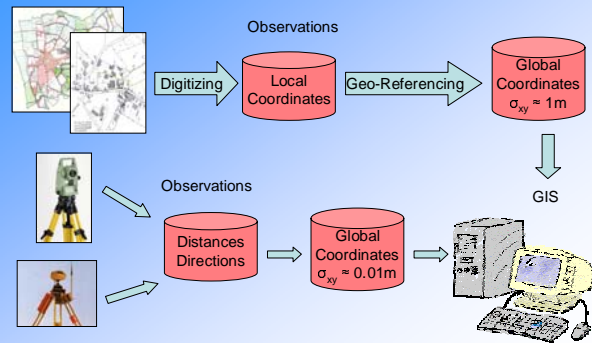


Positional Accuracy Improvement a Necessary Tool for Updating and Integration of GIS Data

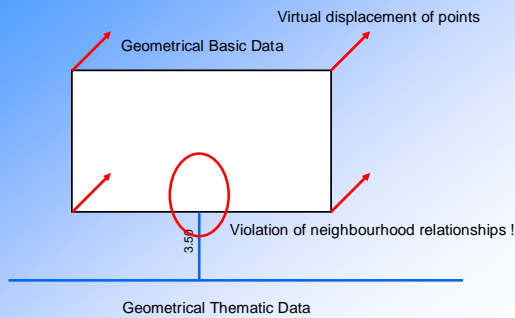
Frank Gielsdorf TU Berlin
Lothar Gründig TU Berlin
Bernd Aschoff technet gmbh

Data Acquisition



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Problems caused by PAI



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Reasons of PAI Problems

View of Computer Scientist

- Coordinates are constants
- Each relative measure can be derived from coordinates
- Coordinates and relative measures are equivalent

View of Surveying Engineer

- Coordinates are calculated from observations
- Observations are:
 - redundant
 - random variables
 - contradictorily
- Coordinates are random variables
- Coordinates and Observations are **not** equivalent

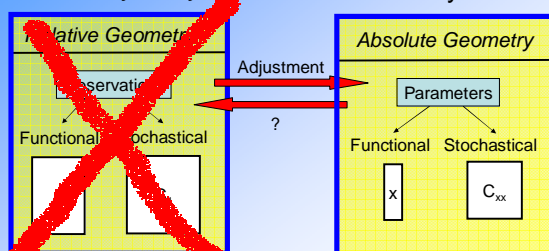
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Two Different Views

~~Surveying Engineer~~

~~Primary Data~~

Primary Data

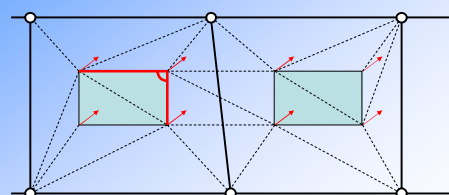


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Integration of Relative Geometry

Case 1: Original observations do not exist

Solution: Adjustment with artificial observations, e.g. simulation of membrane behaviour, geometrical constraints

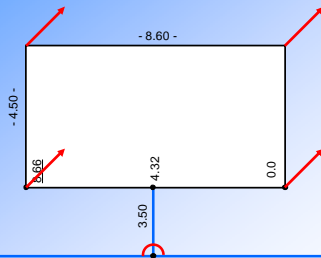


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Integration of Relative Geometry

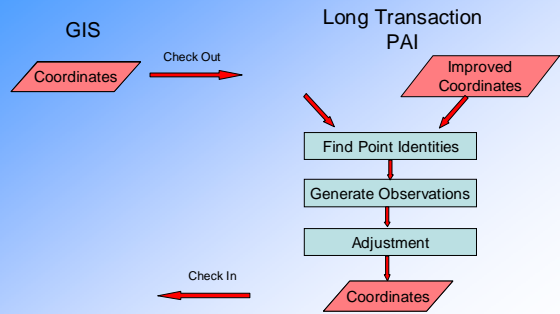
Case 2: Original observations exist

Solution: Adjustment with original (and artificial) observations



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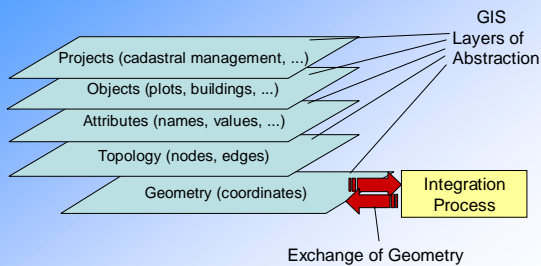
Updating Process



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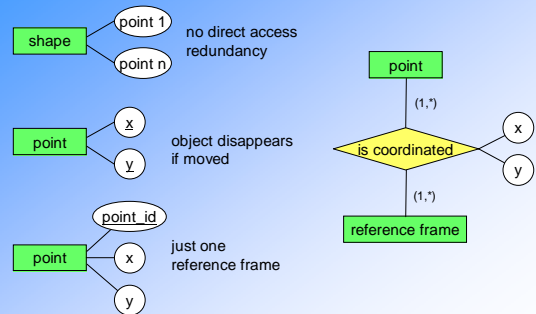
Data Management

Implementation in GIS



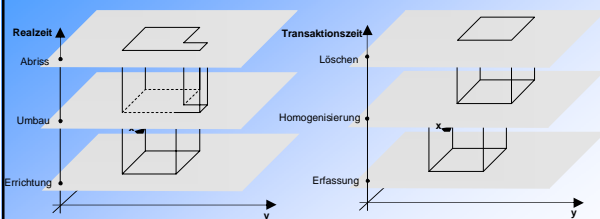
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The Role of Topology



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Time Axes



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Functional Modelling of Identities

Approach: Introduction of identity observations

Functional Model

$$v_{\Delta X} = X_k - X_i$$

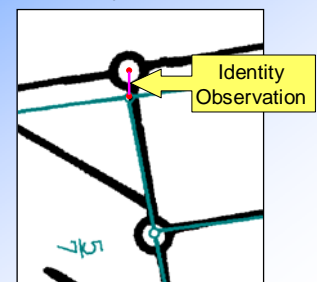
$$v_{\Delta Y} = Y_k - Y_i$$

Stochastically Model (Error Propagation)

$$\sigma_{\Delta X}^2 = \sigma_{X_i}^2 + \sigma_{X_k}^2$$

$$\sigma_{\Delta Y}^2 = \sigma_{Y_i}^2 + \sigma_{Y_k}^2$$

$$\sigma_{X_i} \dots \sigma_{Y_k} \approx 0$$

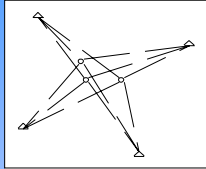


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Proximity Fitting

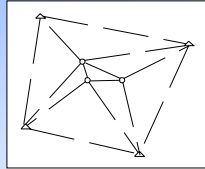
Topological Model

Disregarded Neighbourhood



- Each point can be calculated separately
- Problems with geometrical constraints and field measurements

Regarded Neighbourhood



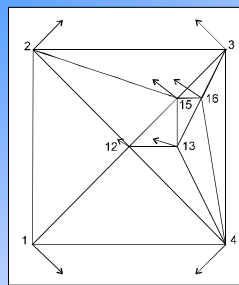
- Network adjustment is necessary
- Geometrical constraints and field measurements can be integrated

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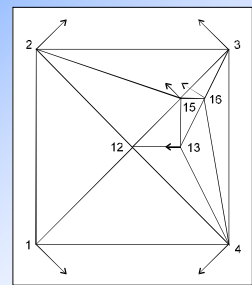
Proximity Fitting

Functional and Stochastically Model:

Distance Dependent Interpolation



Membrane Method



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Integration of Geodesic Measurements

Membrane Triangles

Collinear

Orthogonal

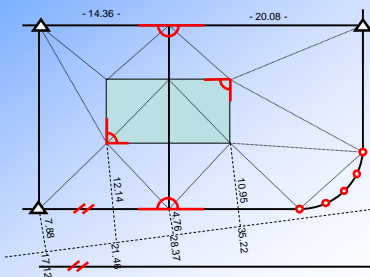
Parallel

Circle Continuities

Global Coordinates

Local Coordinates

Distances



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Proximity Fitting of local referenced Point Fields in Hamburg

The Project:

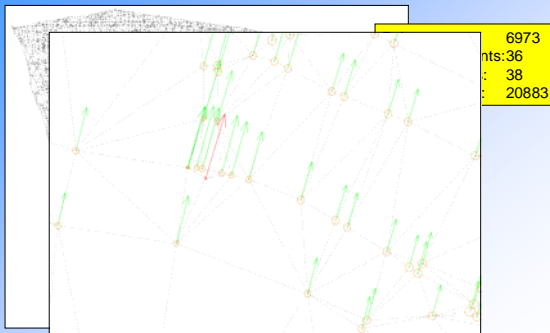
- Cadastre of coordinates
- Ca 200.000 points at 255 km²
- 10 local reference frames
- Coordinate deviations up to 17 cm

The Task:

- Simultaneous transformation and proximity fitting into a unique reference frame (ETRS89)
- Required point accuracy 2 cm

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Subproject of Hamburg



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Thank you for your attention!

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