Workshop on Network Planning for English speaking African Countries

(ITU COE, Nairobi, Kenya, 7-11 October 2002)

Session 5.6

Supporting Network Planning Tools I

by

Roland Götz

Dipl.-Ing. Roland Götz,
member of the board of management of LS telcom AG, studied electrical engineering and received his Dipl.-Ing. (M.S.E.E.) degree from the Technical University Karlsruhe/Germany.

From 1993 to 1998 he was with L&S Hochfrequenztechnik GmbH in various positions including that of head of Radio Network Planning Department. During this period he worked on the specification of radio network planning software, technical trainings, costumer support and RF planning projects.

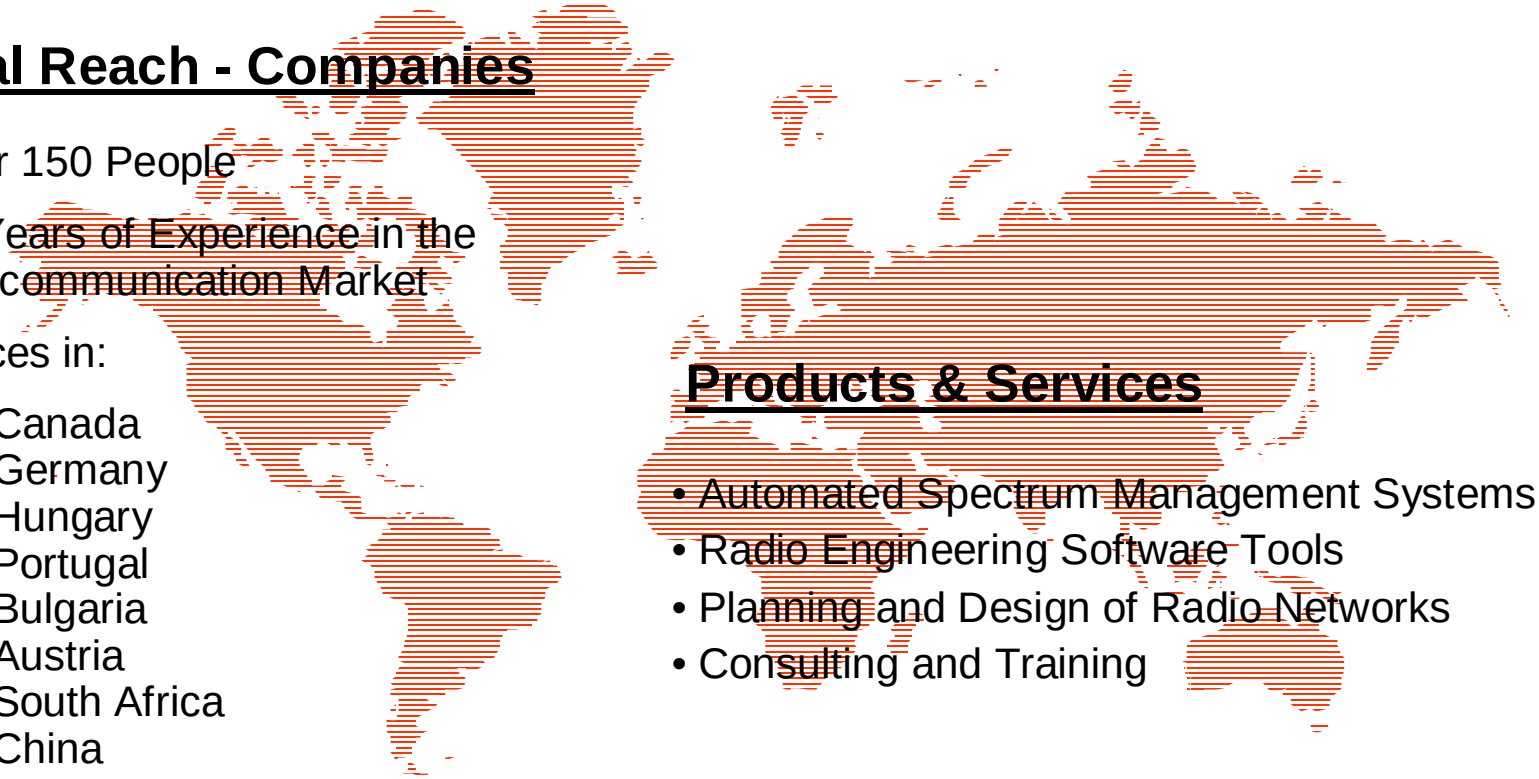
From 1998 to 2000 he was managing director of the new founded L&S Radio Communications GmbH performing radio network planning and consultancy services in the field of wireless communications.

Since 2000 he has been a member of the board of management of the LS telcom AG, responsible for the divisions consulting & engineering services as well as the strategic business development.

LS telcom Spectrocan

Global Reach - Companies

- Over 150 People
- 17 Years of Experience in the Telecommunication Market
- Offices in:
  - Canada
  - Germany
  - Hungary
  - Portugal
  - Bulgaria
  - Austria
  - South Africa
  - China



Products & Services

- Automated Spectrum Management Systems
- Radio Engineering Software Tools
- Planning and Design of Radio Networks
- Consulting and Training

Software for Regulatory Authorities:

License Issuance and Monitoring of Licensing Conditions to Guarantee Interference-Free Frequency Bands for all Services and Operators

Software for Network Operators

By use of LS telcom‘s comprehensive software solutions, clients can perform all essential planning and management tasks, which there are:

- Network calculations, dimensioning and analysis
- Coverage, frequency and traffic planning as well as market opportunity simulations
- Site planning for base stations; database for existing radio sites
- Management of sites and network elements
- Acquisition and maintenance of geo-data
- Terrain and field-strength profiles

Lines of Business – Consulting Services

Our Consulting Team includes Spectrum Managers and RF Specialists, who have managed Spectrum of various countries and assisted regulators worldwide.

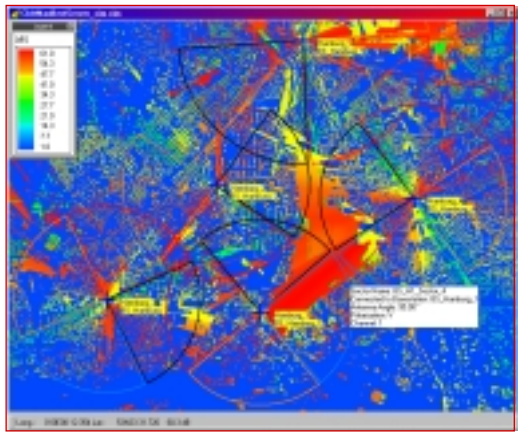
Several hundred person years of experience and capability in:

- Radio Policy
- Frequency Planning
- Spectrum Operations
- Automated Tools
- Radio Monitoring

- Preparation of Tender Documents
- Feasibility Studies / Expert Surveys
- Process / Workflow Development
- Technical Concepts

This comprises all sorts of planning services relevant to network operators, regulatory organisations and system suppliers, including:

- coverage analysis
- license application support
- network planning and design
- network implementation and radio site qualification
- network optimisation: interferences analysis and frequency plan optimisation
- geo data: consulting, generation, conversion and acquisition



Planning services are offered for all types of wireless communication systems.

Mobile networks (GSM900, UMTS), Trunking networks (Tetra, analog), Microwave links, PMP, Air traffic control, Maritime services, Analogue broadcast (FM), Digital audio broadcast (T-DAB), Digital video broadcast(DVB-T)

Trainings and Seminars

This comprises a wide variety of trainings in the whole field of telecommunications, including:

- Basic- and Expert-seminars for our Software Solutions
- Expert trainings for Radio Network Planning (mobile, microwave and broadcast services)
- Expert Trainings on Spectrum Management Tasks
- Seminars on radio site qualification and EMC
- Seminars on „New technologies“

ITU Centres of Excellence

AIBD - Asia-Pacific Institute for Broadcasting Development, Malaysia

LS Training Center, Germany

Supporting Network Planning Tools

One fits All?

for:

- **basic coverage maps?**
- **interference calculations?**
- **network analysis?**

Network Planning Tools for
Wireless Communication Systems

Mobile Communication

- analog
- GSM
- 3G / UMTS
- Trunking
- TETRA
- Land Mobile Systems

Fixed Communication

- Microwave (PtP)
- Point to Multipoint (PMP)
- Wireless Local Loop

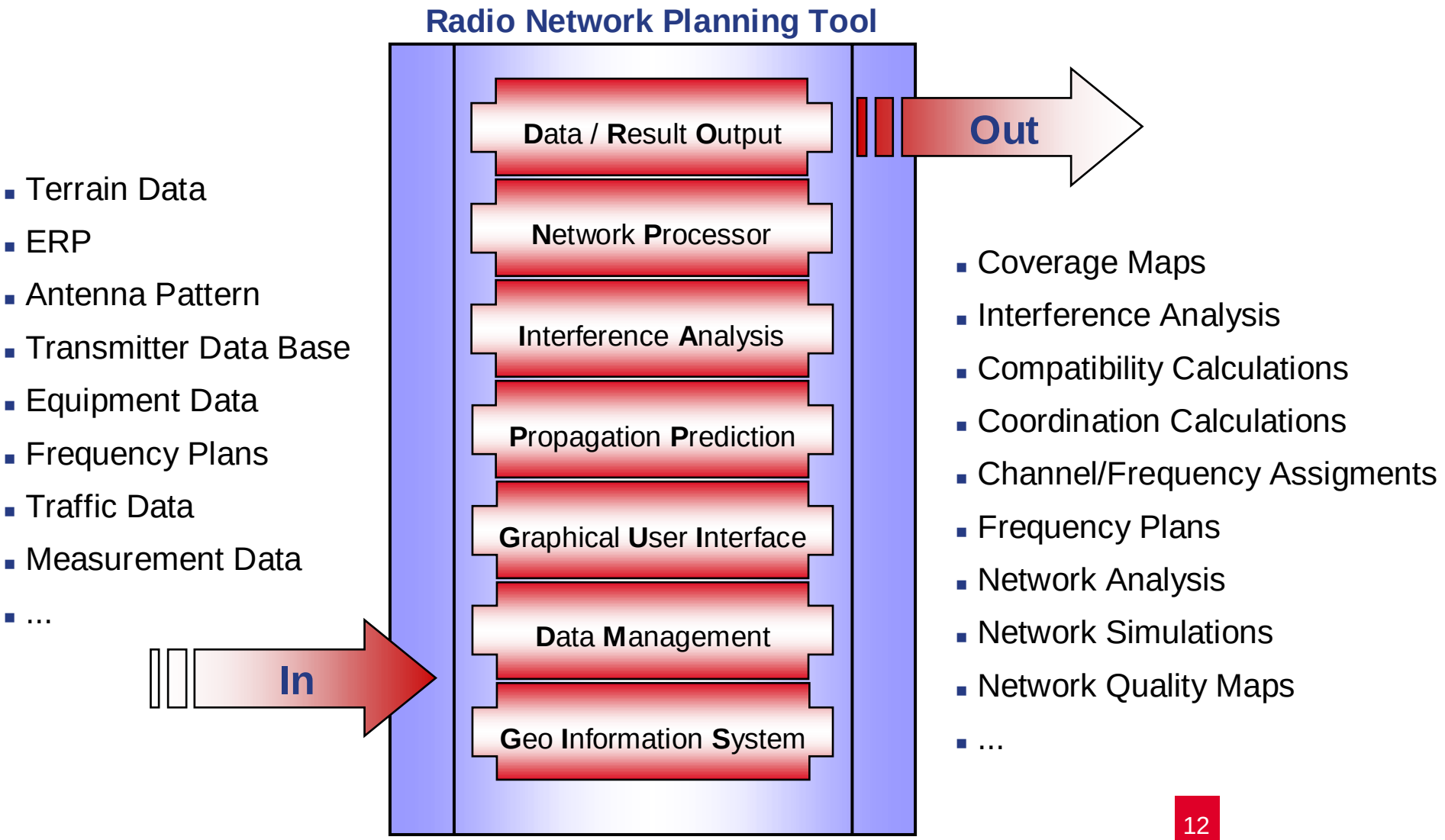
Broadcast

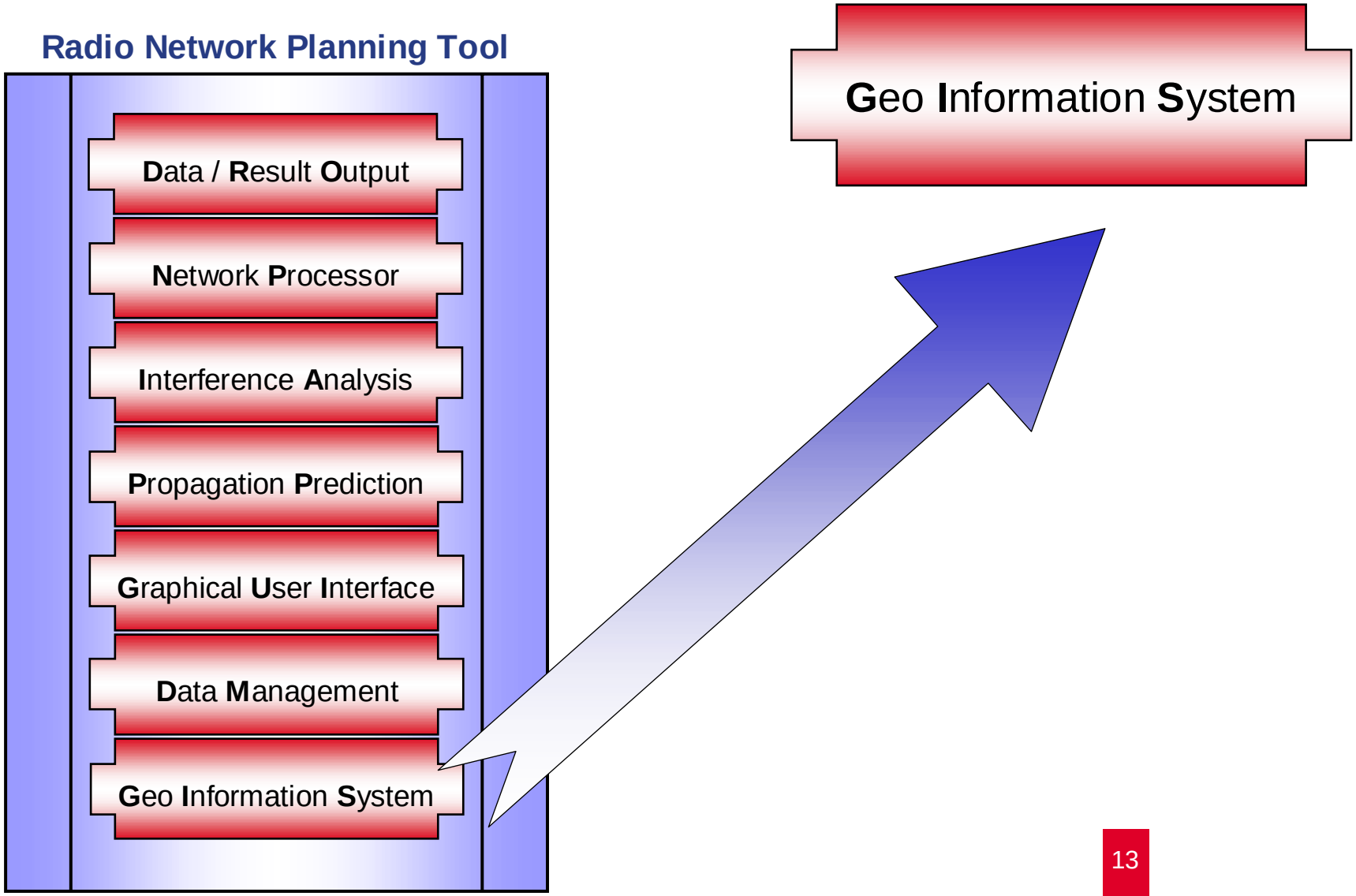
- FM
- TV
- T-DAB
- DVB-T

„Special“ Systems

- Satellite
- Air Traffic Control
- Maritime Services

Modern Radio Network Planning Tools





Modern Planning Tools typically use to basic Data Formats

Geo Information System

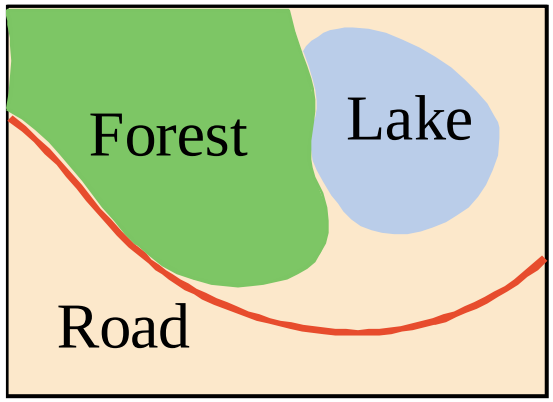
Vector Format

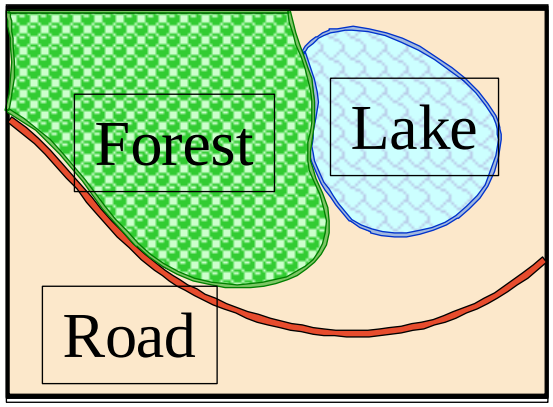
Geographical features described as:

- Points
- Lines
- Polylines

e.g.

- Names
- Contours
- Borders
- Roads



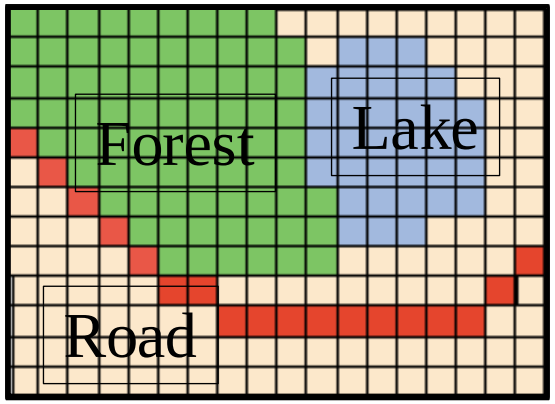


Raster Format

Geographical region divided in equally spaced areas (pixel)

Only **1** valued information for each pixel

- Elevation
- Clutter



Data Types

Modern Radio Network Planning Tools are using Digital Terrain and Mapping Data for:

- Display, Visualisation and Overlay Functionalities
- Comprehensive Calculations and Analysis (Coverage, Availability…)

Only used for Display, Visualisation and Overlay Functionalities

Geo Information System

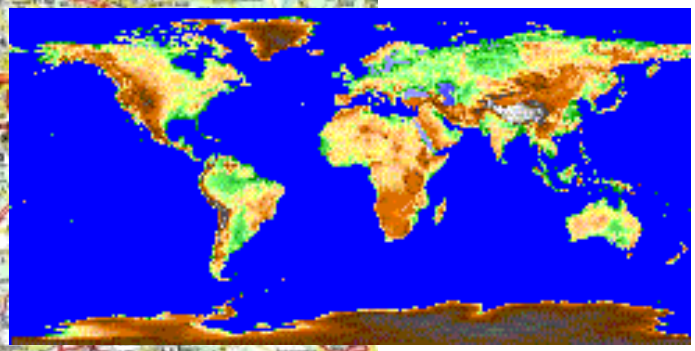
Overview Maps, Road Maps

Sources

- National Ordnance Survey
- Local Map Suppliers
- International Flight Maps

Scales

- 1:10,000
- 1:50,000
- 1:200,000 / 1:250,000
- 1:500,000
- ≥ 1: 1,000,000



...only used for Display, Visualisation and Overlay Functionalities

Geo Information System

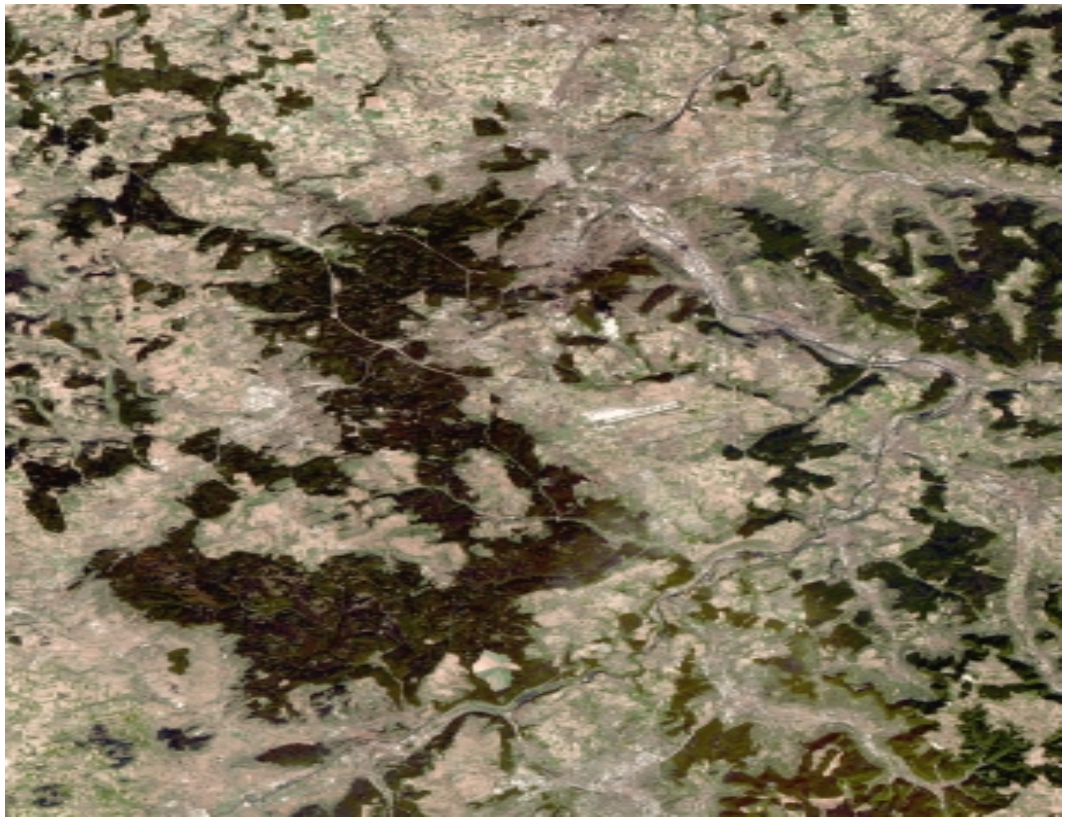
Satellite Images

Sources:

- SAR – Satellite Airborne Radar
- Optical Satellite Images
- Aerial Photography

Resolutions:

- 0.2 m
- 1 m
- 10 m
- 35 m
- 100 m



Data Types

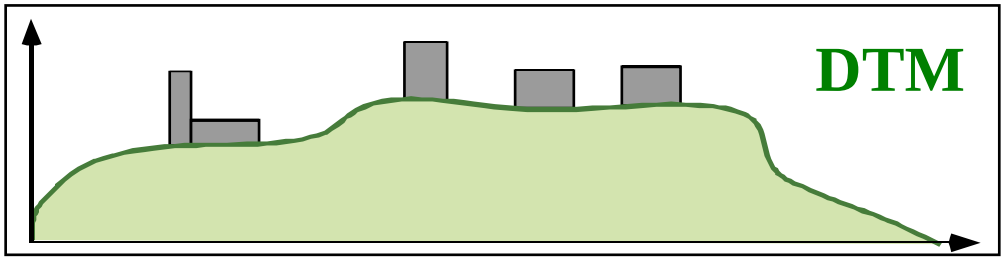
... also used for Calculations and Analysis

Geo Information System

Topographical Data ⇔ Elevation Data

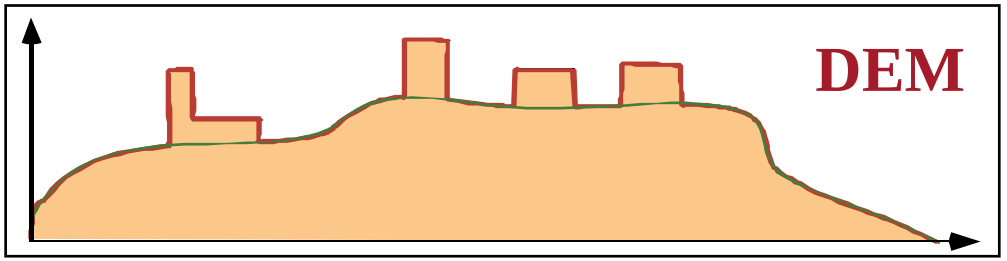
DTM – Digital Terrain Model

Elevation of earth surface



DEM – Digital Elevation Model

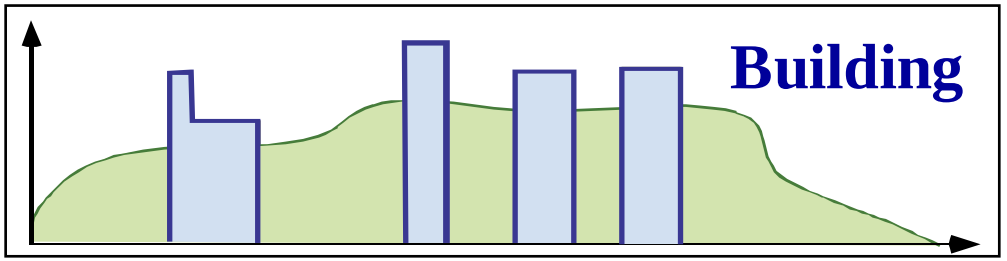
Elevation of earth surface
+ building height



Building

Elevation of earth surface
+ building height

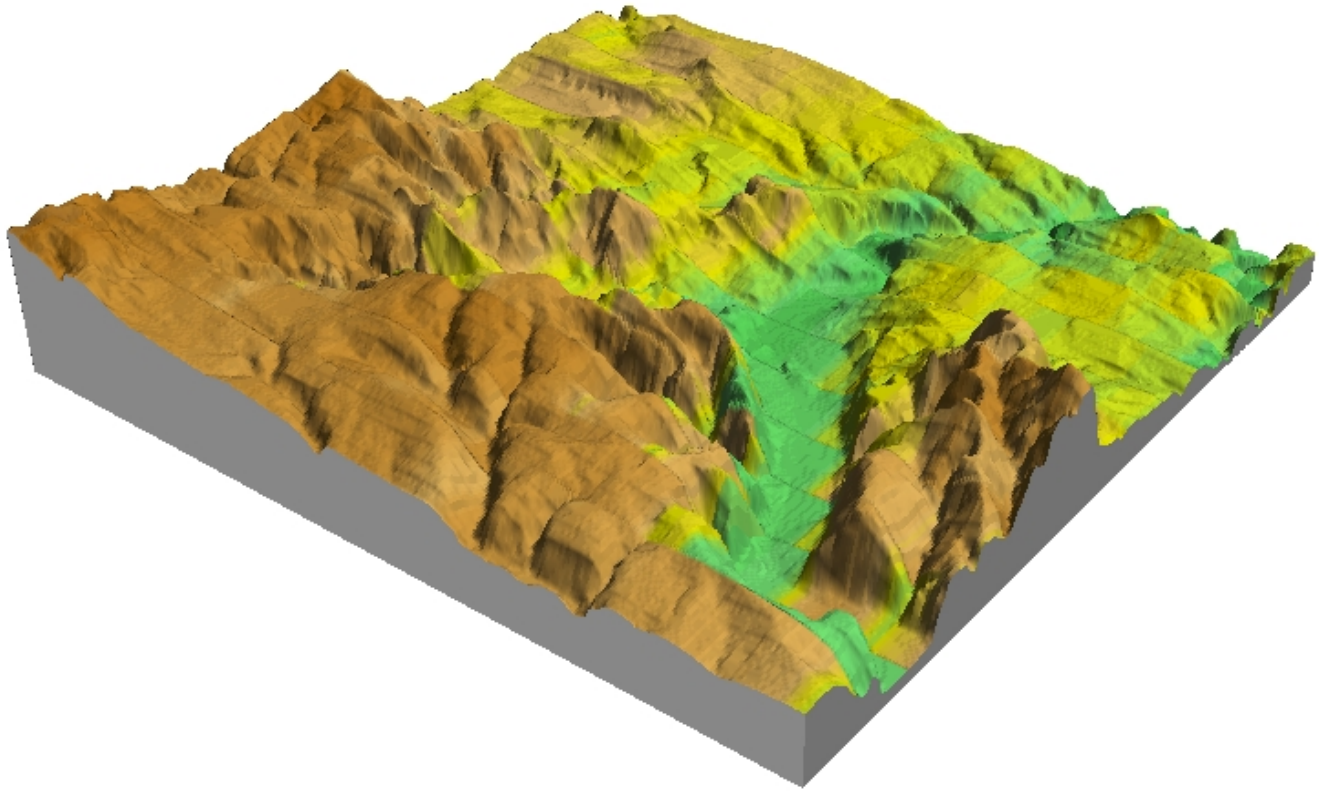
Only at building areas



DTM – Digital Terrain Model

Geo Information System

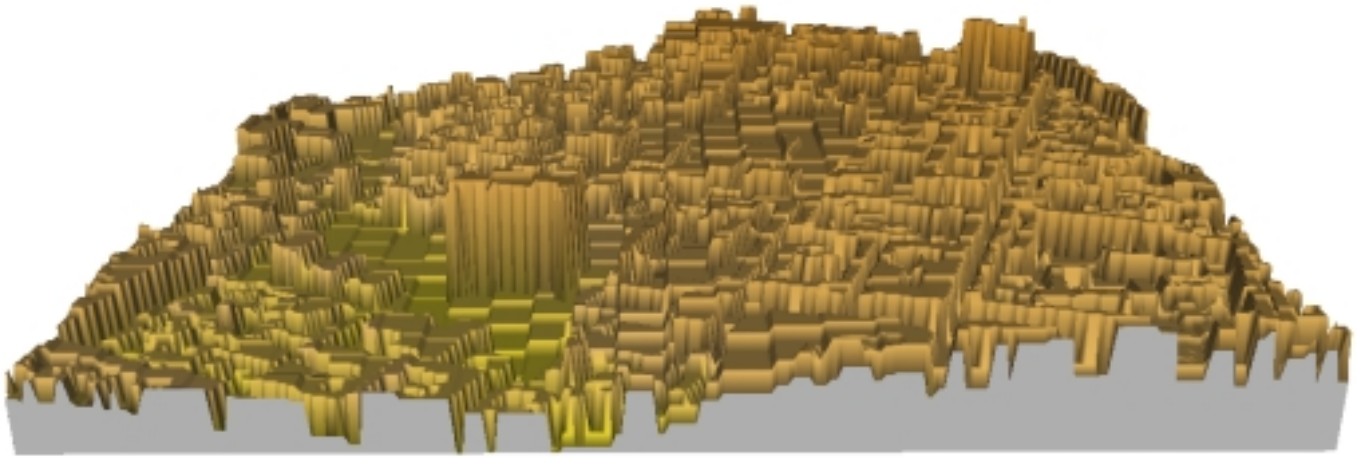
Resolution	Source: Paper Maps	SAR Satellite Data	Satellite Images	Aerial Photography	Laser Scanning
1000m	x				
500m	x				
200m	x				
100m	x	x			
50m	x	x			
25m	x	x	x		
10m	x		x	x	
5m	x			x	x
1m	x			x	x



DEM – Digital Elevation Model

Geo Information System

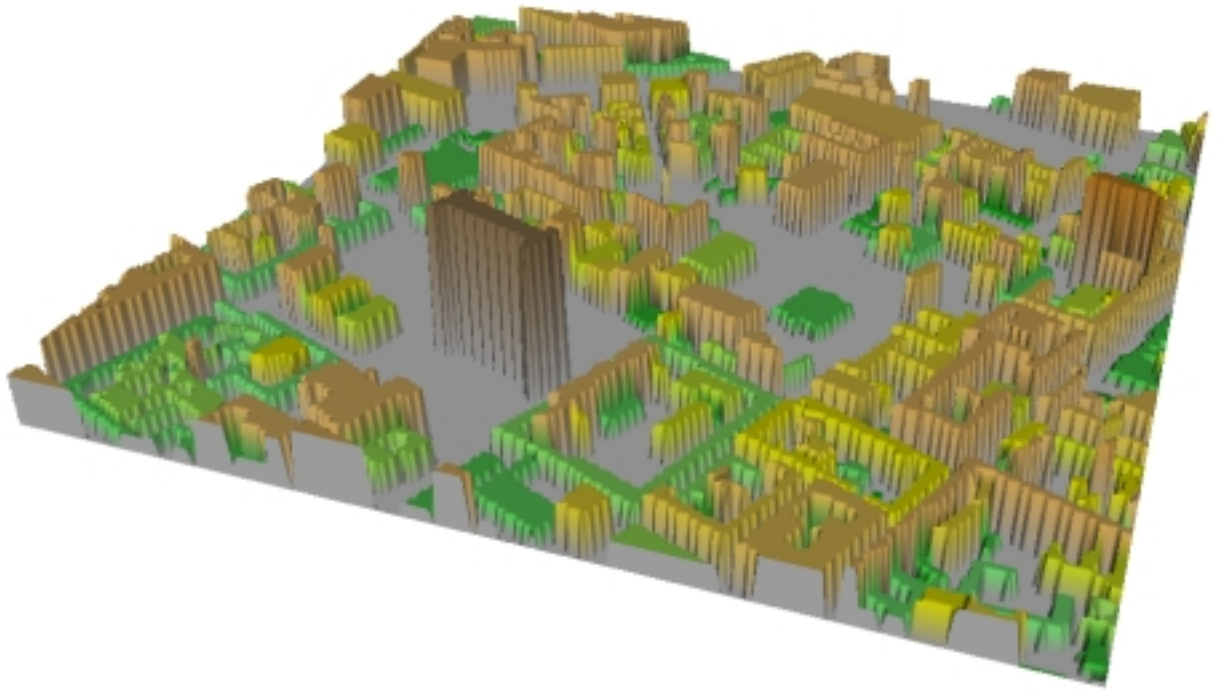
Resolution	Source: SAR Satellite Data	Satellite Images	Aerial Photography	Laser Scanning
1000m				
500m				
200m				
100m				
50m				
25m	x	x		
10m		x	x	
5m			x	x
1m			x	x



Building Data

Geo Information System

Resolution	Source: SAR Satellite Data	Satellite Images	Aerial Photography	Laser Scanning
1000m				
500m				
200m				
100m				
50m				
25m	x	x		
10m		x	x	
5m			x	x
1m			x	x



... also used for Calculations and Analysis

Geo Information System

Clutter Data

Also called:

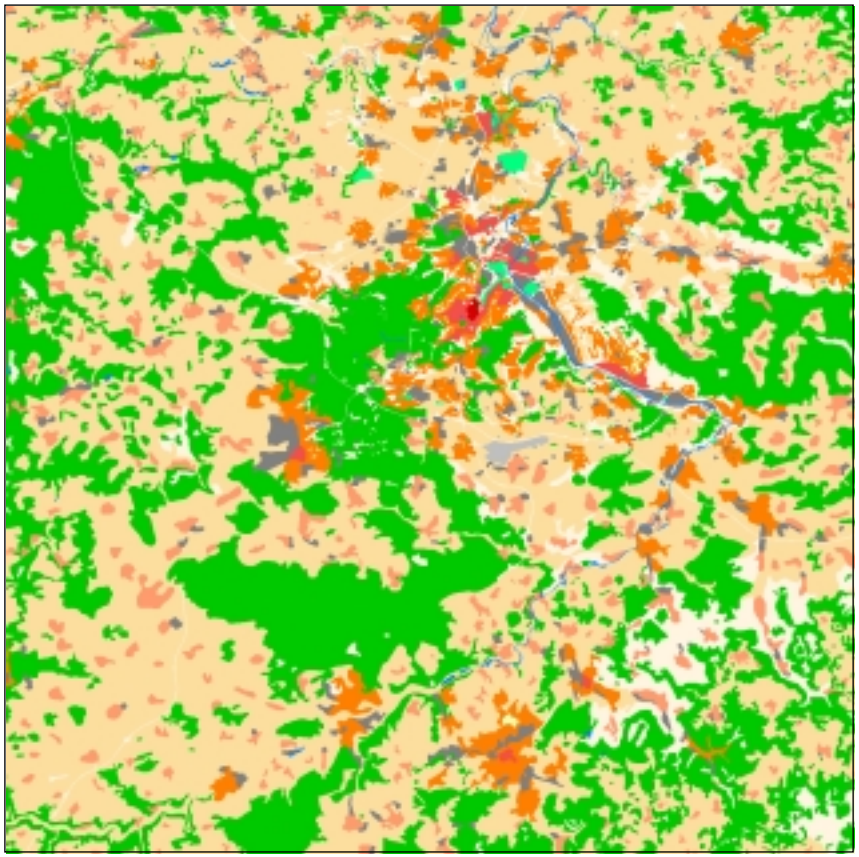
Morpho

Land-Use

Land-Coverage

Stores information about the coverage of the earths surface, like:

- Water
- Agricultural land
- Forest
- Village
- Industrial
- Urban

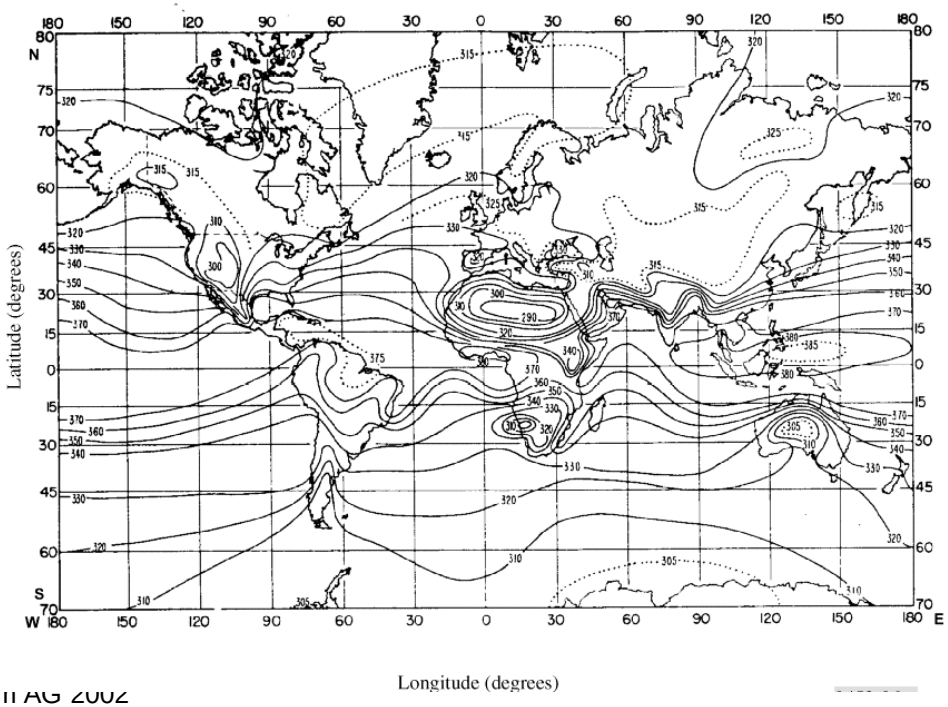


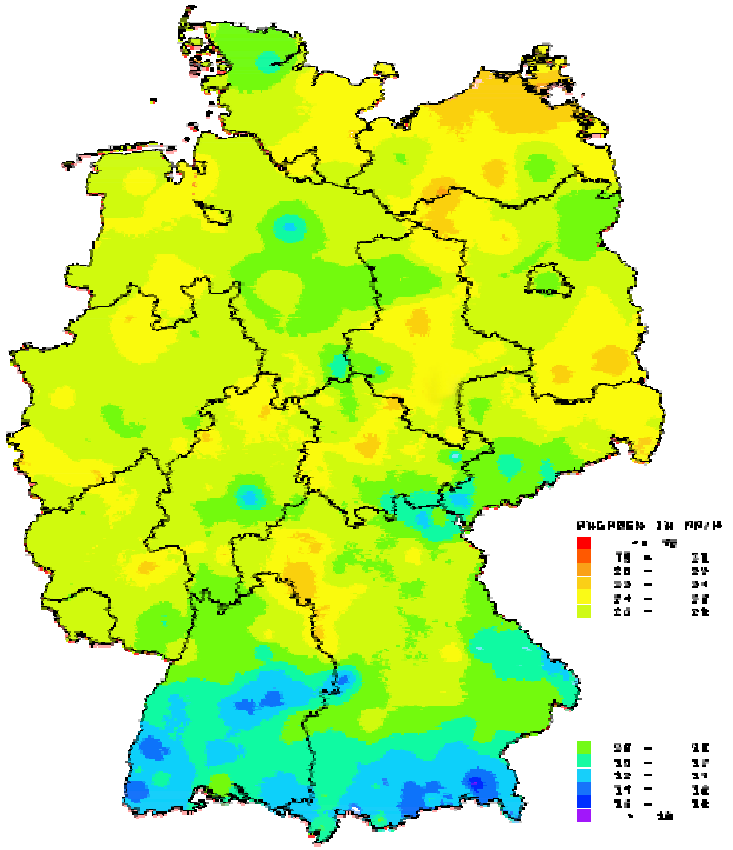
Resolution	Source: Paper Maps	SAR Satellite Data	Satellite Images	Aerial Photography	Laser Scanning
1000m	x				
500m	x				
200m	x				
100m	x	x			
50m	x	x			
25m	x	x	x		
10m	x		x	x	
5m	x			x	x
1m	x			x	x

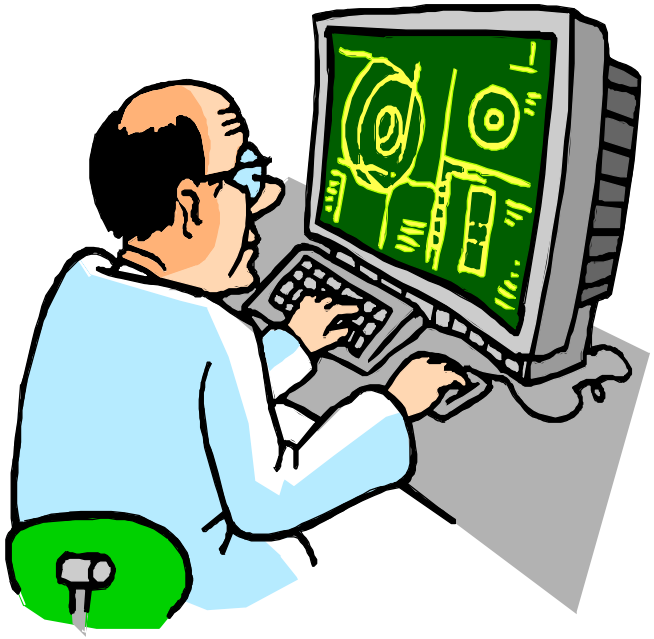
... for special Calculations and Analysis

Geo Information System

- Radio Climatic Zones
- Rain Rates
- Sea Level Surface Refractivity N0
- Electrical ground Conductivity
- Population Density







Live
Planning Tool Demonstration

Turn Key Data Services

- **The Quality of the Planning results are strongly dependend on the the type and quality of the used data.**
- **The best data for the planning job have to be found considering the costs.**

Turn Key Data Services

Generation of Digital Terrain Data

DTM, Clutter,Population, Traffic, Conductivity

Conversion of Customer Data

Conversion between different file formats

Transformation between different Coordinate Systems

Integration into LS telcom tools

Terrain data

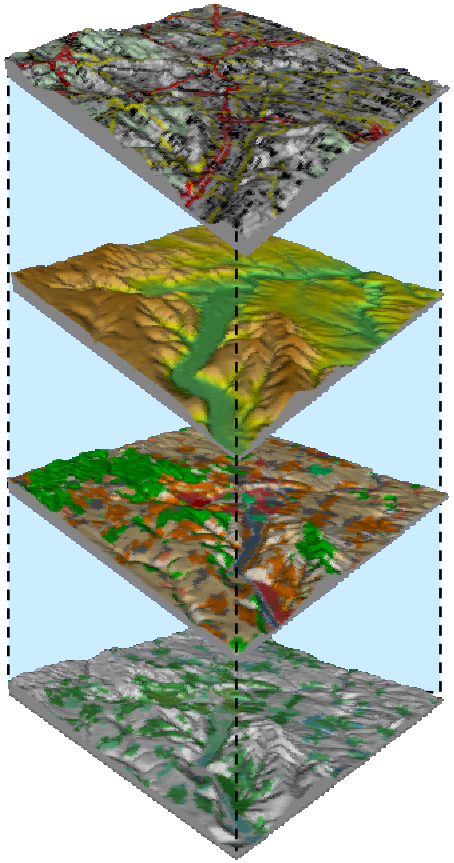
Local Coordinate Systems

Independent Evaluation of

Available data on the market

Best quality ⇔ price relation

Consulting



Software Tool

CATCHit