

Possibilities of Storage of Spatial Data of Real Estate Registry Information System

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Content

- An information system used by the real estate registry in the Czech Republic.
- Storage of spatial data in Oracle Spatial.
- Data generalization in Oracle Spatial.
- Spatial data modeling by the usage of a topologic data model.

An information system used by the real estate registry in the Czech Republic.

- Real Estate Registry Information System (RERIS) was created in 1997.
- Management of this system takes place within the Czech Office for Surveying, Mapping and Cadastre's (COSMC) authority.
- Presently it is the largest system in the Czech Republic.
- Real estate is registered according to the cadastre territories.
- The cadastre territory is the main unit of administration.

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Real Estate Registry Information System

- The content of Real Estate Registry Information System is composed by the file of survey data and by the file of descriptive information.
- The functionality of RERIS depends on the digitalization of cadastral documentation.
- The process of cadastral documentation digitalization has started in 1993.

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Process of cadastral documentation digitalization

Number of cadastral territories with digitalization of the file of survey data in the department of COSMC.

Situation in the year	Number of cadastral territories				Digitalized cadastral territories in % ¹
	DKM	KM-D	total in the year	total on 31.12.	
do 1997	436	1	437	437	3,4
1998	157	12	169	606	4,7
1999	239	94	333	939	7,2
2000	402	647	1049	1998	15,3
2001	180	260	440	2428	18,6
2002	305	148	453	2881	22,1
2003	475	68	543	3424	26,3
2004	380	3	383	3807	29,2
2005	314	0	314	4121	31,6
2006	279	0	279	4400	33,8
2007	406	0	406	4806	36,9

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Spatial data in RERIS

- RERIS was built on the Oracle platform.
- A very important part of the file of survey data is a digital cadastral map (DCM).
- DCM is a continuous and seamless map on a scale 1:1000.
- The way of storage of DCM in RERIS is similar to the “topological” concept.

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Storage of spatial data in Oracle Spatial

- Oracle Spatial (further Spatial) is an integrated set of functions and procedures allowing storage, access and analysis of spatial data in rapid and affective way of the Oracle database system.
- Object-relational model.
- Topology (winged-edge) data model.

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Object-relational data model

- Spatial supports the object-relational model for the storage of spatial data.
- It actually means that each geometrical description of spatial object is stored in a cell within the table.
- This is possible because of to the usage of SDO_GEOMETRY object type of data.
- Then there are stored descriptive data together with spatial data in one table.

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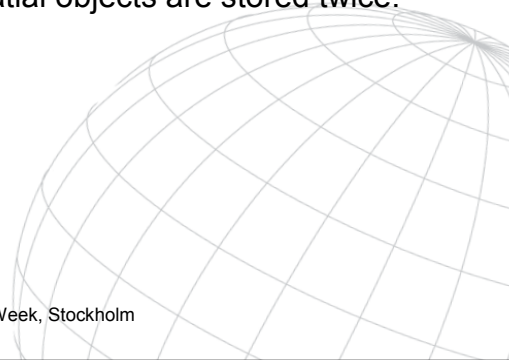
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Object-relational data model

- One of the main facilities of object-relational way of modeling of spatial data is easiness of creation of spatial index.
- On the other hand the object-relational model causes the data redundancy because an identical part of geometrical descriptions of adjacency spatial objects are stored twice.

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Use of SDO_GEOMETRY object type of data to model the cadastral boundary

- We tried to store a cadastre boundary in an object-relational way.
- The storage of spatial data by means of object type of data allows users/administrator to store the geometrical description of spatial feature in one cell within the table.
- The minus is if two cadastral territories share a part of boundary this way of modeling of spatial data leads to the origin of duplicity data.

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Usage of the SDO_GEOMETRY object data type

- ```
CREATE TABLE CADASTRE_TERRITORY (
 id NUMBER PRIMARY KEY,
 cadastre_code NUMBER(6),
 boundary SDO_GEOMETRY,
 def_point SDO_GEOMETRY
);
```

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## Usage of the SDO\_GEOMETRY object data type

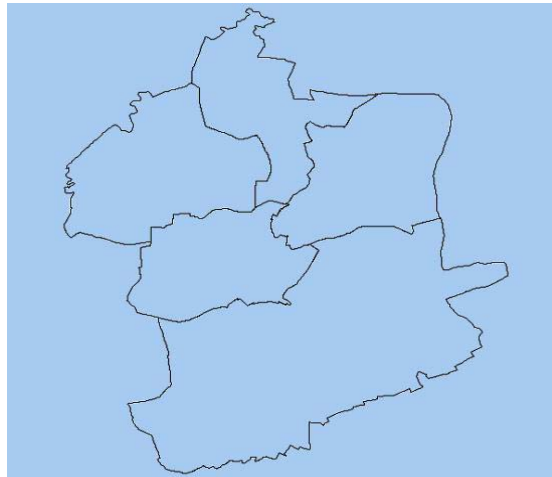
- The special program was created.
- This program loads spatial data from RERIS and return the right geometrical description of boundary of particular cadastral territory.
- Due to the usage of the application MapViewer by Oracle we were able to display data stored in SDO\_GEOMETRY.
- Display of spatial data from the CADASTRE\_BOUNDARY table run very quickly due to the fact that all geometrical descriptions are stored in one place.

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## Plan position map of cadastral territories

Plan position map of cadastral territories.



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## Facilities of object-relational data model in Oracle Spatial

- Without any doubt there are pluses in spatial data modeling by means of the SDO\_GEOMETRY object type of data.
- For example it displays data fast and it is easy to build up a spatial index.
- The most negative part of object-relational concept that was tested are occurrence of data duplicity and difficult editing.

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## Data generalization in Oracle Spatial

- We tested available Spatial's functions over spatial data stored as objects.
- We can use these functions written in PL/SQL programming language for the purpose of generalization.
- The main purpose of data generalization is to produce data with less spatial details from the very detailed data.
- Very important request regarding the function generalization it is preservation of all spatial relationships.

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## Data generalization in Oracle Spatial

- We want to keep adjacency after simplification of origin geometrical descriptions in case of cadastral boundaries.
- All tested functions of generalization need a geometrical input of SDO\_GEOMETRY object type of data.
- Functions were tested with various values of input parameters.

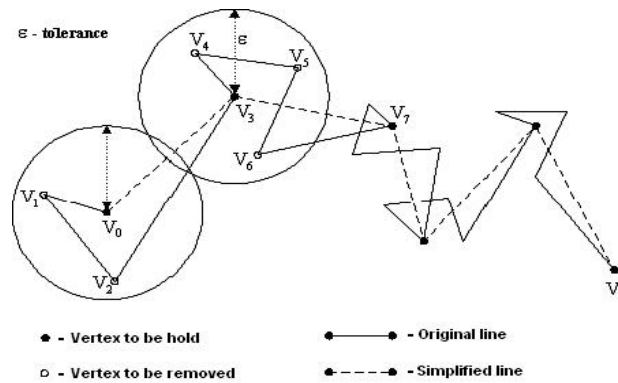
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## Data generalization in Oracle Spatial

- REMOVE\_DUPLICATE\_VERTICES function.



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## Data generalization in Oracle Spatial



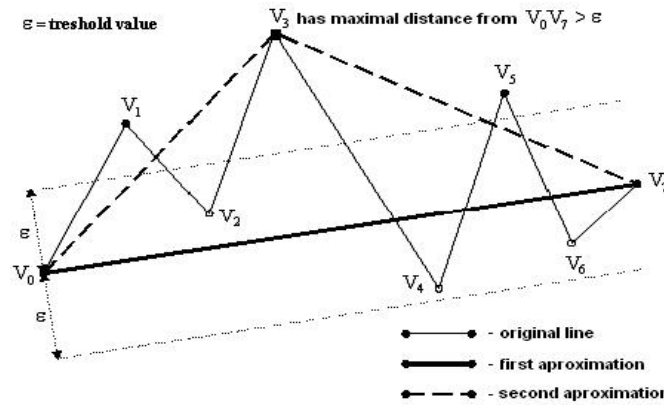
Plan position map  
after applying of  
REMOVE\_DUPLICATE\_VERTICES function.

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## Data generalization in Oracle Spatial

- SIMPLIFY function.

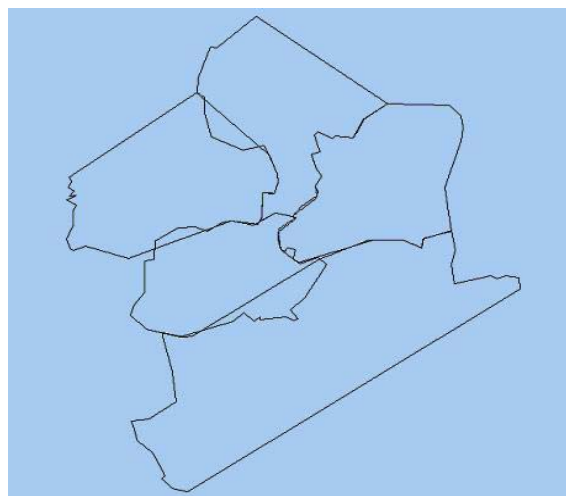


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## Data generalization in Oracle Spatial

Plan position map  
after applying  
function SIMPLIFY.



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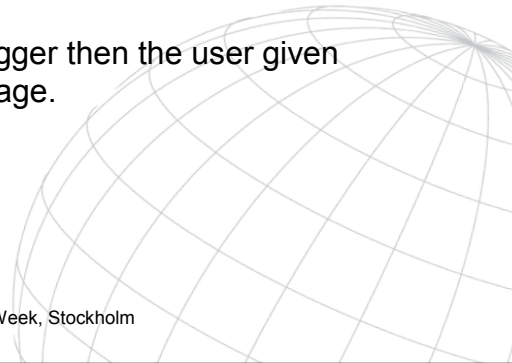
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## Data generalization in Oracle Spatial

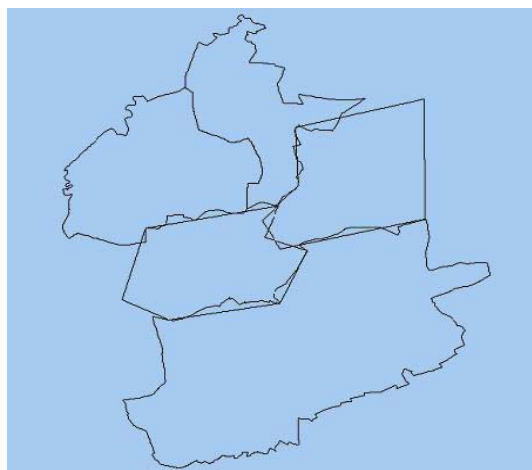
- **SIMPLIFY\_GEOMETRY function.**
  - The main purpose of this function is to simplify geometrical description of spatial feature.
  - We compare the area of origin polygon to the area of simplified polygon.
  - This ratio should not be bigger than the user given threshold value in percentage.

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## Data generalization in Oracle Spatial



Position plan map  
after applying of  
SIMPLIFY\_GEOMETRY function.

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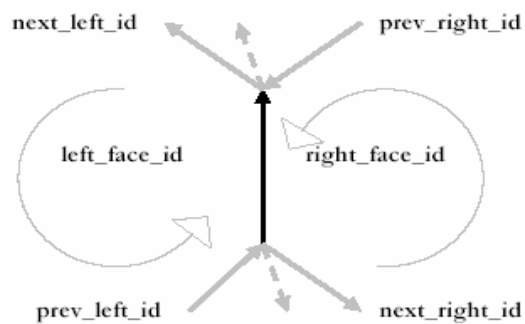
## Topology data model in Oracle Spatial

- The topology of Oracle Spatial data model corresponds with the winged-edge structure.
- The start node and the end point determine the edge orientation.
- For each edge we store reference on the face on the left side and on the face on the right side.
- Next we store references on four edges.

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## Topology data model in Oracle Spatial



Winged-edge structure in Oracle Spatial.

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## Hierarchical data model in Oracle Spatial

- Oracle Spatial 10g offers very interesting facility for data modeling - it is possible to create several hierarchical layers for one data set.
- The higher layer level consists of the lower layer level within the frame of hierarchical data model.
- This can be very useful for cadastre because the regional division has apparently a hierarchical character.

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## Conclusion

- If we want to keep a topologically structured spatial data in a database we must consider carefully pluses and minuses of it.
- We must especially consider demands for the data maintenance and the functionality of the application working with these data.
- Fast evaluation of the most frequent usage of the spatial queries is preferred very often.

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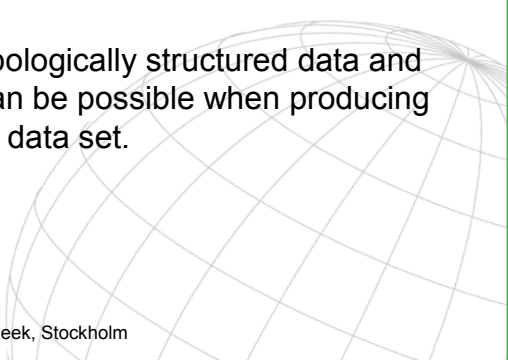
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## Conclusion

- Possibility of the usage of the Oracle Spatial and the winged-edge structure for spatial data of the Real Estate Registry information system is the topic for our next research.
- We want to focus mainly on the usage of the hierarchical data model.
- Advantage of the usage of topologically structured data and the hierarchical data model can be possible when producing hierarchical layers for the one data set.

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## Thank You for Your Attention!

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