LS telcom Deutschland

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Näher dran.

Investigation on the Influences of Different Base Cell Geometries for Grid Based Structures in "Spectrum Licensing" applied to LS SPECTRA System

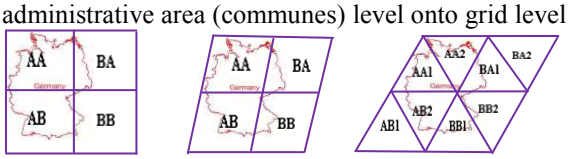
Introduction

Electromagnetic Spectrum is a scarce and precious resource. It is owned by the government of different countries. Frequency Spectrum is the complete range of electromagnetic waves from 3 Kilo Hertz up to 300 Giga Hertz which is used for different radio services e.g. broadcast service, mobile service etc as frequency band. Spectrum must be managed to ensure the efficient and equitable access for the services which use it and to facilitate re-use of spectrum which is limited by interference. For distributing and efficient use of spectrum the governmental authority needs spectrum licensing which is an authorization of specified radio frequencies to be used for a defined geographic area. Cost for a frequency use is often influenced by socio-demographic issues. The geographic area / license area is modeled by subdividing the land area into regular grids of different grid shapes. Each grid cell is identified by unique cell id. The license area definition can be provided to the license owner by using vector outline of the area or by listing the grid cells by cell ids. For the complexity of licensing process the spectrum management authority demands methods and the use of spatial software tools.

The goal of this work is the improvement of the existing spectrum management system tool e.g. **SALT** (**S**pectrum, **A**rea, **L**icense, **T**rade) and practical solutions to the problem within LS telcom's spectrum management system.

Contribution

- Developed methods for creating different hierarchical grid structures with unique cell id for the study area Germany and distributing population from administrative area (communes) level onto grid level



- Implementation of the developed methods for ***Create Grid Structure*** and ***Population Distribution*** tools which could be integrated into existing spectrum management system tool of LS telcom AG e.g. SALT
- Identified criteria for the rating of best suitable grid size and shape for a new country

Tools

- *MapBasic development environment* and *VB* programming language have been used for the algorithmic implementation of the developed methods
- Standard GIS tool *MapInfo Professional* has been used for data visualization and analysis

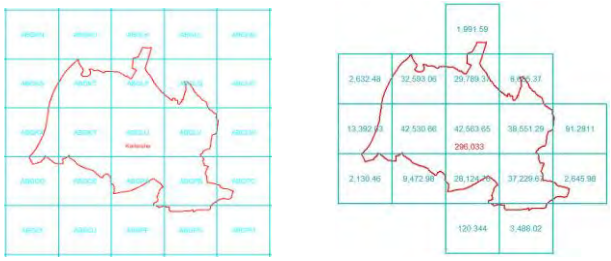
Comparison of Different Grid Shapes

Different grid shapes have been compared to find the best suitable grid size and shape for a new country. Comparison carried out for two different scenarios:

- Using grid shapes with different area sizes
- Using grid shapes with equal area sizes

The comparison criteria are:

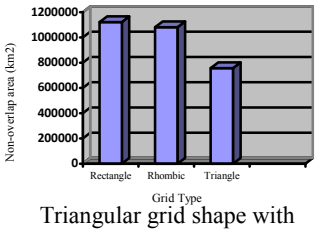
- Number of grid cells to cover the communes
- Amount of overlapping area of the grid cells per commune
- Amount of non overlapping area of the grid cells per commune
- Displacement of the distributed population due to non overlapping area per commune



Example: area around Karlsruhe

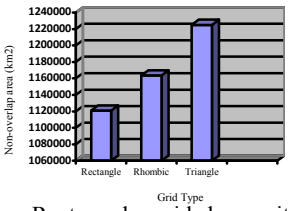
Comparison Results of Different Grid Shapes

The comparison of different grid shapes of different area sizes results that the grid shape which is smaller in size is best suited for the study area due smaller non overlapping area and less displacement of the distributed population.



Triangular grid shape with smaller non overlapping area due to it's smaller area size

The comparison of different grid shapes of equal area sizes results that the grid shape which needs fewer grids to cover the communes of the whole of the study area is best suited. Due to smaller non overlapping area it results less displacement of the distributed population.



Rectangular grid shape with smaller non overlapping area

Conclusion

The rules for defining a grid for new countries will be:

- The cell size should be as small as possible
- Total number of grid cells needed to cover the study area should be small
- Displacement of the population at the border of the study area according to the non overlapping area of the grid cells has to be small
- The total non overlapping area of all grid cells for every commune should be as small as possible

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