

Information – focus of GIS and BIM technology

Msc. Dražen Galić, civ.eng.

About myself

- I graduated on Civil engineering faculty in Rijeka and got master of science from FAGG Ljubljana, Slovenia
- I worked on Civil engineering faculty in Rijeka for 15 years as assistant professor and lecturer. My teaching courses are related to geomechanics and geotechnical engineering
- Also, I lead courses regarding GIS implementation in communal engineering
- Currently I'm in company StudioARS. I am company founder and CEO
- From earliest professional days I am deeply interested in IT and implementation of IT in civil engineering
- Today I will talk, in more details, about some BIM aspects in comparison to GIS technology (think that GIS is more matured as technology in practice)

2/26

About StudioARS

- Main StudioARS activity is implementation of IT in civil engineering - infrastructure
- Base of all company activities is Autodesk technology
- Important fact is that StudioARS produces software Urbano for design and analysis of underground pipe systems – water distribution and drainage systems (up to 3,000 users)

My GIS story

- In 90's I was part of some GIS implementation projects, especially in communal companies (water and sewage systems)
- I followed and analyzed different IT solutions for GIS implementation (Autodesk, ESRI, Intergraph)
- As mentioned, I did teach lecture “GIS in communal engineering” on Civil engineering faculty in Rijeka

My BIM story

- Because of the global impression that BIM approach is mainly IT issue (that is basically wrong), StudioARS and me personally participate in presenting, demystification, and implementation of BIM approach in several Croatian companies
- I am a part of the team which implements BIM approach in Croatian Roads – governmental company that takes care for all aspects regarding building new roads and maintain existing ones
- I am one of the authors of publication “Directions for BIM approach in infrastructure”, supported by Chamber of civil engineers in Croatia
- I participated in investigation and analysis of using BIM approach in obtaining of building permits from Ministry of Physical Planning, Construction and State Assets

GIS and Urbano

- Software Urbano is mainly used for detail design and analysis of underground pipe system
- From early days I understood that GIS is inseparable part to detail design
- The crucial component of effective design are valid and complete set of existing data coming from GIS
- In Urbano we developed, with special care, set of functions to import existing data from various sources
- In addition, we implemented some well-known GIS functions like search and query, thematic mapping, flexible data grid views. Also, we applied network topology rules to manage pipe networks

6/26

BIM and Urbano

- I take care that basic BIM principles are embedded in software Urbano so it can be treated as “BIM ready” software
- Program architecture which was adapted to meet GIS demands (data input/output, data management...) well serves for some BIM approach purposes
- In addition, some possibilities for communication inside of team are also implemented – multiuser environment based on external data base
- Very good IFC exporter is implemented in Urbano, as well.
- 3D presentation of model (just view style, dynamic behaviour)

In general about GIS technology

- If we represent GIS and BIM as two apart technologies, we can say that GIS is older one, more matured and more understandable to wider audience
- I would say that nobody really questions GIS, its use and benefits, contrary to BIM (which still has sometimes wrong perception)
- I can say that nobody doubt that information about existing resources should be constantly captured, modified and analyzed
- Also, it is pretty expectable that data/information in GIS systems should be well organized to be accessible in any moment from any place (means cloud storage systems)

In general about BIM technology

- In comparison to GIS technology, BIM attracted attention later never mind that it was initially defined almost 50 years ago
- cca. 20 years ago, global software companies initiated aggressive marketing and promoting of BIM technology by using their products
- There are several myths that the engineers started to believe in, such as “BIM is basically 3D design”; “I use software *XY* and I am in BIM”...
- Real nature of BIM technology was very simplified, often misunderstood and hidden
- It was not clear to the engineers that BIM is a set of comprehensive procedures, recommendations and rules which have impact on all phases of object creation from initial planning, design to construction and maintenance

9/26

What is in common to GIS and BIM?

- In general, the both technologies have in common INFORMATION (that letter “I” in acronym)
- Seems to me that this fact is clear in GIS but hidden and bit foggy in BIM approach
- The only important difference is way how information exist – in GIS they are existing information and in BIM information refer to something what will happen (future object/project)
- Also, some information in BIM supported processes are of temporary significance (just used in the building process) and later on not relevant any more

10/26

GIS and BIM together

- We start with assumption that relevant and updated set of necessary information exists for specific location where new project/object should be created
- Set of necessary information is stored in several information containers like existing utilities, objects and parcels, social data (inhabitants, points of interest...), meteorological data, ...
- Holistic design approach tends to capture all relevant data which can have influence on future behaviour and function of new object/project
- In BIM supported processes different tools should be able to capture necessary data from GIS systems to make analysis which are part of design
- It is very important to analyze and understand influence of new project/object on existing resources (environment, human activities, nature protection...)

11/26

Information management

- Previously it was emphasized that base of everything is information (worthy and useful data) – both in GIS and BIM technology
- It is necessary to imagine wider picture of information. Information could be some single data (numerical, string, logical...), picture, text, symbol, graph...
- It is possible to group some information according to different criteria, to facilitate their management
- Information can be saved roughly in two ways – files and databases
- Seems to me that in GIS the barrier of “databases” is overcome – databases are quite usual way to store data (files are used mostly for data sharing)

12/26

File based information storing

- File is information container which can be created or edited in specific software
- There are countless number of file types
- All the file types can be divided into two groups – those which format is public and those which are proprietary (ownership of some company)
- Examples of proprietary formats are i.e. DWG, RVT (Autodesk) while open formats is i.e. IFC (bSI)
- With proprietary files you must have appropriate applications to view, edit and save files (information in files) while with public file formats we can use more applications
- If we have choice to select different applications we can benefit in price, functionality, support...
- OpenGIS and OpenBIM ideas become stronger, and more and more engineers accept and favorize them
- Complete collaboration and interoperability are easier to achieve in OpenGIS and OpenBIM approach

13/26

Information storing in databases

- In this presentation I will not go deep into analysis of theory, types and properties of different database systems. I will make simple explanations
- When we talk about database we have in mind group of tables with data/information which are connected with relations (relational databases)
- Databases can be files (i.e. Acces, SQL Lite) but we have more in mind “non-file-based” databases like Oracle, SQL Server, Postgre SQL, and so on.

Advantages with file based information storing

- **SIMPLICITY** – file-based information management is usual, and everybody understands it
- **ORGANIZATION** – by creating folders it is simple to achieve understandable organization
- **FILE SHARING** – it is ease to share files – e-mails, social networks,...
- **FILE PROPERTIES** – it is easy to check file properties (size, dates...)

Disadvantages with file-based information storing

- **VERSIONS** – versioning doesn't exist (we don't take into account CDE or other platforms). Versioning is usually achieved with copies with different names
- **CONCURRENT WORK** – doesn't exist usually
- **FILE SIZE** – files significantly increase and become cumbersome for using
- **HOW TO REACH NECESSARY INFORMATION** – file contains information which producer defines. It is hard to extract really necessary information (sometimes they don't exist)
- **USING PRIVILEGES** – not possible to define
- **REDUNDANCY** – it is hard to avoid redundancy

Advantages with database information storing

- **USING PRIVILEGES** – it is easy to create rules who and in what way can access certain information (administrative privileges, different categories of user privileges)
- **MULTIUSER ENVIRONMENT** – it is possible with data locking and restricting of possible actions
- **NOTIFICATIONS** – in one team notifications to different triggers can be established
- **SYSTEM SAFETY** – there are well defined procedures of system safety (i.e. preventing of unauthorized access)
- **ACCESS TO INFORMATION** – information can be accessed through different applications with different SQL with attribute or spatial conditions. It is possible to access only necessary information
- **INFORMATION MANAGEMENT SPEED** – much faster work with huge quantity of information
- **ADMINISTRATION** – it is possible to take care of usage statistics, to have history of different actions and so on
- **VERSIONING** – good databases have versioning options
- **REDUNDANCY PREVENTING** – unlike work with files, it is possible to avoid redundancy (“single source of truth”)

17/26

Disadvantages with database information storing

- **PRICE/EXPENSES** – DBMS costs more than standard systems. Maintaining of the system requires more resources (financial and human)
- **COMPLEXITY** – system could not be simple and requires knowledge and experience

Trends in GIS

- As mentioned earlier, in GIS there is no doubt that databases have to be used, that data should be available from any place in any time, that only updated information have value
- I would say that in GIS field there are visible processes of integration of different information containers.
- We used to look GIS in more narrow form, just spatial and attribute data about objects of interest
- It is obvious that different information containers should be connected or even overlapped. That means that “classical” GIS should be integrated with AM, then ERP...
- Target would also be finding better systems to store more and more information which can be captured, with faster responsiveness when finding and reading them

Trends in BIM

- If we look at BIM from information point of view, it is of most importance to enable equal approach to all necessary information by all stakeholders in the BIM process
- Challenge is that all stakeholders in BIM can have pretty different roles and tasks. Some of them are in the process just temporary (short term), their tasks vary a lot, they are using very different software and technology...
- From all above it would be clear conclusion that information saved in files (never mind open or proprietary) is not long term effective and sustainable
- Long-term speaking BIM should go in direction of some kind of database information storage

20/26

Data connector technology, data exchange

- With DC technology we can establish data exchange which **takes data structured under a source schema and transforms it into a target schema, so that the target data is an accurate representation of the source data.** Data exchange allows data to be shared between different computer programs.
- DC offers API for creating different connectors to different files or databases.
- Destination is kind of database, sometimes called “data warehouse” or “data lake” (they are different according to existence of relational schema)
- When we are talking about DC technology, very often we mentioned so called „Granular data concept”
- “Granular data concept” is term which describes concept in which it is possible to approach information itself through prepared functions/procedures (API) (i.e. ontological data organization)
- In that concept user can take just necessary information (with all connected and related parts) and do appropriate actions
- That concept opens the door to real interoperability and collaboration which are so important in BIM

21/26

Examples of data connector technology in BIM

- First of all we have to conclude that DC technology in BIM is on conceptual level, means that we have some proofs of concept but not real use (at least not according to my knowledge)
- We need to invest efforts to make public data schema of data storage in BIM. Only with that we will be able to use full potential of DC technology to strengthen interoperability and collaboration in BIM processes
- Autodesk showed data connectors which enable data capturing from various applications (Revit, Civil 3D) and save them to data storage (unspecified data storage in BIM 360)
- I follow the company/solution Speckle which showed their DC solution. That solution is very promising (at least from my point of view)

22/26

About IFC (Industry Foundation Classes)

- IFC is a very famous file format, sometimes treated as synonym for BIM
- IFC is maintained by buildingSmart International association which is probably the strongest independent BIM association in the world
- Current newest version of IFC is 4.3, which includes some necessary modifications for infrastructure (roads, ...)
- IFC implementation is not on highest level. Software vendors frequently implement IFC on low level. They do not use all possible features and often support just basic level of IFC
- My personal opinion is that IFC file format did not fulfil expectations completely

23/26

General IFC properties

- First of all, IFC is **FILE**. Previously I analyzed and concluded that files are not future of BIM – no matter how well defined and supported they are
- IFC is not meant to be permanent information storage, it is just file for data sharing among BIM stakeholders
- Furthermore, IFC is not meant to be information storage for complete recreation of design model. That means if design model is created in software A, through IFC it is not possible to recreate model in software B (if A and B are software packages for same purpose – i.e. authoring design software)
- IFC is not bidirectional. For example, when model is created in authoring design software through IFC file, part of model can be delivered to 3D coordination software (i.e. for clash control).
- Some authors to better explain role of IFC file, defined IFC like PDF file format for BIM.

24/26

Future of IFC

- There are some announcements for transition IFC to version 5, not in details just general
- Seems that bSI would like to move IFC from single direction file to kind of permanent information storage. They open possibility to add several group of information for objects by different stakeholders (at least I understood like this)
- IMHO it is not effective way. My opinion is that bSI should use their enormous knowledge and experience of information management to create and support some data warehouse storage which can replace or contribute IFC files

Future of BIM

- Even on oldest pictures and explanations BIM level 3 was shown as ultimate target
- BIM level 2 uses files for communication, CDE environment and so on
- BIM level 3 was represented as cloud saved information container and models which are disposable for concurrent work of all stakeholders
- Now we can show contours of BIM level 3, but lot of work is in front of us.
- The biggest problem is standardization in every aspect – capturing, storing, finding, reading, editing and writing of all information
- There are many additional difficulties, but I can say that we are better and better, and we started to fulfil promises have given when BIM approach is initially presented.

26/26