IDC
Analyze the Future

WHITE PAPER

Business Value of AutoCAD Map 3D and Autodesk MapGuide Enterprise in Postrecession Economies

Sponsored by: Autodesk

David Sonnen Randy Perry

June 2010

EXECUTIVE SUMMARY

This IDC study details the business benefits of using AutoCAD Map 3D and Autodesk MapGuide Enterprise in utilities, telecommunications, and government. Our intent is to provide information useful to decision makers who are considering solutions for reducing costs and improving process efficiencies within their information systems.

This information is timely in light of economic and organizational trends emerging in postrecession recovery. While the recovery process will be complex, the basic dynamics are simple. In a recession, customers question existing processes and cut all but essential elements. As economic conditions improve, users have a fresh appreciation of what is possible with less. As they begin to invest again, users will jump on innovations that provide a major advance — cheaper, faster, or better. These transformational changes have occurred predictably at each recovery point since the recession of 1873.

In prerecession economies, organizations could afford to maintain separate information technology (IT) for processes such as planning, design, and operations. But siloed IT processes cause errors and unnecessary costs. The recent recession brought these inefficiencies into sharp focus, driving organizations to find better solutions.

Through concerted efforts with technology, standards, and IT governance, organizations are now eliminating IT barriers between processes and seeing solid returns. These advances were an important trend during the recent recession and will now become standard practice. Technologies such as AutoCAD Map 3D and Autodesk MapGuide have been capable of cross-process integration for some time. Going forward, those capabilities will continue to play an important role in enterprise information systems.

AutoCAD Map 3D and Autodesk MapGuide Enterprise are foundation products in Autodesk's infrastructure portfolio. The portfolio's business value centers around its ability to support a broad range of work systems that include processes such as planning, design, construction, operations, and maintenance.

To evaluate the business value of AutoCAD Map 3D and Autodesk MapGuide capabilities, IDC interviewed executives at nine organizations in telecommunications, utilities, and government in North America and Europe using IDC's proven ROI survey methods.

Global Headquarters: 5 Speen Street Framingham, MA 01701 USA P.508.872.8200 F.508.935.4015 www.idc.com

Table 1 summarizes the key costs, benefits, and ROI.

TABLE 1

Benefits Summary

Metric	Value
Average three-year investment	$385,740
Average three-year discounted benefits per 100 users	$2.9 million
Average workflow efficiency improvement	451%
Payback period	9.5 months
Average three-year ROI	551%

Source: IDC, 2008

AutoCAD Map 3D and Autodesk MapGuide provide a return of $5.51 on each dollar invested. The average three-year discounted benefits are $2.9 million per 100 users. The Autodesk solution pays back a three-year investment in less than one year — 9.5 months.

Workflow efficiency is the area that AutoCAD Map 3D and Autodesk MapGuide improve most dramatically. The public agencies we surveyed improved their workflow efficiency (ratio of projects completed to revenue spent) from 0.88 to 4.84, an improvement of 451%. This improvement in workflow efficiency enhanced operations in a number of ways, including more effective collaboration, less time wasted finding the right information, and the enabling of user feedback that constantly improves data quality.

The public agencies we surveyed improved their workflow efficiency (ratio of projects completed to revenue spent) from 0.88 to 4.84, an improvement of 451%.

New revenue is also an important business value. Seven of the nine organizations surveyed were public agencies, and as such their revenue was controlled and growth was limited. Even so, on average, organizations were able to increase their revenue by $57,198 annually per 100 Autodesk users. This includes users of all Autodesk products, including AutoCAD, Map 3D, Autodesk Utility Design, MapGuide, and Topobase.

The largest single area of benefits came in hard cost reductions. IDC found that the organizations surveyed were able to reduce project staffing by an average of 19% and reduce their equipment and operational costs by an average of $1.0 million per 100 users while maintaining or increasing workloads.

IDC found that the organizations surveyed were able to reduce project staffing by an average of 19% and reduce their equipment and operational costs by an average of $1.0 million per 100 users while maintaining or increasing workloads.

The organizations we studied benefit from positive network effects from their broad use of Autodesk products. These network effects accrue from a number of interrelated factors. First, we found that organizations were able to maintain consistent, accurate spatial data across enterprise work systems that include processes for planning, design, construction operations, and maintenance.

Users had direct access to consistent spatial data from their enterprise applications — even applications that were not primarily geospatial, such as ERP, asset tracking, and CRM. Because data and access were more effective, users were better able to collaborate as they worked through their daily tasks. We also expect that organizations that broadly implement Autodesk technology are able to refine their work practices and IT governance to optimize their benefits. The result is a significant increase in overall efficiency that drops to the bottom line.

The key takeaway from this study is that Autodesk's AutoCAD Map 3D and MapGuide products provide significant, tangible business benefits. These benefits are particularly relevant for organizations that must improve efficiencies across planning, design, construction, operations, and maintenance of physical infrastructures.

INTRODUCTION

GIS-dependent organizations, such as telecommunications providers, utilities, and government agencies, depend on consistent, accurate geospatial information. To drive the most business value, this geospatial information resource must be integrated into an organization's entire IT system. Correctly implemented, geospatial information becomes a dynamic resource that users constantly improve as they use it.

Unfortunately, many organizations still consider geospatial information to be separate from the rest of their IT. GIS and CAD, the primary applications used to maintain geospatial information, are owned by different groups, operated independently, and managed as specialties that have little to do with an organization's core business. Because of this information isolation, workflow suffers at virtually every point at which geospatial information is used. Employees are forced to bridge gaps between technologies — such as engineering applications, CRM, and GIS. People spend time unnecessarily seeking and verifying information that is hidden in other systems. Projects conflict with each other.

These inefficiencies compound into budget overruns and failed projects. The public, reasonably enough, sees these inefficiencies as a waste of its taxes and fees. Public relations suffer and politicians intervene. We are all familiar with these too common problems.

Autodesk addresses these issues. Its technology has evolved over years of service to millions of users. Today, products such as AutoCAD Map 3D and Autodesk MapGuide support Autodesk customers' work systems that include planning, design, construction, customer service, and ongoing operations.

That brings us to the question of why we did this study. AutoCAD Map 3D and Autodesk MapGuide have been implemented and are well-established in many thousands of installations. Users have found improvements in efficiency and reductions in cost. But how much? Just what is the hard business value of AutoCAD Map 3D, Autodesk MapGuide, and the rest of Autodesk's infrastructure portfolio? IDC conducted this study to answer these questions.

Methodology

IDC's ROI methodology for this study is based on our analysis of data from current Autodesk users. IDC combined extensive research on project and portfolio management systems with in-depth interviews with nine organizations that have deployed Autodesk solutions.

IDC performs a three-step process to calculate the ROI and payback period:

1. Measure the financial benefits from reduced costs (operations and infrastructure), increased user and IT staff productivity, and increased revenue
2. Ascertain the investment made in deploying the solution and the associated training and support costs
3. Estimate the costs and savings over a three-year period, then calculate the ROI and payback for the solution

Because the full benefits of the solution are not available during the deployment period, IDC prorates the benefits on a monthly basis and subtracts the appropriate amount for the deployment time from the first-year savings.

IDC uses a discounted cash flow methodology to calculate the ROI and payback period. ROI is the ratio of the net present value (NPV) and discounted investment. Payback period is the point at which cumulative benefits equal the initial investment. IDC uses a standard 12% discount factor (which allows for risk and the missed opportunity cost that could have been realized using that capital).

Survey Demographics

IDC interviewed nine organizations representing telecommunications, government, and utilities. These entities operate in North America and Europe and their workforce numbers range from 60 employees to 1,500 employees. On average, the organizations have been using Autodesk MapGuide and AutoCAD Map 3D for over two years and have an average of 27 AutoCAD Map 3D users and 198 Autodesk MapGuide users per organization. The study demographics are in Table 2.

TABLE 2

Study Demographics

Average number of employees	888
Average number of AutoCAD Map 3D users	27
Average number of Autodesk MapGuide users	198
Percentage of workforce using Autodesk products	21
Industries	Government, telecom, utilities
Geography	North America, Europe

Source: IDC, 2008

ANALYSIS OF BENEFITS

IDC designed this study to identify the specific changes resulting from the use of AutoCAD Map 3D and Autodesk MapGuide in four main areas: user productivity, business benefits, revenue increase, and operational costs. Please note that a technology may benefit more than one area.

- **User productivity:** Measures changes in individual productivity. Examples are as follows: AutoCAD Map 3D and Autodesk MapGuide users saved time during their analysis because several previously separate functions have been consolidated into one solution. Also, users save time because manual tasks are automated. Data accuracy is improved. The number of system errors per month is reduced.

- **Business benefits:** Measures changes in overall business productivity. Examples are as follows: The organization avoids new IT staff hires because of more efficient task execution. Project staff sizes are reduced due to higher productivity. Processes are more efficient because of fewer data repairs. Problems caused by bad data are reduced. Project backlogs are cut as projects are completed faster.

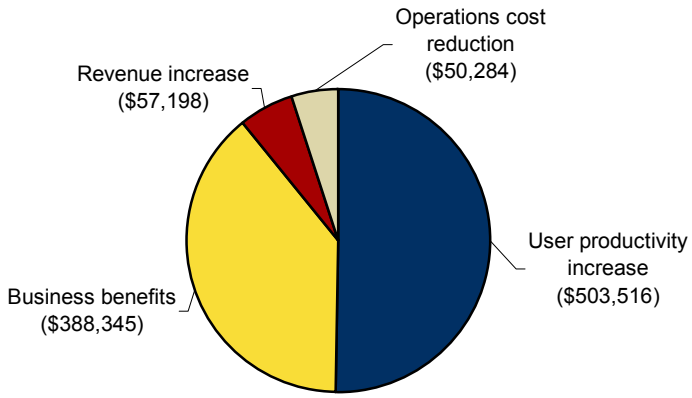
- **Revenue increase:** Measures overall changes in revenue. In the case of government agencies, we measure changes in workflow efficiency. Examples are as follows: Revenue increases are attributed to an increase in the number of new bids created or the total number of projects serviced per year. Workflow efficiency may reflect changes in project turnaround time, increasing the organization's ability to handle more projects for the same or reduced cost.

- **Operational costs:** Measures the changes in costs for individual operations. Examples are as follows: Customers who implemented AutoCAD Map 3D and Autodesk MapGuide were able to reduce the total number of truck rolls and miles traveled per month, which led to lower fuel costs and saved technicians hours in the field. Since the deployment, customers print fewer pages of paper per month. Annual licensing fees have been cut because of the reduction in the total number of applications.

The distribution of benefits is shown in Figure 1.

FIGURE 1

Distribution of Benefits



Source: IDC, 2008

User Productivity

The average annual user productivity increase is $503,516 per 100 users. Table 3 summarizes the improvements in user productivity.

TABLE 3

User Productivity: Time Reductions by Task (%)

Manual tasks	47
Project planning	50
Searching for data	57
Processing data	82
Downtime	93

Source: IDC, 2008

Data accuracy was the primary contribution of Autodesk's technology to user productivity. Based on user interviews, we estimate that spatial databases that were 50% accurate before the deployment are now approximately 95% accurate. Users make better decisions because their geospatial data is more accurate since the deployment of AutoCAD Map 3D and Autodesk MapGuide. In addition, internal communication among users improved because people at different locations view the same data during discussions and at work.

Based on user interviews, we estimate that spatial databases that were 50% accurate before the deployment are now approximately 95% accurate.

Also, data integration has been automated so tasks can be completed faster. As one customer stated, "We can do things in an hour, where before it took 20 days to a month." Users no longer need to translate data from one format to another. They now input the information, analyze it, and create maps and reports in far less time than prior to using AutoCAD Map3D and Autodesk MapGuide.

Autodesk technology helps customers save time planning and designing projects. One customer estimated that the organization saves two to three days per month in project planning. Another customer has been able to reduce project drafting time by 78%. Many of the drafters are able to serve other roles within the organization, and two staff hires have been avoided because of the added efficiency.

Crews in the field have become more productive because they can access relevant data from their wireless devices. Technicians are able to view precise maps, detailed specifications, and plans at their work site. As one customer said, "When data isn't accurate, bad things happen. People dig in the wrong places, they hit utilities that weren't on the maps, and that's expensive. There is also a big cost in negative public opinion."

Autodesk MapGuide and AutoCAD Map 3D have become essential tools. As one customer mentioned, "Some MapGuide users get here in the morning, open up MapGuide, then go get their coffee. To them, it's right up there with getting their coffee."

Business Benefits

Annual business benefits are valued at $388,345 per 100 users on average. Table 4 shows the business benefits achieved since the deployment of AutoCAD Map 3D and Autodesk MapGuide.

TABLE 4

Business Benefits: Annual Savings per 100 Users ($)

Reduced data deduplication	329,874
Avoided hires	48,630
Data/reduced errors	9,842

Source: IDC, 2008

Business benefits center around efficiencies that affect the whole enterprise. For example, organizations have been able to reduce project staffing by 19% on average. The remaining staff members are able to fulfill other business roles.

Before Autodesk technology was implemented, data duplication was a significant cost. The costs resulted from the inevitable errors that duplication induces plus the cost of maintaining separate data repositories.

The IT staff saves time because the number of data requests has been reduced. Since the users have access to the information they need, they are able to access it directly. In the past, when the ticket was received by IT, it would be passed among several people until a resolution was found.

Revenue Impact

Workflow Efficiency

In public agencies, the best way to understand revenue impact is to look at workflow efficiencies. In this study, we evaluated how the Autodesk solution changed the number of projects sustained by organizations, the average time to completion, and the average staffing. We define workflow efficiency as the number of projects completed per dollar spent to complete the projects.

Before the adoption of AutoCAD Map 3D and Autodesk MapGuide, the average workflow efficiency was 0.88. After implementation, workflow efficiency increased by 451% to 4.84. The efficiency increase means that the organizations were able to increase their workloads by 451% without increasing their budget. That is good bang for their buck.

Revenue Increase

Only two of nine organizations in this study are commercial enterprises. Both commercial enterprises were able to generate new revenue by adding more customers. These companies were able to generate more proposals, which enabled them to seek out and add new customers. One user mentioned, "We probably did 100–150 work orders per year. And now, it's more in the 300–350 range." In addition to servicing more proposals, users experienced faster project turnaround time. As one manager said, "This goes back to planning. The [number of] projects that we can do has almost doubled, and that allows us to handle more customers — to sell more services." Two of the seven government organizations reported increasing revenue as well. The Economic Development Department of a city government used Autodesk MapGuide as one of the planning tools that show businesses where they can locate in the city in order to bring more revenue into the business and the city.

IDC averages the revenue increase of the two commercial enterprises and the two government organizations with the zero revenue increase of the other five government organizations. On average, the annual revenue increase due to Autodesk solutions is $57,198 per 100 users.

Operations Cost Reduction

Annual operations costs were reduced on average by $50,284 per 100 users. This benefit is detailed in Table 5.

TABLE 5

Operations Cost Impact per 100 Users ($)

Redispatch avoided	38,345
Software license savings	4,738
Paper use	7,201

Source: IDC, 2008

Reducing operations costs centers around managing the costs for individual operations. For example, in maintenance operations, crews are dispatched to a site to repair equipment. If the crews have the right tools and parts, they make the repair and move on. If they don't have the right equipment, they have to return to base, restock, and return to the site. Some of this yo-yoing back and forth is inevitable. But a lot of it can be avoided through good asset management and accurate geospatial records.

We found that AutoCAD Map 3D and Autodesk MapGuide helped keep asset records straight. Autodesk enables advanced scheduling that allows technicians to service a greater number of trouble calls per day with fewer redispatches.

Paper costs don't sound like a major expense, but they do add up. Autodesk technology allows users to access their data anywhere, without hardcopy. One organization used to print maps in quarters and put them in each crew truck. These maps would have to be periodically updated, reprinted, and delivered again. This production cycle is largely eliminated because data is now available over the Internet. Updates to maps are made at the home office, and physical delivery is avoided. Autodesk customers avoid costs not only on paper but also on printer ink and full-time equivalents (FTEs) needed to deliver the maps.

In the past, multiple software tools were required for viewing parcels, streets, addresses, sewers, streetlights, and other elements of a work site. But since the deployment, this data is available to users through one application. A customer estimated that the organization has eliminated between 25 and 30 tools. Having a single application reduces licensing fees. One respondent saved approximately $2,500 per software license per year after Autodesk deployment.

SITUATION OVERVIEW

Drivers and Constraints That Influence the Impact of AutoCAD Map 3D, Autodesk MapGuide, and Related Autodesk Products

The following nine factors shape the business value and impact of AutoCAD Map 3D and Autodesk MapGuide:

- The current economic situation forces organizations to be more efficient. There is simply less money available to perform steadily increasing workloads. Carefully governed IT can help create efficiencies and thus mitigate the vexing impacts of this situation.
- Organizations that have had to do more with less have proven the value of consistent information across processes. Recognizing this value, users are more likely to select technologies that enable cross-process information flows.
- Users need consistent, accurate information about infrastructure and customers across all processes. This means that one version of information can be used across functions such as planning, design, construction, operations, and finance.
- Some organizations still use separate systems for each process. In these organizations, common data has to be reentered or reformatted in each independent system. This reentry/reformat process inevitably introduces data errors that have to be found and corrected. Still, a predictable percentage of errors go undetected until they cause expensive operational problems.
- Information about customers and the infrastructure that they touch must be accurate and continuously synchronized. For example, an Autodesk customer continuously updates its SAP customer records from its Autodesk workflow management system. This kind of tight synchronization reduces errors and costs.
- Organizations need to respond effectively to changing situations such as new regulation, changing user demands, and natural disasters. While these situations present different challenges, they are each easier to face if basic IT infrastructure and enterprise information is consistent, accurate, and accessible.
- People need to collaborate, share information, and make sense of changing situations. People's interactions are informal and unstructured, but astute. If people have direct, simple access to consistent information, their actions are significantly more effective.
- Open source software will continue to grow in importance, scope, and reach. It is interesting to note that Autodesk has the most comprehensive open source strategy of the major geospatial vendors.
- A new generation of mobile mapping platforms generate enormous volumes of very accurate 3D geospatial data. These ground-based and airborne systems enable planning, design, and infrastructure management that was impractical just a few years ago. Enterprise geospatial technology has to be able to handle this new data without adding substantial costs.

Autodesk Technology

Autodesk's technology addresses the broad requirements of GIS-dependent organizations for CAD, GIS, and integrated spatial data. Given Autodesk's design heritage, one would expect the company to produce excellent design tools. And it does.

Autodesk technology also embeds deep capabilities for data integration, data access, and workflow management. These capabilities allow users to maintain accurate, consistent data across enterprise processes.

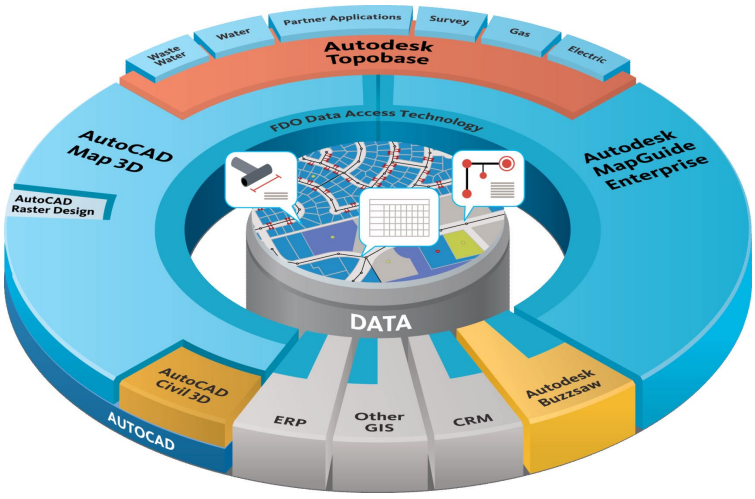
Autodesk has evolved a comprehensive open source strategy that harnesses the collective development efforts of thousands of users/developers. Autodesk's open source software reduces costs and allows broad, cost-effective access to and use of enterprise spatial resources.

Architecture

Autodesk designed and implemented its geospatial architecture to maximize data and application integration. As shown in Figure 2, AutoCAD Map 3D and Autodesk MapGuide are foundation products. This tightly integrated and open architecture allows users to select appropriate capabilities for their specific needs while ensuring that all data, including data from non-Autodesk sources, will be consistent and accessible across the enterprise.

FIGURE 2

Autodesk Product Architecture



Source: Autodesk, 2008

AutoCAD Map 3D

AutoCAD Map 3D is the data creation, editing, and maintenance backbone of the Autodesk infrastructure solution. Based on an AutoCAD foundation, AutoCAD Map 3D is used for integrating, editing, and analyzing GIS and CAD data. It also incorporates the advanced functionality, such as topology, typical of a sophisticated GIS application. Autodesk describes AutoCAD Map 3D as a better AutoCAD for planning and managing infrastructure.

AutoCAD Map 3D gives organizations the ability to:

- Create, edit, and manage spatial data in a multiuser environment
- Support design and as-built data flows to GIS and asset management
- Manage data in multiple formats and sources simultaneously (This capability significantly enhances data integrity and data quality.)
- Produce maps using a broad array of cartographic library tools, including topology, data-driven stylization, transparency, and multiple layer overlay
- View and manipulate original data from multiple sources and formats interactively, increasing the usability of all geospatial data
- Analyze information using a variety of functions, including thematic displays, surface analysis, and watershed delineation

AutoCAD Map 3D is based on open data standards and enabled by Feature Data Objects (FDO) open source data access technology. This allows organizations to work with virtually any spatial data, including DWG, ESRI SHP, and most other standard geospatial formats. The Autodesk mapping solution can manage spatial data in native formats, including Oracle Spatial and Microsoft SQL Server 2008.

Autodesk MapGuide

Autodesk MapGuide Enterprise dynamically builds and displays maps comprising CAD, GIS, and asset information over the Web. Using Autodesk MapGuide and a Web browser, authorized users can request the information they need from the host's GIS and view it — whenever and wherever they need — without the expense and delay of requesting the information from specialists.

Autodesk MapGuide is available in an open source or a supported enterprise version. This unique combination allows users to select the most cost-effective Web mapping solution for their specific needs. Most organizations we interviewed for this study use both the open source version and the enterprise version. Also, most organizations have taken advantage of open source extensions to Autodesk MapGuide that have been developed by other users.

Autodesk MapGuide enables organizations to:

- Give all employees fast access to the geospatial information they need
- Make geospatial and related information freely available to the public

- Minimize manual and paper-based distribution of geospatial information
- Blend geospatial information with relevant tabular data from other databases on dynamic maps or in data sets for visualization and analysis
- Share real-time data across organizations through built-in Open GIS Consortium Web Map Services
- Enhance collaboration between individuals, workgroups, and other organizations (This enhanced collaboration appears to be a significant factor in the high ROI that IDC found in this study.)

Because Autodesk MapGuide supports common Web development standards, it provides an effective environment for application development. This allows organizations to build online applications and custom user interfaces as needed, with minimum expense.

Working in concert, the applications that make up the Autodesk solution streamline the movement of data between CAD and GIS, enhance the usability of raster imagery, and distribute timely geospatial information throughout organizations.

Integrating Autodesk into User Organizations

Autodesk has evolved a sophisticated and comprehensive set of capabilities for integrating its technology into user organizations. These capabilities provide users with integration options that range from single desktop design stations to enterprisewide workflow management for multiple processes. At the high end, Autodesk solutions can include distributed Oracle Spatial or Microsoft SQL Server databases with low-level interfaces to an organization's ERP, CRM, or other enterprise applications.

IDC believes that Autodesk's integration capabilities contribute significantly to the high ROI values we found in this study.

In the following sections, we discuss four elements of Autodesk's integration capabilities: Feature Data Objects, open source strategy, database options, and topology.

Feature Data Objects

Both Autodesk MapGuide and AutoCAD Map 3D use FDO data access technology. FDO is the mechanism that enables Autodesk infrastructure products and enterprise applications to work natively with spatial data, in practically any format, stored in relational databases and files as well as Web-based services. They also share common code for mapping and stylization.

Autodesk has released FDO to open source. The open source community has responded by developing a number of FDO extensions that add to Autodesk's already sophisticated integration capabilities.

One Autodesk FDO user in the United Kingdom told us, "We're using FDO to reconcile hundreds of data sources across the United Kingdom. We've found FDO is simpler and much more efficient than the rather expensive proprietary technology we used to use."

Open Source Strategy

Autodesk pioneered open source strategy for major geospatial vendors. The company supports its open source projects with deep expertise and dedicated professionals and through sponsorship of organizations such as the Open Source Geospatial Foundation, or OSGeo (**www.osgeo.org**).

The open source community has responded to Autodesk's efforts by developing a spectrum of new applications and utilities that extend Autodesk products. These open source extensions are particularly valuable because they directly reflect specific user needs.

We expect Autodesk to continue to contribute to and profit from this mutually beneficial relationship with the open source community. Users will continue to benefit from lower cost of ownership and broader data access across their organizations.

Database Options

Autodesk supports native linkages with Oracle Spatial and Microsoft SQL Server 2008. These linkages allow users to manage their spatial data directly within a database environment. Once user data is in the database, it can be accessed and used by any application that accesses data through SQL or XML — practically any enterprise application.

Autodesk's database options also allow the database to do the heavy lifting for data management, storage, access, security, and backup — tasks at which enterprise databases excel.

Topology

Autodesk infrastructure solutions bring together CAD and GIS. While this sounds like a simple issue, it is not. CAD and GIS are both spatial technologies, but they have very different purposes, uses, and histories. As a result, low-level data architectures are completely different.

In CAD systems, each point, line, or polygon may represent physical elements with different properties. Therefore, those points, lines, and polygons are kept separate and independent. In GIS systems, points, lines, and polygons represent geographic entities such as streams, land parcels, or counties. Therefore, a GIS treats points, lines, and polygons as spatial objects.

Autodesk provides a mature set of topology tools for converting CAD graphic elements to GIS spatial objects. This means, for example, a subdivision layout created in AutoCAD can be converted to parcel and road maps that support a full range of GIS capabilities such as attribution, dynamic boundary adjustment, or dynamic routing.

Selecting Autodesk

In most cases, organizations examined their internal processes and current toolsets while comparing several possible solutions. The organizations made their selection based on Autodesk's solutions that could integrate tools and data already in use to streamline data management and improve efficiencies in their current processes.

Some organizations selected Autodesk because of their previous positive experience with the vendor.

Deployment

Customers noted AutoCAD Map 3D's and Autodesk MapGuide's ease of installation. In most cases, only one or two IT technicians were required for a deployment that lasted between two hours and one business day on average. The Autodesk solutions also required minimal training. Some customers required no training at all, while others enrolled at Autodesk University to learn about customizing the solution to their company's environment.

FUTURE OUTLOOK

Users want to integrate spatial capabilities into enterprise information systems. This basic need drives most new growth in the spatial information management (SIM) industry. IDC expects spatially integrated enterprise systems to continue to grow and mature over the next several years. During this period, systems will be driven by broad IT dynamics rather than the specialized requirements that have driven technologies such as GIS and CAD in the past.

Systems will be driven by broad IT dynamics rather than the specialized requirements that have driven technologies such as GIS and CAD in the past.

IDC expects the following trends to shape spatially integrated information systems for the near term and the midterm:

- Awareness of spatial capabilities and their value will increase as consumer-based applications such as Google Earth/Maps, Microsoft Windows Live Local, personal navigation, and location-based wireless services become ubiquitous. Enterprise users will come to expect the simple interfaces and performance typical of consumer-oriented systems.
- Airborne and ground-based mapping platforms will continue to increase capabilities and lower data acquisition costs. Planners, designers, and operations professionals will demand tools for managing and optimizing the value of these impressive data sources.
- As spatial technologies become simpler, more accurate, and ubiquitous, users will increasingly employ spatial information in their everyday work practices. Spatial information will become an integral, but invisible part of collaboration, conversation, sense making, and social life.
- Cloud computing and software as a service (SaaS) will enable deep integration of all types of data and applications, including spatial.

Spatial information will become an integral, but invisible part of collaboration, conversation, sense making, and social life.

- Mobile devices such as smartphones and slate computers will enable field workers to interact with enterprise information systems easily and inexpensively. Most of the data from these devices will be location-specific.
- In highly integrated systems, data is continually merged from many sources. This means that information systems have to be designed from the ground up to maintain predictable data quality. The user has to know that the data being used for a particular application is fit for the purpose at the time of use.
- Higher-quality spatial data will be increasingly available from diverse sources such as tracking devices; networked sensors; satellite, aerial, and ground-based imagery; and location-specific information extracted from tabular data streams.
- Enterprise IT capabilities such as service-oriented architecture (SOA), Web services, and enterprise solutions platforms will make SIM implementations easier and a lower risk for the customer.

Autodesk is continuously working to address issues inherent in the future environment we describe. As we see in this study, Autodesk customers are building systems that address near-future demands and are achieving solid results.

CHALLENGES/OPPORTUNITIES

Autodesk solutions are most effective when they are broadly deployed across an organization. But deploying technology broadly across an organization is easier to say than do.

Traditionally, organizations have segregated technologies according to function — CAD for engineers, GIS for planners, ERP for managers, and so on. The result has been a familiar, but inefficient pattern of multiple systems with multiple ownerships from many vendors.

Most organizations realize the problem, but this problem has deep roots in culture, budgets, and organizational structure. Autodesk users will have to address these issues as they work toward more seamless and efficient IT architectures.

Autodesk has provided some tools: open source solutions that address budget and ownership issues, integration capabilities that allow data from different systems to work together, and database options that simplify cross-function exchange.

However, users still have to address fundamental organizational issues before any technology, no matter how efficient, can be broadly deployed.

CONCLUSION

The organizations we studied are typical of the Autodesk customer base. Any Autodesk customer can implement similarly effective systems. We expect that customers will increasingly take advantage of Autodesk's broad, open, and highly integrated capabilities to achieve the efficiencies demonstrated in this study.

These efficiencies and Autodesk's demonstrated business value will be critical in the next few years as we all learn how to make do with lower funding and increasing demands for service.

From IDC's experience with Autodesk and its customers, we can say that Autodesk deeply understands its customers' changing needs and works to meet them. The company has developed not only technology but also an organizational culture and operating philosophy that directly support its customers.

Autodesk's technologies, culture, and community-oriented philosophy position it to grow and serve its customers.

Going forward, Autodesk's technologies, culture, and community-oriented philosophy position it to grow and serve its customers increasingly well.

CASE STUDIES

Organizations using Autodesk infrastructure products number in the hundreds of thousands. IDC selected the following three typical cases from Autodesk's substantial user base to illustrate key aspects of Autodesk technology.

City of Tacoma, Washington

Tacoma is a midsize urban port city, the county seat of Pierce County, and the third largest city in the state of Washington. Tacoma-Pierce County has recently been named one of the most livable places in the United States. With a growing population of about 203,000 residents, Tacoma is busy coping with growth and steady increases in demand for services.

Tacoma represents a best-practice example of fully integrated geospatial technology with strong central management. In March 2008, Oracle presented Tacoma with an Integrated Enterprise award for Tacoma's government Made Easy (govME) site. govME allows citizens to access data as varied as parcel information and engineering drawings of the water system. Citizens can also use govME for a number of civic tasks, including filing for permits, reporting potholes, locating sewer lines, and reporting traffic signal or streetlight problems (see **www.govme.com**).

Tacoma's govME site is just the public-facing element of its geospatial system. The city makes extensive use of AutoCAD, AutoCAD Map 3D, and Autodesk MapGuide for engineering and GIS. Tacoma, like most municipalities, uses AutoCAD for engineering and design. AutoCAD Map 3D handles geospatial data flows into GIS and asset management applications, including ESRI and GE Smallworld. Autodesk MapGuide is the primary tool for data access. Oracle is the underlying database that the city uses to manage its geospatial data.

Tacoma has evolved an effective data architecture and IT governance capability for geospatial data. It has implemented policies and standards across the city that continuously enhance and correct geospatial information as it is used. Tacoma's sound geospatial IT management allows it to enjoy higher-than-average return on its technology investment.

City of Garden Grove, California

Garden Grove is an ethnically diverse city of about 173,000 in Orange County, California. Like many heavily residential communities, Garden Grove has to do a lot with less.

Garden Grove is perhaps best known for its proximity to Disneyland and Orange County's beaches. Less well-known is Garden Grove's innovative, decentralized approach to mapping and the management of geospatial data. Unlike many cities its size, Garden Grove does not have a large GIS department. Instead, Garden Grove relies on existing departments, such as public works, to maintain design and GIS information.

Charles Kalil, Garden Grove's IT director, explained why the city has taken its unique approach: "In Garden Grove, we are committed to doing more with less. By using Autodesk's GIS technology, we exploited our engineering team's existing computer design and mapping skills and taught them the GIS skills they needed to ensure that the database contains high-quality GIS information. This approach is much less expensive over time."

Garden Grove's approach makes a lot of sense. According to Autodesk, engineers trained in design and mapping outnumber GIS specialists about 10 to 1. As Garden Grove's experience has demonstrated, those engineers can handle GIS duty quite well.

By using Garden Grove's broad base of engineering professionals, the city has avoided another problem with separate CAD and GIS. Jim Deyo, Garden Grove's lone GIS specialist, explained, "The bigger issue for cities our size or smaller is the potential for GIS bottlenecks. When just a few specialists update the GIS database, the data isn't always timely, costs a lot, and can't be used as creatively."

City of Moissy-Cramayel

Moissy-Cramayel is one of nine communities composing the town of Sénart (Sénart-Ville Nouvelle). Located 30.8 kilometers from the center of Paris, Moissy-Cramayel is seeing sharp growth from its 2006 population of about 17,000.

In 1994, Sénart initiated a GIS strategy, but did not involve a single choice of software. Moissy-Cramayel needed a GIS solution that also handled its CAD operations. The other eight communities were using a mix of ESRI, Bentley, MapInfo, and Autodesk software, and Moissy-Cramayel needed to interact with all of them.

Moissy-Cramayel chose AutoCAD Map 3D to integrate the community's GIS elements into its CAD operations. AutoCAD Map 3D allowed Moissy-Cramayel to share its cartographic data with its own technicians and its surrounding communities.

Moissy-Cramayel also needed a simple tool that would allow it to disseminate geospatial information through a Web browser. In 2006, Moissy-Cramayel installed Autodesk MapGuide Enterprise. With the help of Autodesk partner GEOMAP, it implemented a solution for integrating, sharing, and publishing geospatial information

among internal teams and remote workgroups. Jean-Marie Prévost, the city's manager of technical research, explained, "We wanted a solution that would allow us to use the data in AutoCAD Map 3D and would be compatible with ESRI data. MapGuide Enterprise was the ideal. We showed MapGuide to representatives from the different communities, and everyone was impressed. Several communities remarked particularly on the ease with which we installed the software; they saw that this type of solution was within their reach. The tool really allows us to make GIS accessible to the people."

Prévost and the city have made a strong commitment to open source by implementing Autodesk MapGuide Open Source along with a number of other open source geospatial applications. The city's open source approach has allowed it to optimize the value of its geospatial information resources while maintaining the lowest practical cost.