

## Chapter 6: Conclusion

As stated in Chapter 1, the aim of this study is to determine to what extent GIS software can be implemented in order to manage, analyze and visually illustrate an IT-network between buildings as well as inside buildings on a campus. The study intended to address this problem statement by achieving four objectives, as set out in Section 1.2. Chapter 6 is divided into four sections, describing the purpose of each objective, as well as the methodology to achieve them. The four objectives are:

- Literature study
- Data capturing
- Developing the data model
- Data model analysis capabilities

### 6.1 Literature study

The literature study aimed to create an understanding of the implementation methods of computer network. The literature study also highlighted the need for an information management tool to store, organize and analyze the network infrastructure data. It was concluded that GIS software offers numerous benefits when compared to alternative information management tools.

In order to create a better comprehension of GIS, the literature study described the basic concepts of a GIS including coordinate systems and feature representation. It was found that the geodatabase offers the most advantages in terms of feature representation, which lead to an exploration of the basic geodatabase elements.

The geodatabase concepts were described in detail in the literature study, including the different types of data, the various geodatabase types, and a comparison of geodatabase design techniques. It was decided to use a hybrid of two of the design techniques as the guideline when the study data model was developed.

The literature study concluded by examining previous case studies of GIS implementations which are similar to this study in order to learn techniques which would benefit the development of the data model.

## **6.2 Data capturing**

Data capturing was essential to the development of the data model. Information about the layout of buildings, the location of the infrastructure and the non-spatial information, such as room and owner names, were vital to the success of the study.

A referenced QuickBird (2007) satellite image was obtained and used as the background in order to reference all the other data. Types of data acquired included digital CAD drawings (.dwg files), a list of personnel responsible for some of the rooms and hard copy CAD maps.

The data capturing process was a difficult task due to a lack of data about the utility infrastructure on campus. Some of the University's data was unorganized and out of date. In some cases (such as the information about the campus contractors), no data could be obtained due to security reasons and had to be assumed. The complexity of capturing the data once more highlights the need for an information management tool on campus.

## **6.3 Developing the data model**

Chapter 3 and Chapter 4 respectively describe the chronological steps that were taken to design and develop the data model.

The data model geodatabase design was performed in accordance with a combination of the design methods presented by Actur and Zeiler (2004) and Buliung & Kanaroglou (2004). The data model was designed by following 10 steps that were divided into three phases.

The conceptual phase consisted of identifying the final product; identifying the key thematic layers; and defining the scale ranges and spatial representation of each thematic layer.

The logical phase grouped relevant layers into datasets, after which the tabular database structure was defined. The logical phase also defined the spatial properties of the datasets and concluded by proposing a geodatabase design.

The physical design phase entailed the physical development of the data model. The data model was created by utilizing the ArcGIS 10 software. The data model was implemented, tested, reviewed and refined in this phase. After the data model was found to be satisfactory, data flows were created which describe how the data model should be updated. The final design step was to document the data model.

The data model is a functioning GIS and accompanies the dissertation in the form of a DVD. The data model can be viewed and analyzed in ArcGIS 10 software.

#### **6.4 Data model analysis capabilities**

The analysis capabilities that are offered by the data model can be divided into four types:

- Extracting the attributes
- Selection queries
- Network analysis
- Locating outdoor infrastructure and providing attribute statistics.

Displaying the attributes is a vital part of a GIS. It provides the user with the essential information which is needed in order to make good decisions. The attribute information of all the features as well as the non-spatial information can be displayed by opening the attribute table. The feature attributes as well as the attributes of the features related to them can be viewed through the Identifier tool.

The data model offers users the opportunity to create and run queries on the feature layers in the table of content. The Select by attribute tool provides the means to run complex queries using the feature's attributes. The Select by location tool runs queries on the spatial position of the features in relation to one another. The examples that were discussed in Chapter 5 include:

- Selecting a specific feature in terms of its Unique\_ID attribute.
- Locating and extracting rooms that contain switches.
- Using the Related tables tool to detect all the network ports that are linked to a certain switch.
- Highlighting the location of a specific owner's office.
- Running a Select by attribute query to display cables of a certain type that exceeds 100m.
- Displaying all the features that were installed/upgraded by the same contractor.

One of the most important benefits of implementing a GIS was the ability to perform analysis on the computer network. The presence of the network dataset created connectivity between the utility features, which provided the opportunity of network analysis. The data model offers various network analysis methods including displaying the route between the source and a network port, which was made possible through the introduction of the "3D Shortest Route Model". The "3D Shortest Route Model" also contributed to illustrating the shortest route between two network ports as well as locating the optimum path for a cable between a switch and new network port.

The Network Analyst toolbar provided the necessary tools to determine the route between a network port and its switch in 3D, as well as finding the common ancestor switch of all the network ports in the study area.

Finally the data model could provide the user with an estimated, narrowed down location of where outdoor infrastructure elements are located, as well as statistical information about each feature attribute.

## **6.5 Conclusion**

The aim of this study is to determine to what extent GIS software can be implemented in order to manage, analyze and visually illustrate an IT-network between buildings as well as inside buildings on a campus. In terms of data storage and organization, the geodatabase in the data model creates an easily accessible environment which can be managed and updated effortlessly. The geodatabase also offers storage for a wide variety of spatial and non-spatial data. The 3D environment provided by ArcScene enhances the visual representation of the spatial data to such an extent that it creates a better understanding of the nature of the features, that otherwise would be lost in 2D. Although the ArcGIS 10 software lacks certain key elements such as 3D geometric networks and 3D topology rules; the data model accurately represents the connectivity between network features. The attributes extraction, selection queries, statistical information and network analysis contributes to a set of satisfactory analysis methods offered by GIS. In conclusion, although ArcGIS software is not perfect, it offers an excellent solution to the need for managing, analyzing and visualization of an IT-network.

## **6.6 Comments and suggestions**

This study was a pilot study to determine to what extent a GIS can be applied to manage, analyze and visually represent a computer network between buildings and inside buildings for a campus. This study can be performed in the same way for other utility types such as water management, electricity and access control infrastructure.

An extended study on the feasibility of an enterprise GIS system for the campus may potentially help to benefit the campus by employing an advanced data information management system such as a GIS.

The data used for this data model can be altered in order to comply with later GIS software versions, which may include three-dimensional geometric network utilization.