

# **Enterprise GIS Search Engine**

## **Enterprise GIS Interface with Multiple Systems**

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### **I. Introduction**

Like most cities across the US, the City of Denton has experienced rapid economic and population growth. It has prompted the city to further address the needs of the community in a more comprehensive and efficient manner. At the digital and information age, the city has to be able to support various businesses from Public Safety, Utility, Engineering, Planning, Building Inspection, Tax and so on. All those departments have different business purpose and their unique system (software and database) to serve them, but they all have the common customers and stakeholders. To help the city to meet the challenges, our GIS (Geographic Information System) group has innovated The City of Denton's Enterprise GIS Search Engine, an application to integrate data from different systems and to display different data in one easy web interface with common map format.

GIS system is the best choice because it brings together different systems (data) across different platforms and databases to the same Geographic location, and can be displayed in variable data type (table, image and video). All information can also be displayed in common map format. With ArcIMS, we want to build our search engine and to achieve our objectives: 1). data integration to bring data together; 2) data integrity to provide accurate data; 3). data distribution to provide easily accessible and live data; and 4). user friendly interface to make data easily understood.

### **II. Enterprise GIS Search Engine Process**

Our Enterprise GIS system consists of software (ESRI products), hardware (**Table 1**), Data (over 100 GIS layers) and talent GIS group. ArcSDE stores the city asset inventories. Each asset (data) has its owner to ensure data integrity and accountability. ArcIMS, a great data distribution tool, links to live data and web access. Our central GIS team provides excellent experience and knowledge on GIS applications and software.

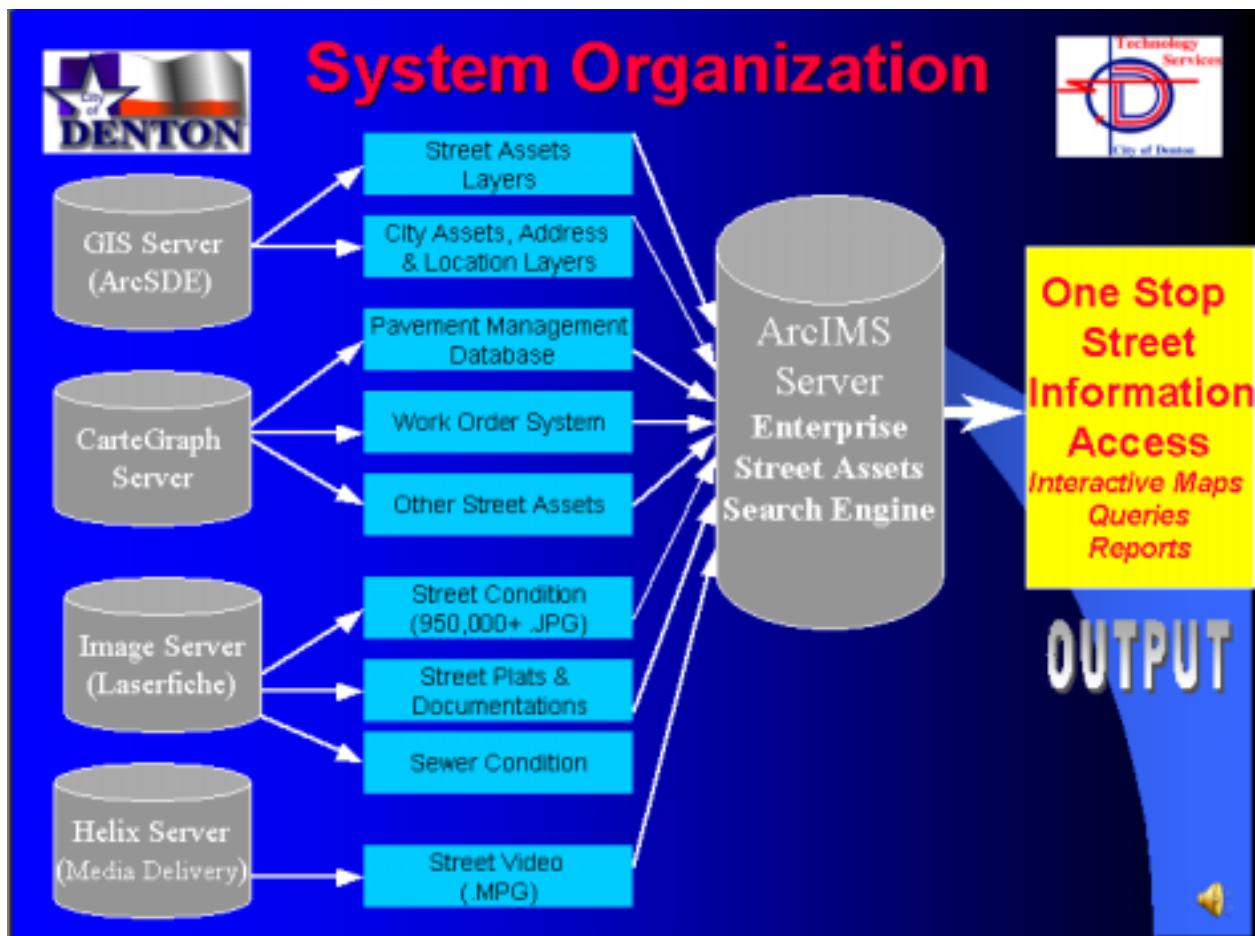
**Figure 1** illustrates an architecture where each system links to the ArcIMS. The Enterprise GIS System manages the city assets layers. A unique ID is assigned to each GIS layers. For example, Parcel data has a address and unique Tax ID. Street centerline has unique segment ID, street name and so on. This is the key to the system integration.

CaterGraph is an assets management tool that consists of Pavement View, Pavement View Plus, Signe view, signal view and work order directory modules. The Pavement Plus hosts all pavement assets that are assigned with street segment ID's, so we can easily plot that

information to the map. With assigned street segment ID, work order can be easily plotted to the map as a layer as well. Using ODBC, we are able to make direct link from ArcIMS to CarteGraph SQL database to achieve live data mapping.

**Table 1.** Software and hardware operating for the four systems.

Software	Server	Operating System	Database
ArcSDE	IBM 6000	AIX 4.3.3	Informix 9.4
CarterGraphic	Dell 2450	MS 2000	MS SQL 2000
LaserFiche	Image	MS 2000	NA
	Index	MS 2000	MS SQL 2000
Helix	Dell 2650	MS 2000	NA



**Figure 1.** System organization architecture of Enterprise GIS Search Engine.

In 2003, a consultant firm conducted street survey for the entire city. This survey gathered information from street pavement conditions (implemented to CarteGraph Pavement

View Plus), street GPR data, and about 1 million (.JPG) street pictures and 170 GB street videos (.MPG). Pictures were taken of every 20 feet of every street including front view, side view and down view. In order to make this large amount of pictures searchable, we worked closely with the consultant to ensure the accuracy of data delivery. Every picture has a GPS point and a video segment that is linked with street centerline segment ID in GIS as shown in **Figure 2** for a demonstration of data integration.

All videos (.MPG) are stored in our Helix server and all pictures were installed in our image server. Picture file name with the GPS point was indexed in SQL server. The Helix is a streaming server that is based on Real Networks Technology. It allows contents to be streamed instead of downloaded, which greatly improves loading speed of media. Because of this, we are able to plot all pictures and video to the map.

Using LaserFiche technology, we scanned all community plats into the image server and indexed them in our SQL server. All plats are indexed by our plat layers and also linked to our street segment ID. Consequently, we are able to select a street to query for a specific plat.

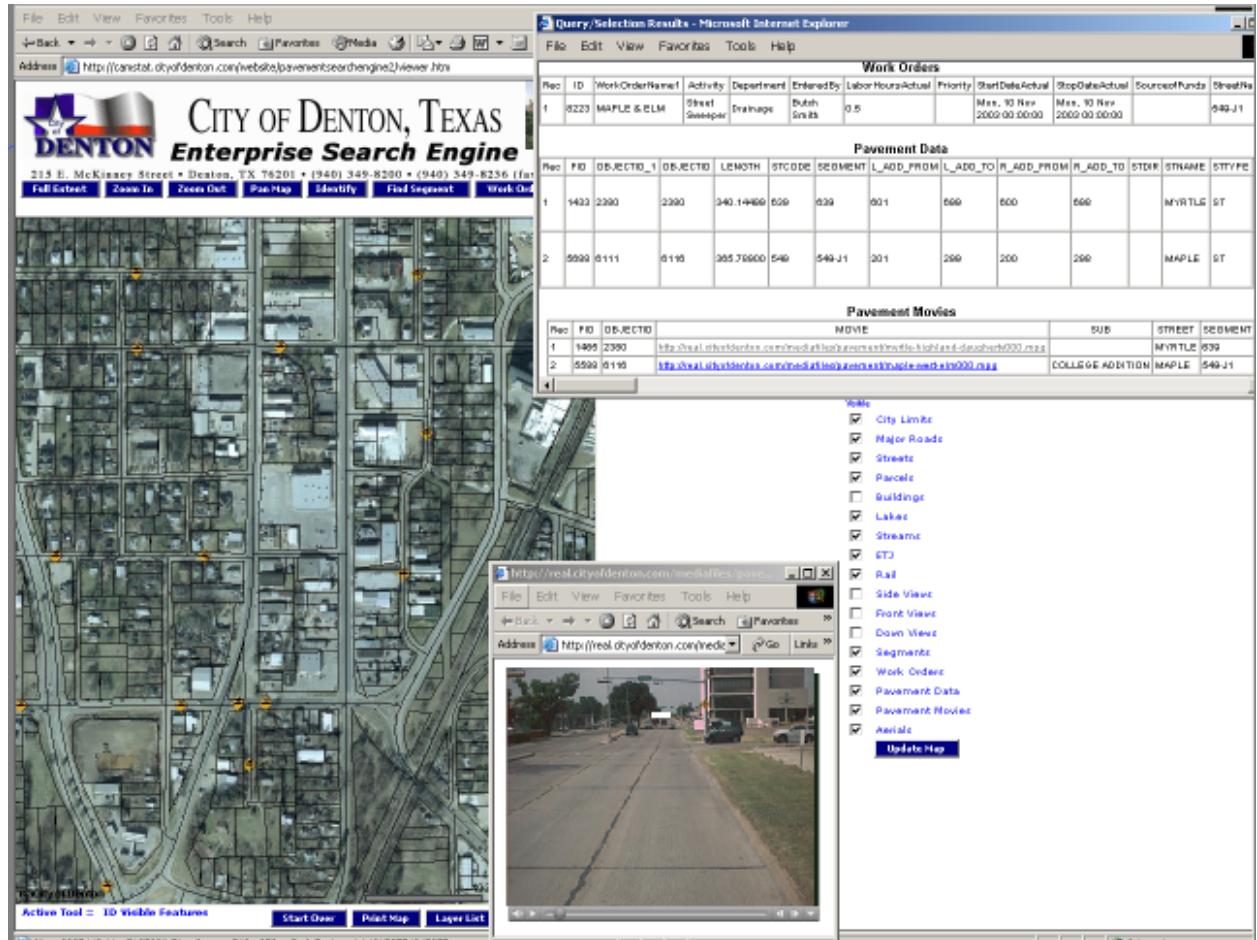


**Figure 2.** Example of Data Integration in Enterprise GIS Search Engine.

### III Capability of Enterprise GIS Search Engine

We developed our intranet Enterprise Street Search Engine using ArcIMS 4.1. This website is available to each department via Intranet across the city. It provides all the

information listed in **Figure 3** (an example of our Intranet web page). The engine searches via a variety of means, such as parcel address, street name, street segment ID, street intersection, work order number, activity, department, date and so on.



**Figure 3.** An example of search result by the Enterprise GIS Search Engine.

The search engine can zoom to any location with zoom in tool. Simply select an area with identify button, it will query for you all the information related to the area. In addition, the returned query report for the work order system can be exported to excel for further analysis. All maps can be printed or saved as documentation for e-mail attachment.

#### IV. Project Results and Benefits

Since implementing the search engine, we have received great feedback from users from many departments. The engine has saved the city from purchasing additional licenses for each application. Because its friendly Intranet interface requires no additional training, it has quickly

become a popular tool. The accessible street video and pictures capture a great deal of street information. For example, Police, Fire, and Utility Traffic Operation have been able to understand community, neighborhood and street better, can easily identify traffic signs, signals and street marking; Solid Waste can quickly locate their dumpsters and so on.

The search engine allows sharing work order information with other departments, which has improved the inter-departmental communication and operation efficiency. Sharing information online limits redundant work and maximizes city resources utilization.

Information available in the desktop saves a lot of trip for field verification and improves work efficiency. Mapping work orders into the map helps supervisors to better manage resources based on Geographic location. This visual tool provides better analysis for the engineer to understand street pavement conditions.

## **V. Project Summary and Future Applications**

With our search engine, information that has been made readily available can now be used to help management make more informed decisions when budgeting and making forecasts.

The system allows maximum return of the project's investment. It has also improved employee productivity by easing access to the data. We have accomplished the goal of linking multiple systems and bringing together information from different departments in a one-stop access format.

The Enterprise Search Engine tool's potential is unlimited. As it is expanded to more systems, such as link to all utility work orders, citizen request, customer services billing and so on, it is a significant tool to empowering our employee with information, then improving the city operation, continue providing outstanding services for the all stakeholders in the City of Denton.

As this system is expanded from the Intranet to the Internet, information will be easily accessible to the public. With Internet mapping, property information is made available to citizens, developers and our stakeholders. They will be able to locate utility lines on their property, obtain work order history by area as well as all other property related information. Developers will have the ability to see videos of specific streets and property in any area of the city before coming to Denton, thus providing better economic development opportunities. We strive for providing quality service to city and the public as we continue to seek innovative applications of technology information.