Possible candidate for introduction text

Users of spatial information now need to make maximum use of their hard-won and valuable spatial data—beyond traditional GIS applications. This need influences general user requirements within the mainstream IT solutions, which have been moving toward open distributed systems for some time.

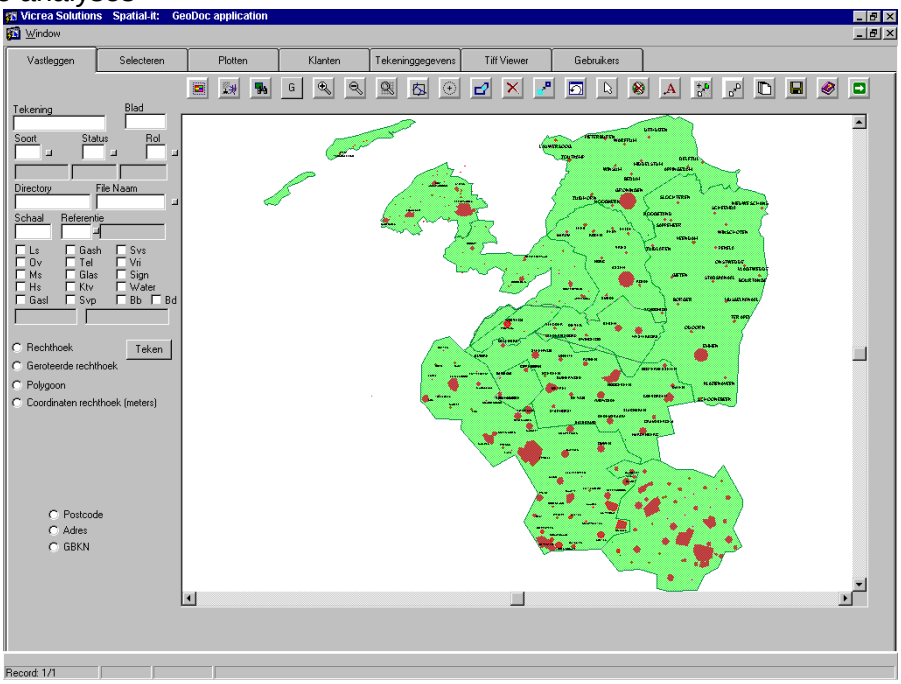
Article text

Spatial-it within the Enterprise IT environment

In the June issue we've introduced Spatial-it as a concept that offers interesting opportunities to empower organisations by providing its employees with the right in formation utilising spatial data within the corporate information systems. With Spatial-it GeoInformatics extends its focus beyond Geo-Information technology. Where Geo-It allows us to capture, edit, store and present geographic data, Spatial-it is all about optimising (corporate) business processes by utilising this Geo-IT data and other spatial information such as designs, pictures, video etc. Spatial-it introduces spatial information in the "mainstream" IT-environment where we allow a multitude of users to benefit from this visual information. Incorporating Spatial-it with information management enables an organisation to:

- ✓ Visualise the warehouse data
- ✓ Improve decision support
- ✓ Optimise efficiency of the operations
- ✓ Allow for more intuitive analyses

In this article we'll take a closer look at the evolution of information technology and how this influences Enterprise information systems in general and Geo-based systems in particular. We examine current trends and look at the future of spatial information systems within the Corporate IT framework.



Spatial info crisis

The current crisis in Spatial Information Systems (SIS) was well summarised on the Open GIS Consortium (OGC) Internet-site when they started their work: "OGC was initially founded...in response to the widespread recognition of the following problematic conditions in the geoprocessing and geographic information community:...the multiplicity of geodata formats and data structures, often proprietary, that prevent interoperability and thus limit commercial opportunity and government effectiveness."

Spatial information systems are yet to penetrate deeply into the corporate framework. Largely because of the interoperability problems identified by OGC. The reasons behind the multiplicity of data formats and lack of interoperability are many and varied. Part of the problem is that spatial data is complex and difficult to manipulate. The various providers followed different paths in the technology to handle spatial data. Today, almost all spatial information systems lie outside the arena of mainstream information technology (IT) which more directly addresses the needs of a distributed enterprise. This article looks at the direction of mainstream IT and at the lessons that can be learned for the Spatial-it based systems, the next generation of spatial information systems.

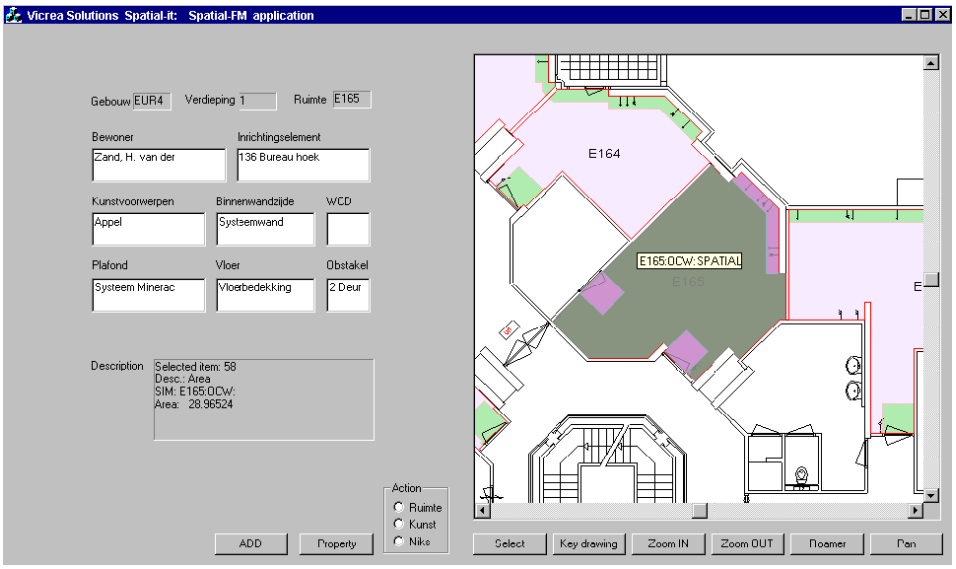
Where is Mainstream IT Heading?

Mainstream IT is being driven by user requirements. Users look for enterprise wide access to information supporting them in their daily tasks. To provide this interoperability and scalability in the IT infrastructure is important. On top of that for efficiency's sake it's necessary to have the ability to utilise a development team across multiple projects within the corporation. These requirements are being addressed by utilisation of standard operating environments, open systems standards, client server, Inter/Intranet architecture and the use of parallel and distributed processing. Standard operating environments are important for the enterprise both for the integration of the various information systems within the organisation as for the efficient use of human resources in the IT-support organisation. The concept of open systems supports the development of vendor-neutral computer technology that enable interoperability across hardware platforms and even across software applications.
Enterprise-wide access to data requires an architecture that maximises data integrity and ease of maintenance. A centralised architecture satisfies these requirements, but always has problems with scalability because eventually the database server can't handle the increasing load. Client-server architecture (in two- or three-tier form) evolved from the old mainframe architecture to increase scalability by putting some of the application or display functionality at the "terminal". The logical development for the server architecture is a distributed processing environment where processing tasks are shared throughout the enterprise on an as-needed basis. Examples of distributed processing architectures are the Common Object Request Broker Architecture (CORBA) and Microsoft's (OLE/COM). Modern Inter-/Intranet solutions are based on the centralised architecture with the ability to utilise the distributed architecture, supported by servers that continuously become more powerful.

What's the position of Spatial oriented Systems?

By contrast with the open, scalable, distributed direction of mainstream IT, spatial information systems have a long way to catch up. Spatial information systems (including GIS, AM/FM and LIS) always relied on proprietary data structures and languages as well as monolithic

architectures. All major SIS vendors relied on proprietary formatted file systems for storing spatial data. This has a number of major drawbacks for openness and enterprise wide access. By definition, a proprietary file format is not open. Users must rely on translators between proprietary file formats, some of which cannot handle the capabilities of others. Topology is a typical example of spatial information that is not handled by many of the common translators. Proprietary file formats also present problems for enterprise wide access to spatial information because of their nature as "flat files". Locking and concurrency present problems for multi-user access and their finite size inhibits the view of the data as a seamless mapbase. An appropriately intelligent file server or data server can be wrapped around the file system to facilitate locking, concurrency and seamlessness—this is essentially a database management system.
In an attempt to reduce the problems with enterprise access to spatial data, most vendors provided links to non-spatial attribute data within an RDBMS that were associated with spatial attributes within the proprietary file format. This introduced further problems as concurrency, spatial and non-spatial (alphanumeric) data got out of step with each other. Backup cycles had to be synchronised between the spatial and non-spatial data and the already complex task of managing very large systems got worse.
The second great sin against openness is that most SIS vendors relied on proprietary languages for application development within their product. This increased the learning curve for application developers and above that required simply to learn the concepts behind dealing with spatial data. Application developers became hard to find and expensive. Knowledge of spatial data and its manipulation becomes a specialists skill.



Barriers to cross

Spatial information traditionally was utilised by only a few small groups within the enterprise. Consequently spatial information is often mis-understood or simply overlooked within the enterprise, by those assembling management information systems, by those carrying out business analysis and by those holding the purse strings. All the issues discussed above must be dealt with in order to bring spatial information out of the backroom and into the enterprise IT mainstream. But the main barrier to cross is simply the inaccessibility of spatial data. There are

no other obstacles to the mainstreaming of Spatial-it as we have already seen with enterprise IT moving from the text-based data processing days into the rather more complex world of multi-media.

Emerging Requirements

This is not new to the users of Spatial Information Systems who have been voicing these concerns for some years now. Their first hand experience of the problems with Spatial Information Systems are driven by increasingly sophisticated requirements for the analysis and manipulation of spatial data. The golden age of the digitiser is over. Capturing spatial data is a problem that is largely solved and the emphasis now moves to maintenance and getting a payback for the investment in spatial data infrastructure.
Examples of the sophisticated analysis required of spatial data are:

- ✓ Visualisation of spatial data which goes beyond the coloured boxes of thematic mapping,
- ✓ Modelling the connectivity and characteristics of a large telecommunications network.

These operations often use specialist software that correlates spatial data with other forms of non-spatial attributes, images, knowledge bases etc; requiring full and open access to spatial information.
A characteristic of these sophisticated spatial analysis tasks is that they require selective access to small elements within a large and seamless spatial database. Or they may require parallel processing across many machines on a network. One example is facilities management where it is desirable for the corporate data to be centralised, yet enable concurrent access by planners and estimators. Multiple versions of plans must be handled within different proposals and scenarios—often overlapping the same spatial location. All of these tasks that make full use of spatial information for the enterprise, require open, seamless access and interoperability.

Technology Drivers

If we look at the technology drivers within mainstream IT we can see how they can be applied to opening Spatial Information Systems. The three main technology drivers enabling the mainstream IT revolution are: software, databases and communications.

Software

Modern software technology aims at maximum maintainability, reusability, applications migration and support of evolutionary development. Proprietary languages available within spatial information products have varying degrees of success in addressing the structured or object oriented methodologies typically used within modern software engineering. The majority of the next generation of SIS packages have not attempted to reinvent the wheel by insisting on proprietary languages for applications development and customisation. There are plenty of good languages out there which can perform the task. Some of the most widely used examples are Visual Basic, Visual C++ and Borland Delphi.

Databases

Database technology is the second pillar upon which enterprise data access rests. Modern relational databases (RDBMSs) are unequalled in their data management, data integrity and security features. Databases provide rapid and efficient data access, support of concurrency and distribution of data across the entire enterprise. Structured query language facilitates access to entities within the database without concern for the storage details of the data. All these attributes are highly desirable for Spatial Information Systems, except that up to recently

relational databases did not support spatial data types, nor indexing of those spatial data types. Now these industry standard databases are extended with options to store and retrieve spatial data. Products like Oracle's Spatial Cartridge or Sybase's SQS include spatial data types and spatial qualifiers. Full spatial integrity and topology is or will be supported.
Integration of spatial and non-spatial data in the enterprise is achieved by utilising and extending the RDBMS technology upon which mainstream IT is already based. Thus Spatial information systems can come into the enterprise without affecting existing data or applications.

Communications

Distribution of resources throughout the enterprise relies on a fast and reliable communications infrastructure. Local and global communications technology is possibly the fastest growing area within mainstream IT. Fast communication is becoming cheaper and more readily available. Most communications traffic, today involves relatively low volume, fixed record traffic for text-based applications. The advent of higher volume and less structured traffic for multi-media and spatial applications will test and ultimately expand the capabilities of today's communications hardware and protocols.
The linking of communications technology and object oriented technology lies in the distributed object architectures of which CORBA and Microsoft (OLE/COM) are high profile players. From the view of traditional IT, this is an upside-down world where data utilises an application, rather than the application owning the data. Data are free to roam the network, calling upon the services of applications as they go. Compound documents may encapsulate many layers of data instances. Electronic document management (EDMS) technology can be used to control the flow of documents around the enterprise to form a workflow solution. Spatial-it benefits from these trends.

Conclusion

The available spatial technology today is more and more tuned to allow us to move the Spatial Information Systems into the mainstream-it environment. In a couple of years everybody will be accustomed to the fact that, in acquiring the necessary information to perform their task, spatial information is used. As we are about to cross the millennium barrier the pioneering organisations are joined by early adapters who dare to translate their confidence in this technology in concrete projects to open their geographic resources to a wider group of employees. Just to name some of these advantages think of benefits as:

- ✓ Deliver improved access to critical information through visual exploitation of data archives.
- ✓ Increase competitiveness by integrating relational data with image and map backgrounds
- ✓ Enable faster customer response within a lightweight desktop or web application by increasing the availability and accessibility of spatial information
- ✓ Provide more intuitive data analysis through visual presentation of information
- ✓ Increase operational efficiency across the enterprise through more efficient access to dynamically changing information.

In following articles we'll look at some examples of Spatial-it implementations in some of these organisations

References

In this article information from the various websites of Spatial-it technology- and solution providers, as well as the Open GIS site was consulted.

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