Data quality and validation

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Part of the material Adapted from presentation prepared by Jon Wang , Monika Kuffer
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African Population and Health Research Center
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Overview

Program of the day

- Importance of data quality
- Definitions
- Topology
- Validation

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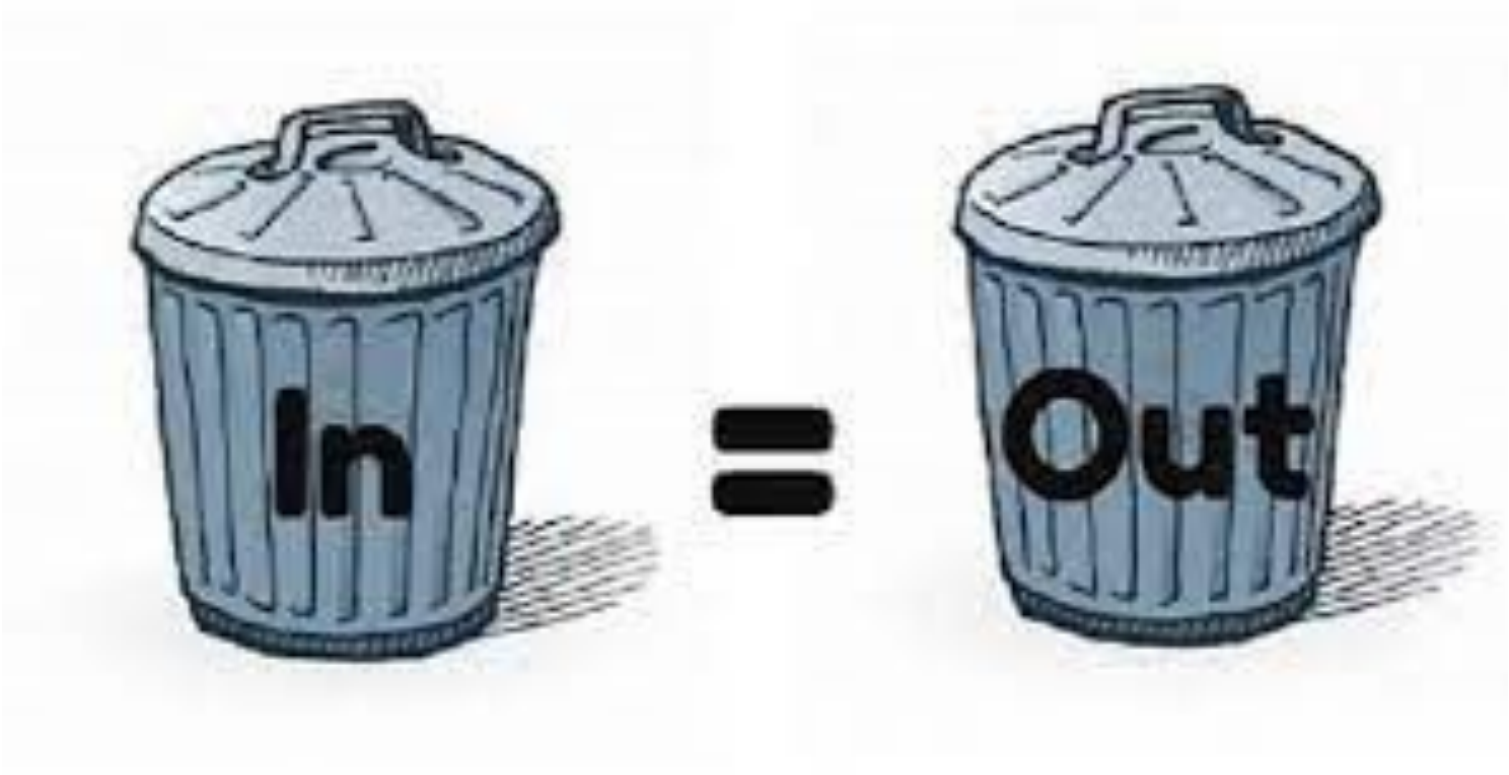
Data quality

Why data quality is important issue?



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Why data quality is important issue?

Valid Data

↳ Valid Analysis

↳ Valid Result

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Data quality

Basic Definition and Terminology

Moving from Accuracy precision uncertainty and Errors To Quality.

- **Accuracy :**

  - Closeness of observation to it's true value
  - Accurate measurement has a mean close to the true value

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Data quality

Basic Definition and Terminology

- **Precision**

  - The smallest unit of measurements to which data can be recorded

  - A precise measurements has small variance

Data quality

Basic Definition and Terminology

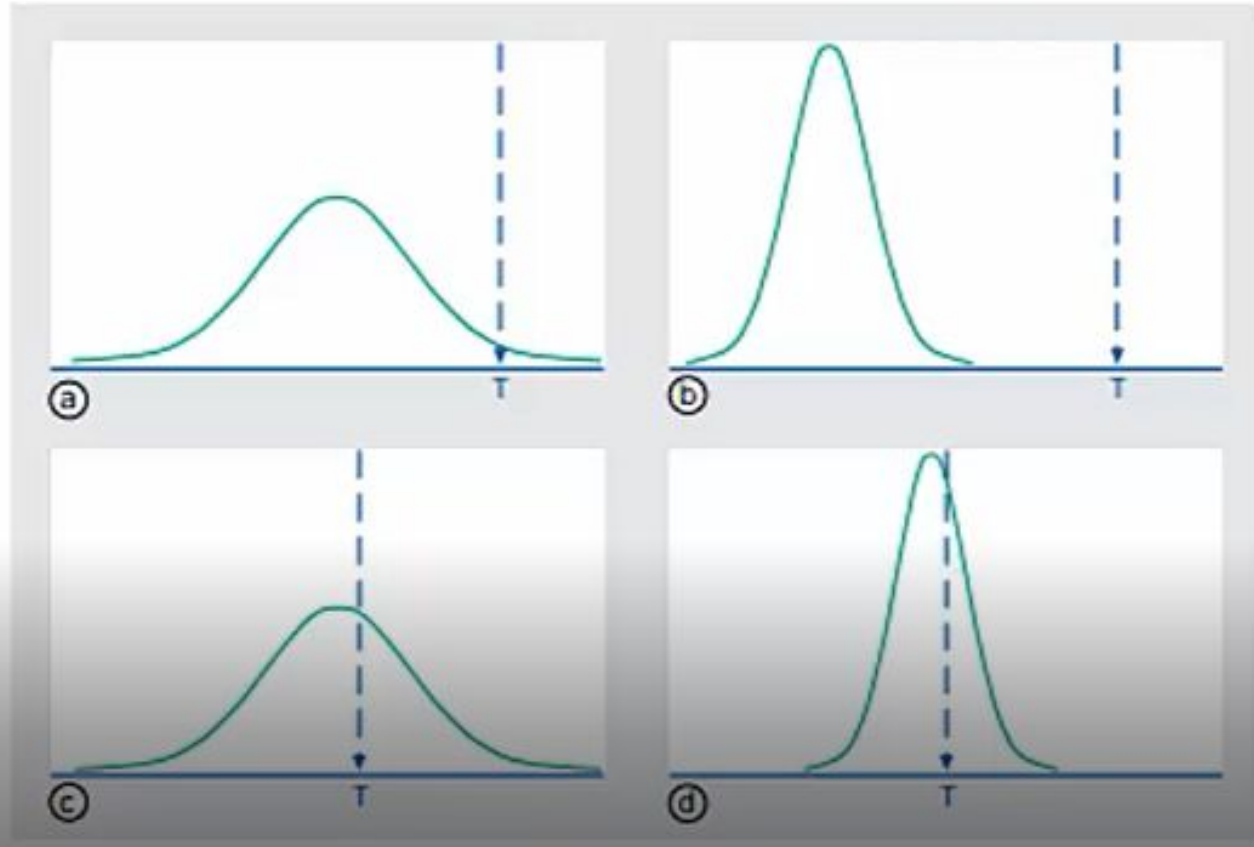

Figure 8.50
A measurement probability function and the underlying true value T: (a) bad accuracy and precision, (b) bad accuracy/good precision, (c) good accuracy/bad precision, and (d) good accuracy and precision.

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Data quality

Basic Definition and Terminology

- Error :

The different between measurement value and a true or theoretically correct value

- Type of errors:
  - Human errors (collecting, digitizing ,interpretation….
  - Instruments error (systematic error not calibrated instrument)
  - Random errors (natural variation , small error)

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Basic Definition and Terminology

- **Uncertainty:**

  - Simply you are not sure about your measurements
  - Uncertainty is not an error
  - Errors usually originate from uncertainty

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Data quality

Basic Definition and Terminology

- **Data Quality :**

  Characteristic of a product or service that bear on it's ability to satisfy stated and implied needs

  - Quality is relative
  - Quality doesn't mean excellence
  - Quality is measured as fitness for purpose

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Data quality

Elements of spatial data quality :

- Accuracy (positional, Thematic)
- Lineage (family tree of the data set)
- Logical consistency (value should not be there)
- Completeness (you have the geometry but not have the names)

These and other data what expected to see in meta data

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How to deal with incompleteness or erroneous data in general

- Completeness is not always their so managing data gaps is essential in research
- There is no single approach to solve this problem but basic principles to keep in mind:
- Be consistent especially if the goal is to compare
- Depending on the nature of the data (estimating , deleting , ignoring) missing values might be an option
- Always document what you did and be consistence

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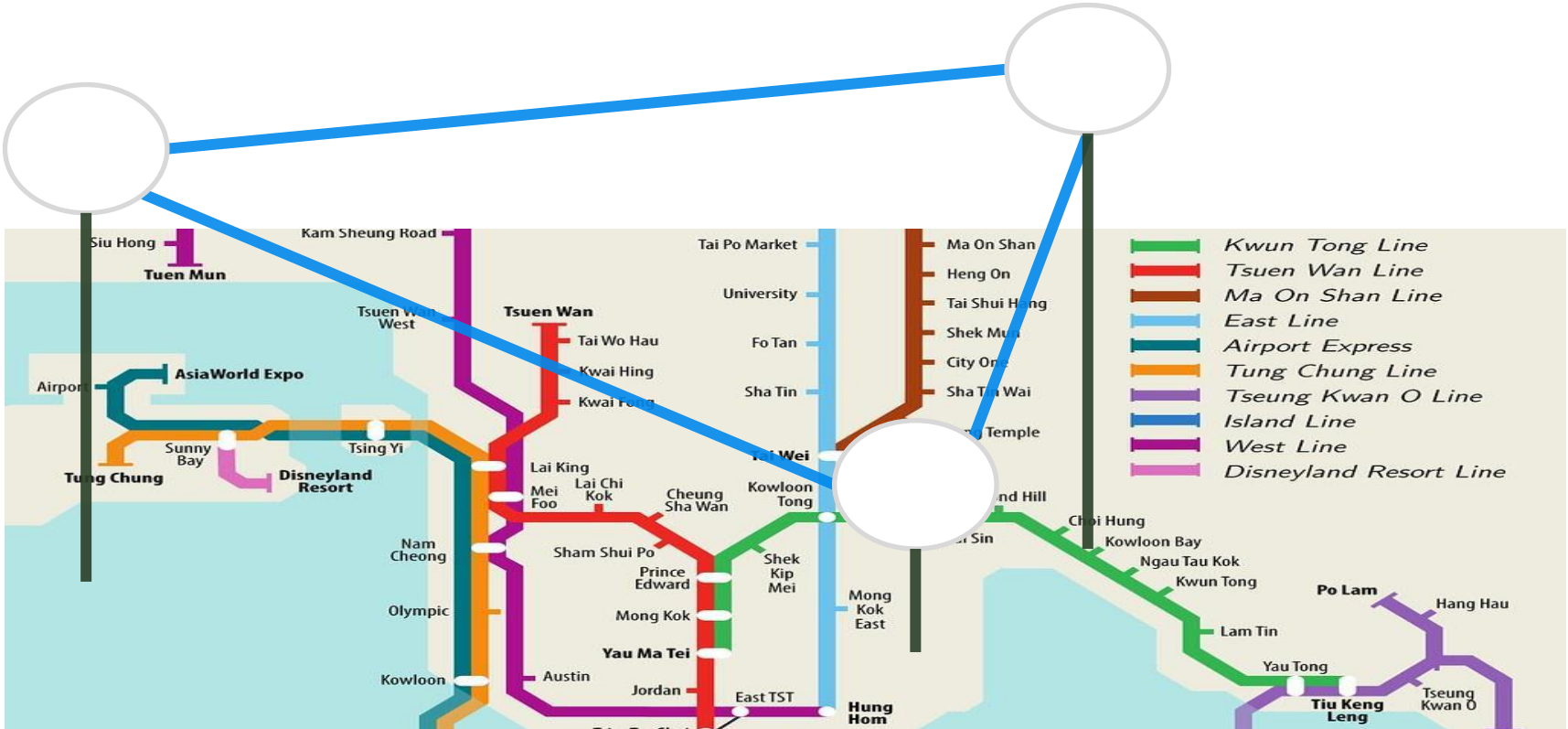
What is a Topology?

- Essentially, topology refers to the relationship between things.
- In GIS, topology refers to the relationship between spatial objects.



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Data quality

Topology

- What is topology?

In GIS relation between spatial objects

- Why topology is important ?

Topology can guarantee that the acquired data is valid

⟶ Valid analysis ⟶ Valid results

Spatial data Data quality

Topology

Topology relationship:

- Connectivity
- Adjacency
- Inclusion

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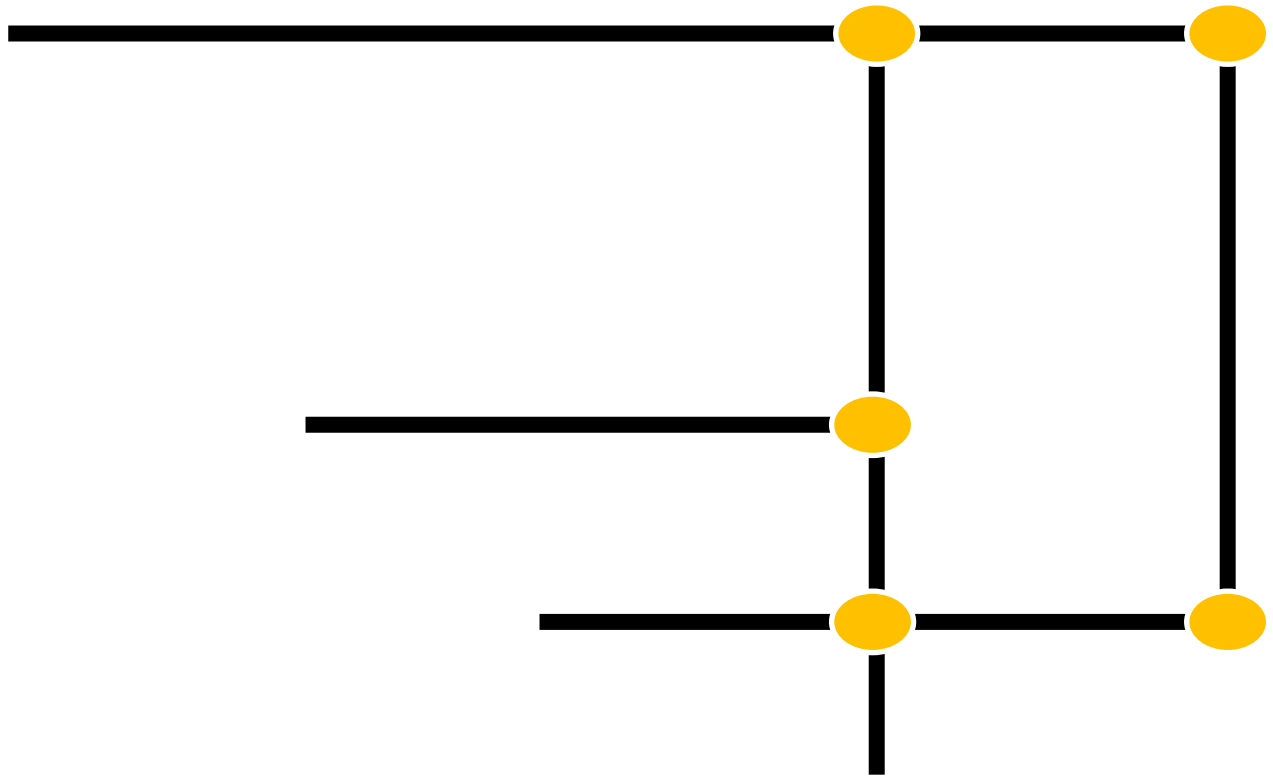
Topological Relationship

- **Connectivity**

Describes how lines are connected to each other to form a network



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Topological Relationships

- **Adjacency**

Describes whether two areas are next to each other.

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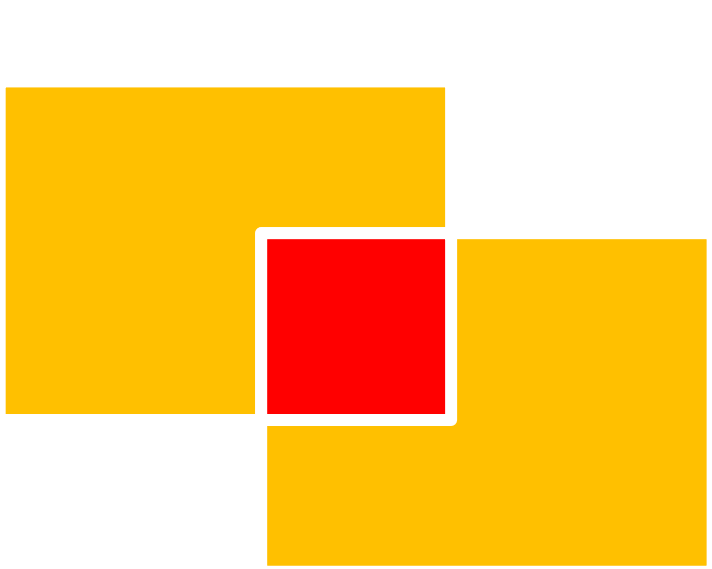
Topological Relationships

- **Inclusion**

Describes whether two areas are nested.



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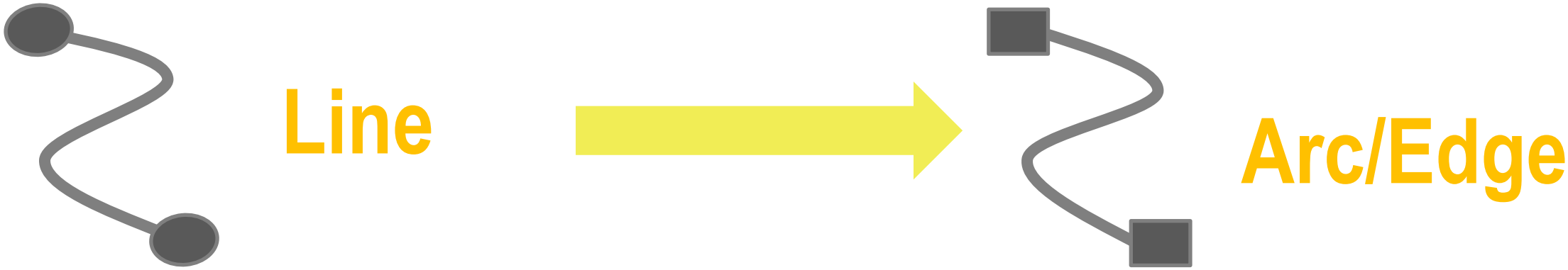
Topology Data Structure

The most common topological data structure is the **Arc/Node** data model



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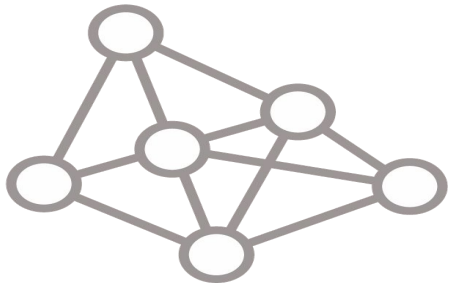
How does topology work?

- Defining topology rules
- Validating data
- Resolving violation



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Data quality

Topology

Topology Rules:

- Define rules and constrains for the feature classes
- +30 different type of topology rules
- Applied in point, line and polygon feature
- Violation expressed by topology errors

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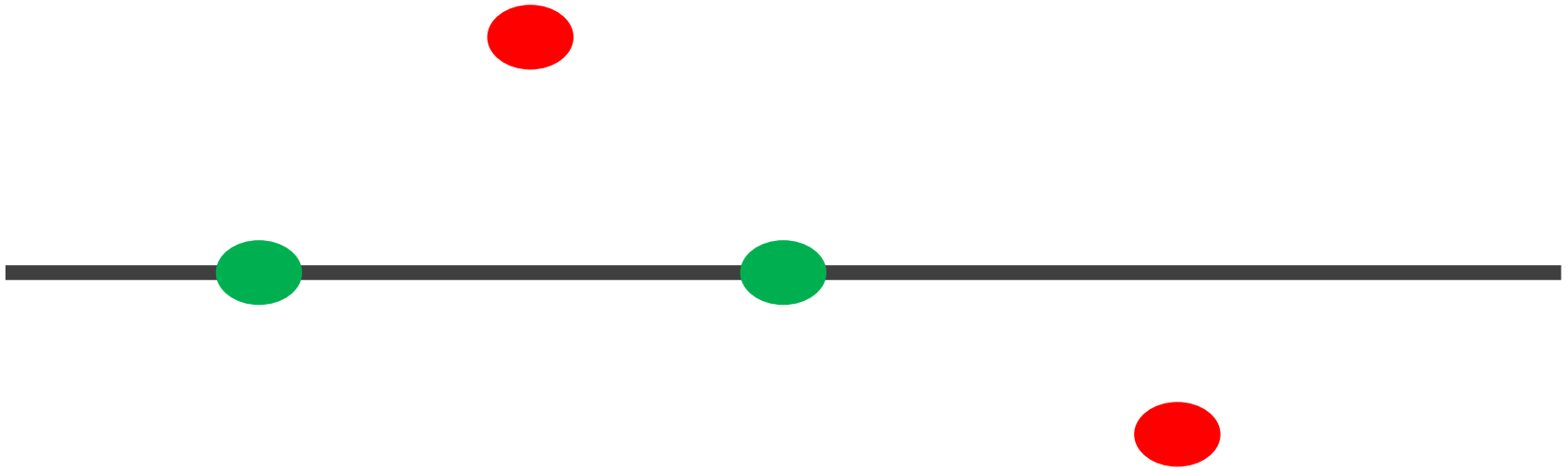
Samples of Topology Rules

- **Point Geometry**

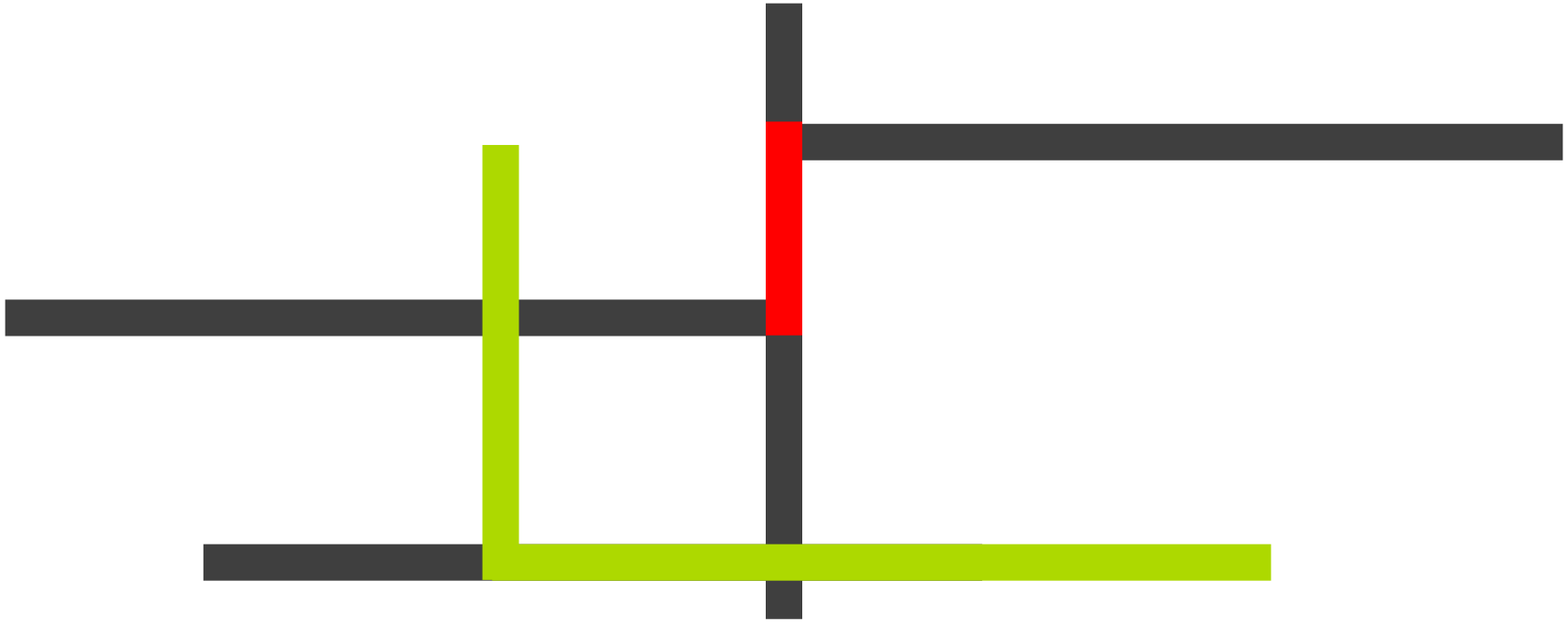
Points Must Be Covered By Line



Samples of Topology Rules

- **Line Geometry**

Lines Must Not Overlap



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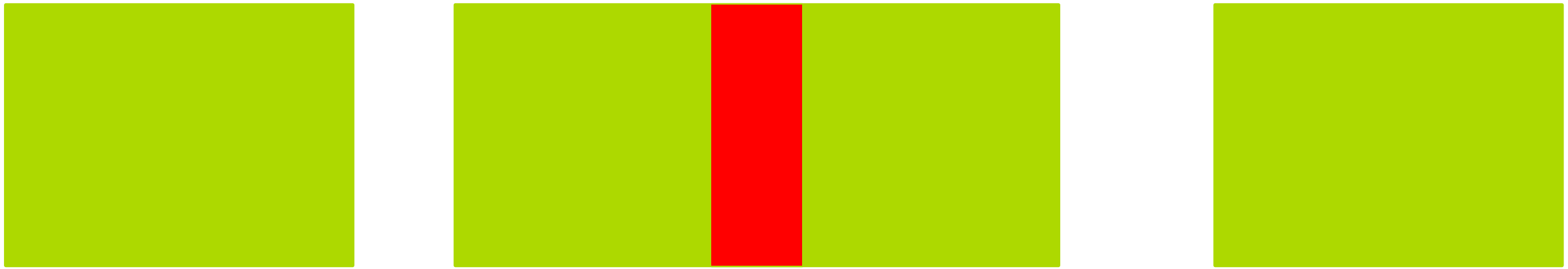
Samples of Topology Rules

- **Polygon Geometry**

Polygons Must Not Overlap



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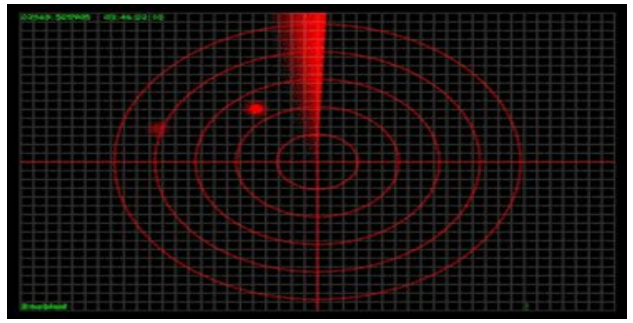
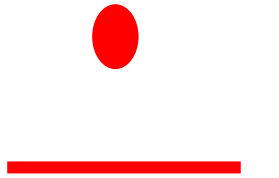
Validation

- It is the process of scanning data for rules violation Scanning the whole data or the visible data



Topology layers:

- Point errors
- Line errors
- Area errors



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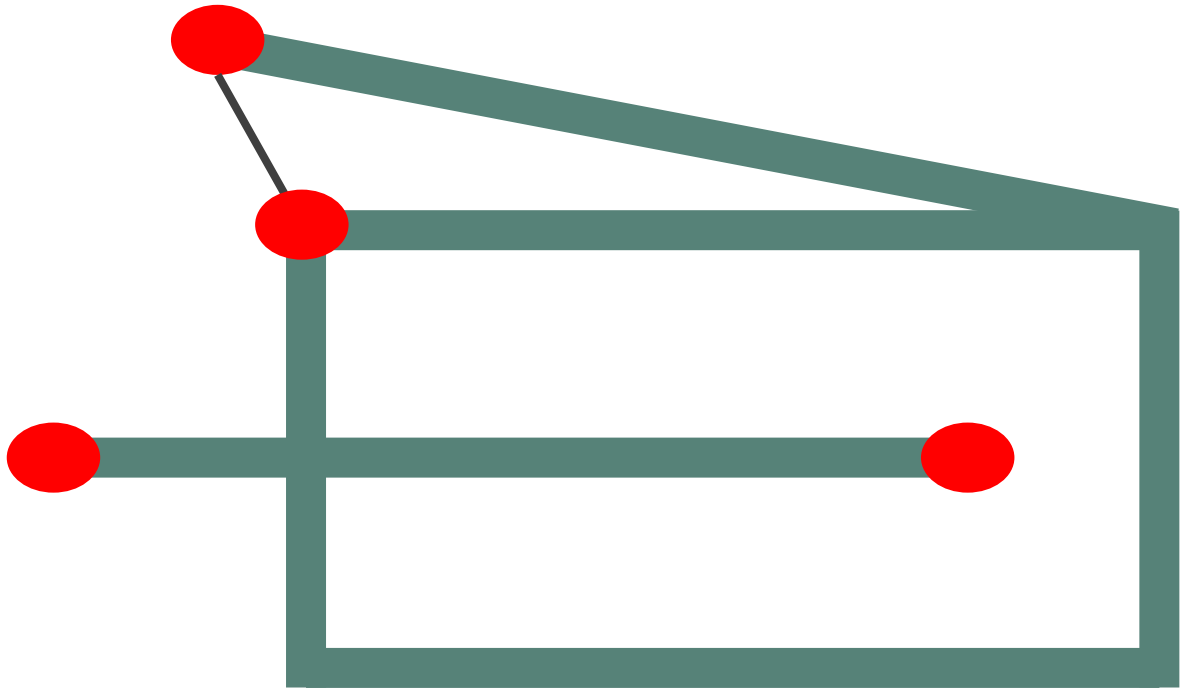
Topology Solutions for Line Errors

- **Case study:** Lines must not have dangles
  - Trim
  - Extent
  - Snap



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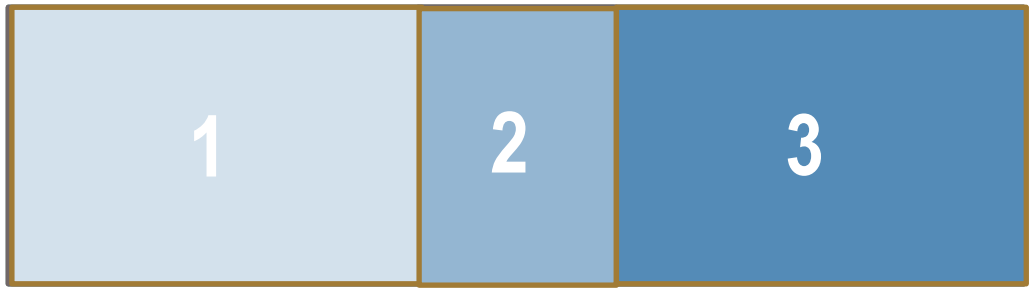
Topology Solutions for Polygon Errors

- **Case study: Polygons must not overlap**
  - Subtract
  - Merge
  - Create feature



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Practical overview:

- Topology is built on data base level
- Target layers should be determined along with their ranks
- Define Topology rules
- Validate data
- Fix errors

The most important thing when dealing with errors is the consistency

Questions?

Selftest