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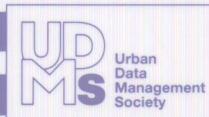
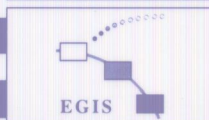
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# GIS of the Town of Zagreb, Croatia

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## Summary:

In this paper intention of the author is to highlight some specialities developed and implemented in the City of Zagreb GIS project. The whole project is standard large multi-user land information system, based on UNISYS System 9 GIS, and as each implementation has its specialities we would like to expose ours. The main facts about project are in the paper "Digital cadastral model - City of Zagreb", given by our managers.

## REQUIREMENTS

The basic idea of this project is to extend current City IS with graphical data and GIS analysis possibilities. The first task was to build LIS based on cadastral entities and addresses as links towards large IBM mainframe on which different kinds of applications like taxation, census and registers, public utilities, etc., are running on more than twelve-hundred terminals in many municipality offices across the town. The database for cadastral entities is not relational (DL/I), but basic integration was required. Also security standards (user privileges, backups, etc.) are very high in IBM world, and was required too. Concerning the source of graphics data, there were no data in digital format, only maps to digitize.

## SOLUTIONS

### SYSTEM ORGANISATION

We put large SPARCcenter 2000 in our data processing centre (GZAOP) to act as central GIS system, and SUN workstations as LAN servers and PCs in local centres. Each user is unique on every system and as all systems have same logical organisation, it looks as one integrated system. The connection with IBM is also established with 3270 emulation, so each user can work on regular IBM applications in GIS environment. Even program to program HLLAPI interface is established to obtain data from DL/I into X environment.

### DATA CAPTURE PROCESS

In data capturing process we decided to scan and manually vectorize the data using SYSTEM 9 possibilities. Some parts of our task are covered with SYSTEM 9 automatic procedures (ACL jobs - Application Control Language) - like raster registration, some of them are just precise defined operators procedures - for data capturing process we describe each step for digitising each feature in DCE(Data Capture and Edit), and some of them are KSH and ATB (Analytical Tool Box) applications - like quality control functions. The basic amount of work is one cadastral district (cca. 20 - 50 1:1.000 maps). Each district is first prepared for data capture, captured and then controlled versus IBM databases.

### MAP PREPARATION AND MANAGEMENT (CHECK IN AND CHECK OUT MANAGEMENT)

For each given district and number of available operators we first establish partition management. In SYSTEM 9 work is done through partitions - areas clipped from whole project, not on project itself in order to assure data integrity. So, first we identify our partitions (size of actual map + cca. 10 % for edge matching area) and exact Check in and Check out order. According to that plan, paper copy of each map goes through map preparation procedure. Each feature and attribute for data capturing process is pointed out. Also edge matching area is clearly marked. It is different for each map depending whether neighbouring map is already finished or not. And also very large features are excluded from this edge matching preparations. They are captured at the end in time of completing and verifying whole district.



#### RASTER REGISTRATION

Each map, from given district, is then scanned, filtered to avoid dirt and ensure best visual quality, and registered via RDM(Raster Management Module) module of SYSTEM 9. Because of distortions of maps, some problems in RDM module and precision required for geodetic purposes each map is divided in 40 100 x 100 m squares and registered in that way.

#### DATA CAPTURE

Data capturing process is done through DCE module of SYSTEM 9 in order to assure all SYSTEM 9 data model benefits like topology checks and usage of shared primitives. Because DCE is not yet programmable (it will be in next release) no special applications are build. But work flow and rules for capturing each feature are done, so some day custom data capture application will be build.

#### QUALITY ASSURANCE

Special attention is given to assure each user (this system is going to have different type of users - not only owners of data) that data that is put in are genuine and correct. At first level we build applications that can help operator to check whether all data is topological correct; check possible relationships towards other data like overlapping, touching, etc.; whether shared primitive rule was used or not; are all attributes filled in; in which ranges; etc. This application is data model independent and is used in different departments according to their specific rules.

For capturing parcels there is another application that checks IBM database looking for all possible parcel numbers and compares calculated and given area. After this control there is very good picture of quality of data in both GIS and IBM parcel databases for that particular district. After finishing data capture and edge matching process for whole district, as this process can last from two to six months depending on number of operators and map sheets, situation in IBM databases changes. Now we can identify only those changes and update necessary data. From now on both databases are up-to-date and any changes are performed parallel in both of them. If necessary this procedure of checking both databases can be performed anytime.

#### SECURITY AND BACKUP

Because of multi-department organisation of town, each department and each type of user inside department has its own security schema - which features he is allowed to see, and for which is responsible to update them. This was not easy to implement, but users and data are protected of each other in most acceptable way. Data processing centre is focal point in which all this administration is done, and also responsible for backing up regime. For each operator there is possibility to do disk backup any time he feels danger of some problematic action, and tape backups are performed automatically at the end of every working day. Also each partition and whole project is backedup in each Check in and Check out time, so rollbacks can be performed in case of parallel data update and data conflict occurs.

#### EXCHANGE OF EXPERIENCE

These are just some basic ideas applied in building of our GIS project. We are willing to share or better exchange our experience so far with anyone having similar organisational or application situation.