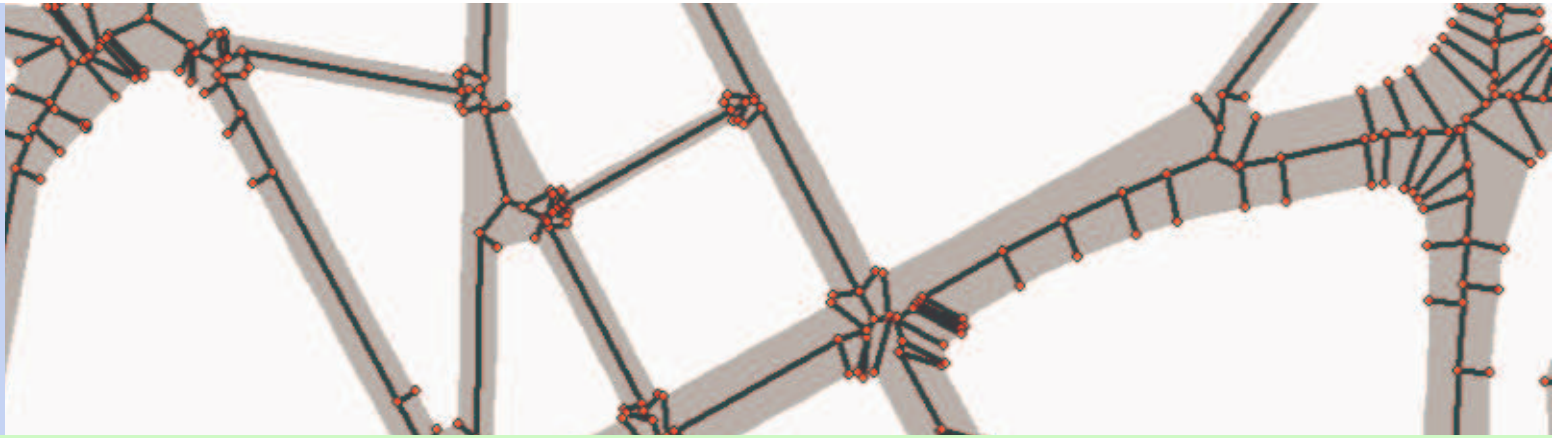

Using the Straight Skeleton for Generalisation in a Multiple Representation Environment

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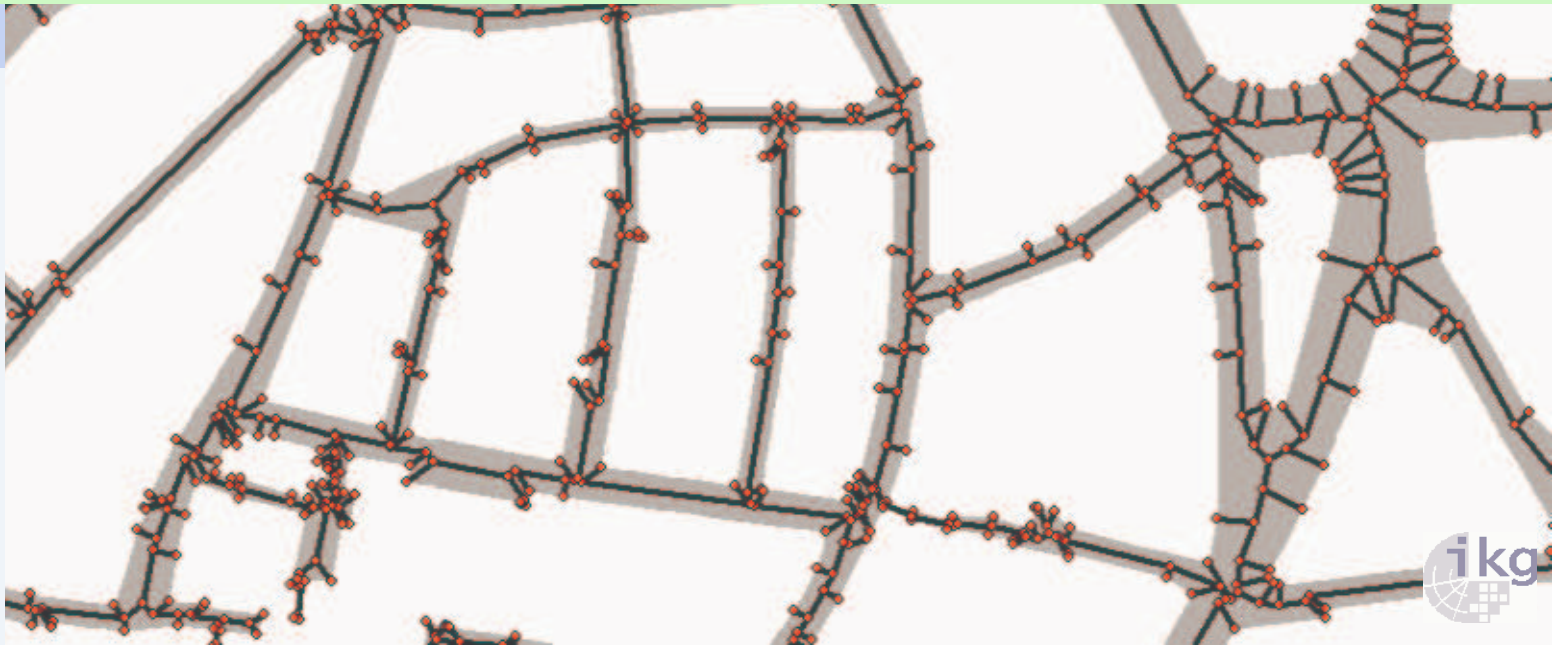


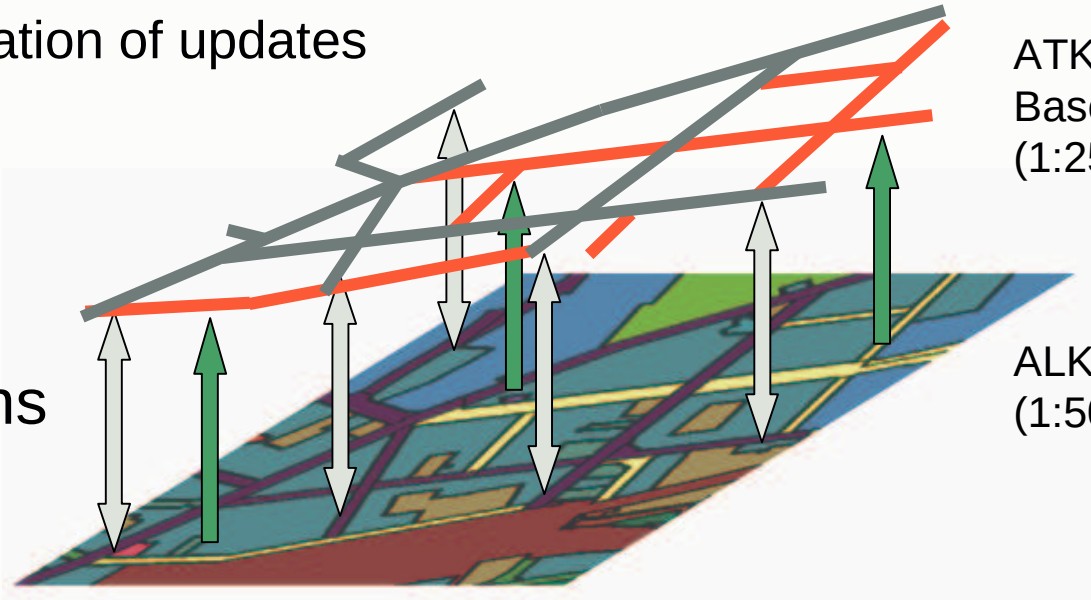
Using the Straight Skeleton for Generalisation in a Multiple Representation Environment

- Outline
  - Motivation
  - Algorithm for Straight Skeleton
  - Application to Generalisation
  - Insertion of a new Feature
  - Future Work & Conclusion

Motivation

- Comprehensive administration of different data sets
  - Better support of complex analysis
  - More efficient updating process
  - MRDB approach:
    - Correspondences are explicitly expressed as links and stored in a database
    - Example: German cadastral and topographical datasets
  - Aim: Propagation of updates

Different representations of features!



Motivation

- Approach for updating in MRDB:
  - Insert feature to base level
  - Generate appropriate representation for target level

1. Generalisation task:

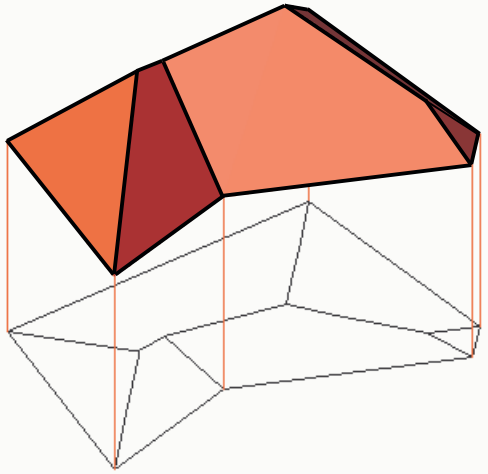
   Need for algorithms that generate the proper representation.

  - Insert new representation to target level

2. Integration task:

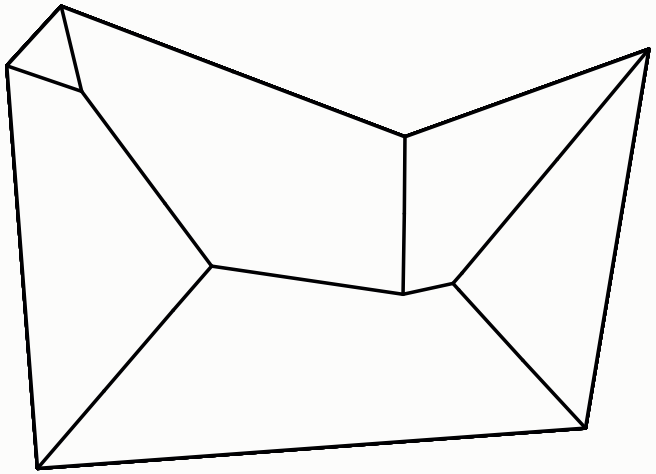
   Conflation of new features with features in target dataset.

Skeleton Algorithm

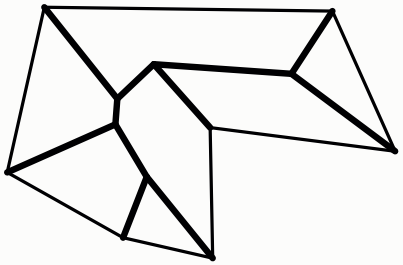


- One possibility to gain a linear feature from an areal one:
  - Straight Skeleton - Raising roof on ground plan of a house

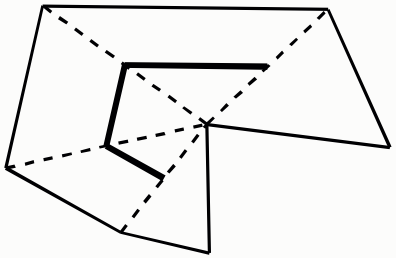
- Construction by shrinking process:
  - Construct bisectors in vertices of polygon
  - Parallel offset of polygon edges along bisectors until event happens
  - Two types of events:
    - Edge Event
    - Split Event



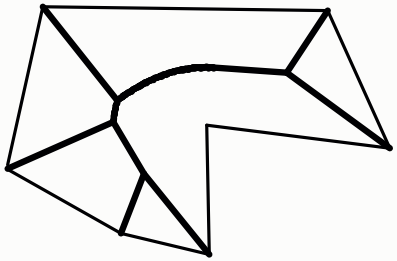
Skeletons



Straight Skeleton



Constrained Delaunay Triangulation



Medial Axis

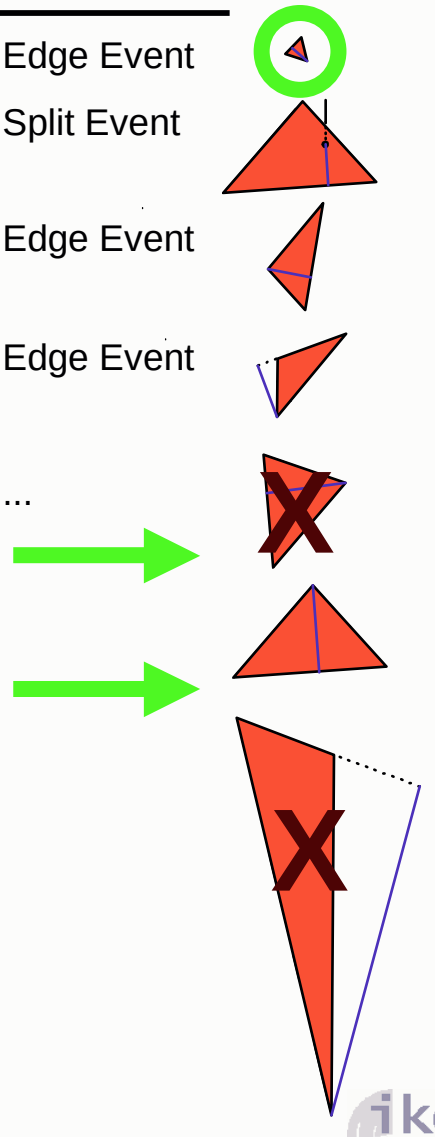
Skeleton Algorithm

- Faster Algorithm: (Eppstein & Erickson 1999)
  - Generate ordered list of events
  - Perform next event and maintain changes in list.

  - Perform next event:
    - Delete adjacent events
    - Add new events
    - Insert skeleton edges
  - Perform next event...

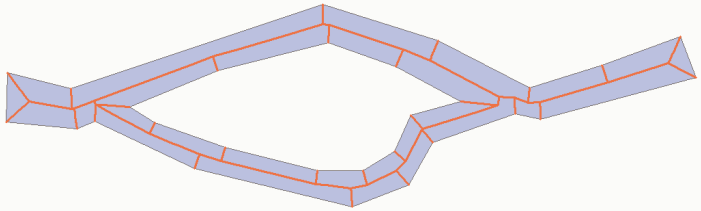
Event List

1. Edge Event
2. Split Event
3. Edge Event
4. Edge Event
5. ...

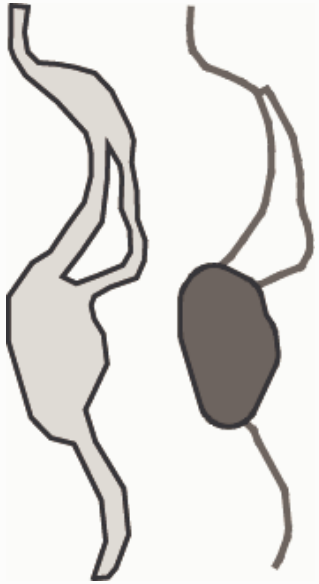


Application to Generalisation

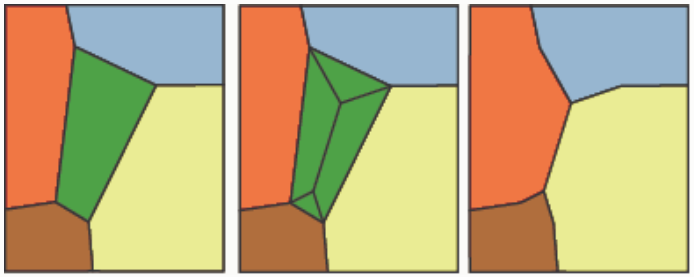
- Using the Skeleton for Generalisation:
  - Geometry type change from area to line



  - Partial geometry type change



  - Collapse of an area



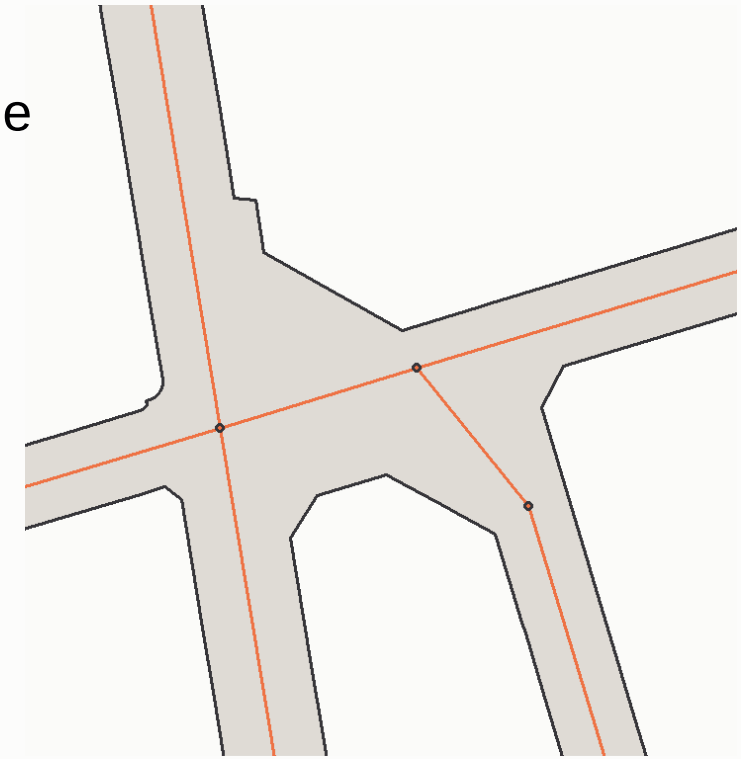
Reconfiguration of junction areas

Construction of incircles in junctions of skeleton

Two incircles, each containing the centerpoint of the other circle:

→Merge to one junction.

Create new junctions by extrapolation of road axes and intersection.



Application to Generalisation

- Example:

  Extracted road axes from parcels

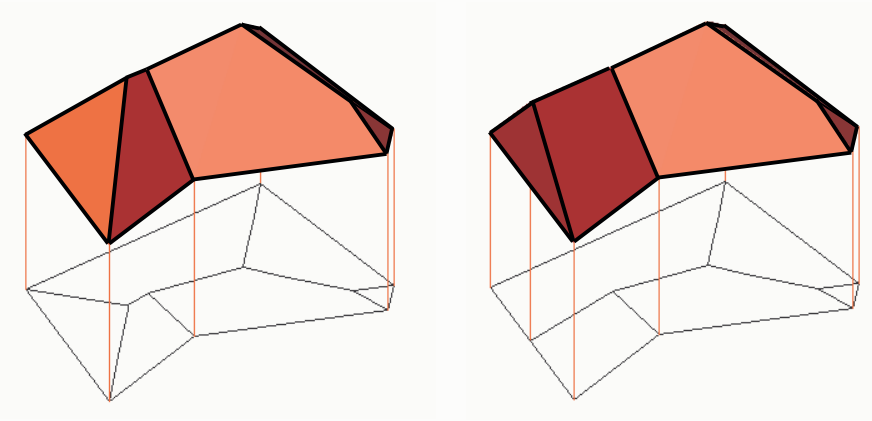
  (after rule based reconfiguration of skeleton)

Derived from cadastral data

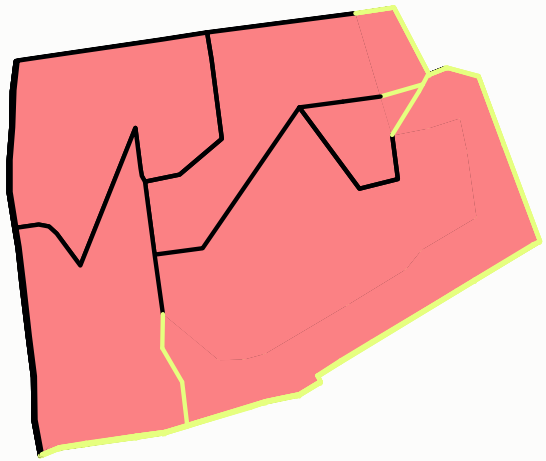
Reference from topographic dataset

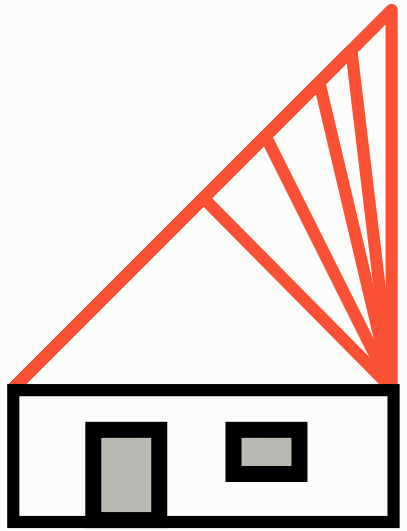
Application to Generalisation

- Modification of Algorithm:
  - Setting different inclinations to roof planes
  - To preserve topological relationship with adjacent features: Vertical plane



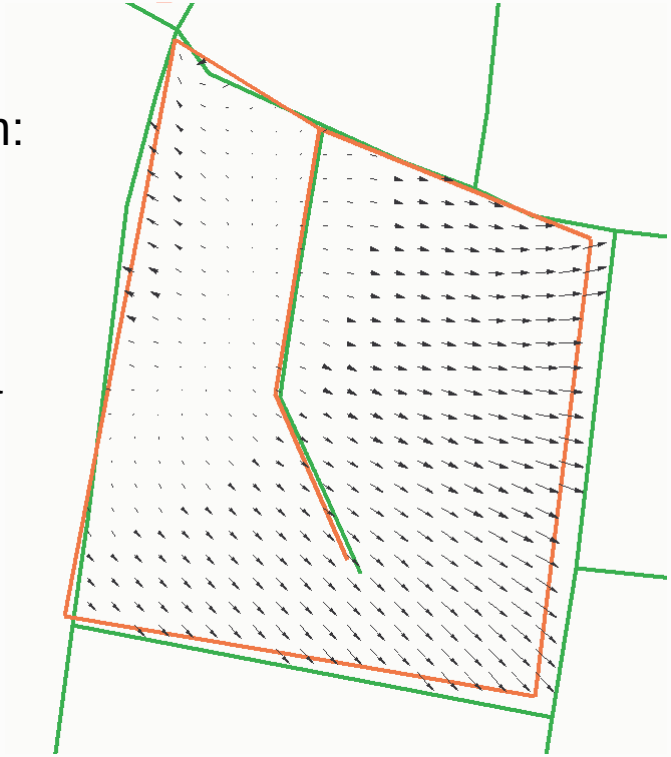
  - Example: Area collapse without change of outer borderline

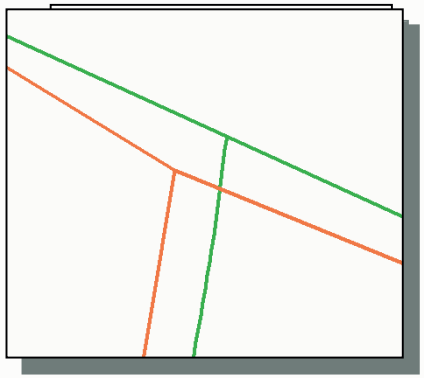




Insertion of a new Feature

- Integrating a new feature to the target dataset
  - Generalisation of new feature and other features that need to be considered.
    Here: Enclosing Region
  - Approach to Map Conflation problem:
    When preserving links within generalisation, then counterpart features are known.
  - Rubber-Sheeting Transformation via counterpart features
  - Transforming new features





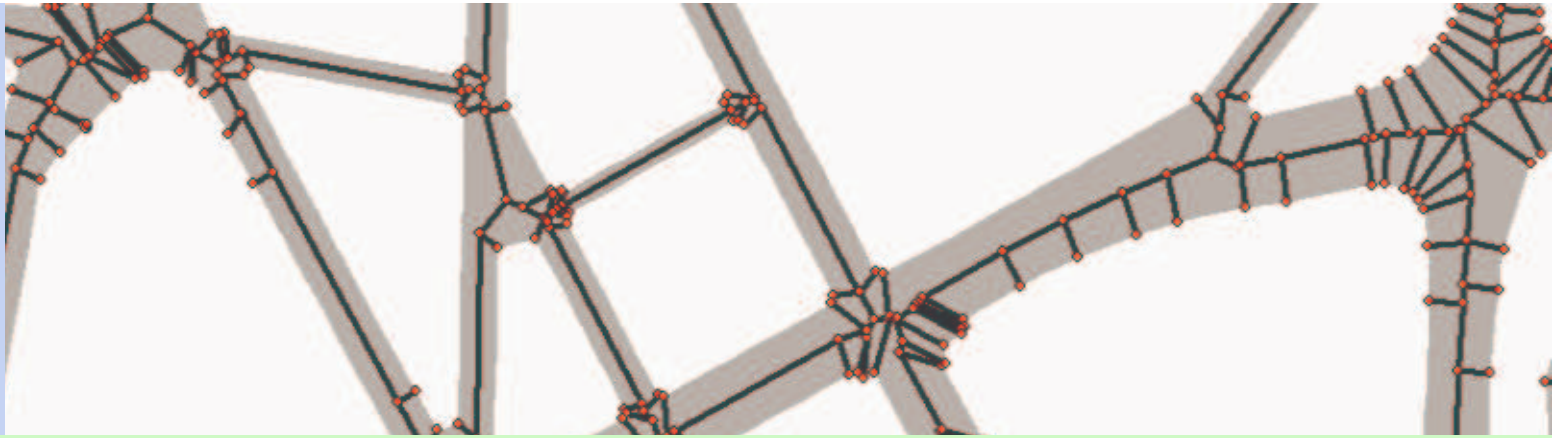
Topological error!

Correct Topology!

Conclusion & Future Work

- Approach for Propagation of Updates:
  - Generalisation and Integration as two different processes
  - Straight skeleton is used for Geometry type change and Collapse

- Future Work:
  - Which feature needs to be collapsed?
  - The geometry type of which feature needs to be changed?
  - With which settings does the algorithm need to be applied?
  - Which impact does this have on other features?



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Thank you for your attention!