
BENTLEY/ESRI AEC-GIS INTEROPERABILITY

WHITE PAPER

March 2003

Introduction

ESRI, as a GIS provider, and Bentley, with its solutions for Architecture/Engineering/Construction (AEC) professionals, both provide graphically oriented applications that use a spatial context.

These applications are often used within organizations served by both Bentley and ESRI. Such organizations include municipalities, transportation departments, national government agencies, utilities, and others.

While Bentley and ESRI applications may create and maintain data in a common coordinate space, they are designed for unique purposes and therefore used by individuals with distinct organizational functions.

ESRI users typically perform enterprise data management, decision support, cartography, planning and analysis functions. Bentley users design, engineer, build, and operate roadways, buildings, plants, communication networks and other large constructed assets.

The planning role, for example, requires a broad view of spatial information, the ability to work with large areas, and a powerful toolbox of analytical functions. Engineers create and work from sets of detailed drawings and models, with spatial information, and require a rich set of 2D and 3D geometry-based engineering and design functions.

The needs of the planner are best met by a continuous database, a GIS. The Engineer's requirements continue to be best met by a model and drawing paradigm.

Yet, despite distinct roles, planners and engineers very much depend upon each other to conduct their work. Planners need accurate information on as-built conditions and engineers and architects need the context of plans to create their designs.

Operational staff need access to all of this information. The work is not static but synergistic, dynamically integrated, and recursive.

Despite the obvious practical need to share information, it is very difficult to share digital content between planners and AEC Professionals. Very little true functional integration exists between AEC and GIS solutions.

In today's world, the requirements for interoperability are met most commonly by exchanging files in an ad hoc manner. Files are then imported and reformatted for use in the target system. Or, for those with lower tolerance levels, workflows are reduced to exchanging printed materials.

With a file exchange paradigm considerable information is lost in the translation. There is no record of information dependencies. There is significant editing of translated information to "clean-up" the data. And there is no central information index, available to both AEC professionals and planners, that details who has what information. File translation allows only the lowest level of information content to be communicated as a unidirectional unique event.

The purpose of this white paper is to describe the high level approach to integrating the AEC content created and managed with the Bentley solution and the GIS information created and managed by the ESRI solution. Specifically, this paper will detail how the two architectures, ArcGIS and the Bentley Create, Manage, and Publish environment will interoperate.

Interoperability

Interoperability is at its best when it is implemented to support real world workflows. The implication of this emphasis is that each environment must extract only the specific data that it needs to support a particular workflow, and then present it in a form natural to the user of the solution. Therefore, interoperability by definition will require connections provided by Bentley that integrate with ESRI solutions, and connections provided by ESRI that integrate with Bentley solutions.

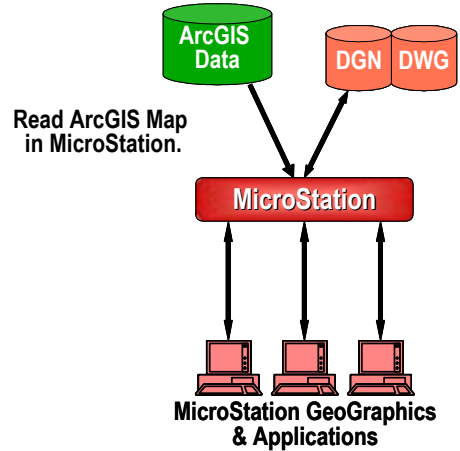
Client Interoperability

The first step in interoperability that we will describe is implemented at the client level. MicroStation® is the AEC content creation platform for Bentley. Upon this single integrated platform, Bentley offers interoperable civil engineering, building design, plant design, and geospatial solutions. These applications read and write DGN and DWG files.

Likewise, ArcGIS® includes a range of GIS client applications, which read and write the file and database types supported by ArcGIS for various GIS related solutions.

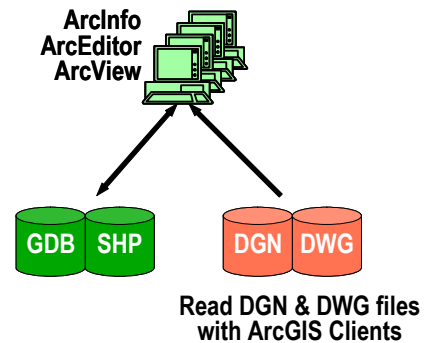
An initial step in interoperability on the Bentley side will enable MicroStation and Bentley geospatial applications to directly read a map project file known as a map document (MXD) and associated data from ArcGIS for the purposes of importing land bases, utility networks, and so forth from ArcGIS in order to support engineering work.

The technology to read the exported map will be supplied by ESRI. Bentley will integrate this technology into MicroStation to enable a direct read of ArcGIS data formats.



ESRI will enable ArcGIS clients Desktop (ArcView®, ArcEditor®, and ArcInfo®) to directly read both MicroStation V8 DGN and DWG files. Bentley will provide the supporting technology to ESRI.

This integration will enable geospatial information created in the engineering phase to be imported and referenced by GIS applications.



Server to Server Interoperability

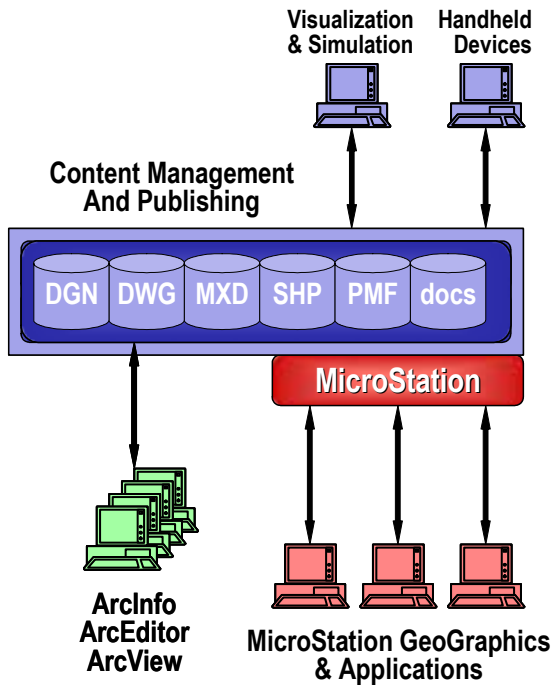
Integration, to be effective, must not only address workflows that support information creation, but also span enterprise solutions designed to manage and publish created information.

Both ESRI and Bentley offer server based solutions to provide a managed environment for their users' data and to facilitate practical integration with enterprise systems. In Bentley's case, this environment is referred to as AEC Content Management and Publishing. In ESRI's case, this environment is a geodatabases accessed via ArcSDE®.

AEC Workflows

Consider first the interoperability requirements of AEC professionals who use Bentley content management and publishing products to manage their AEC content.

The first interoperability requirement is to enable the content management and publishing platform to support the file types created and used by ArcGIS Desktop (SHP, PMF, MXD, etc...).



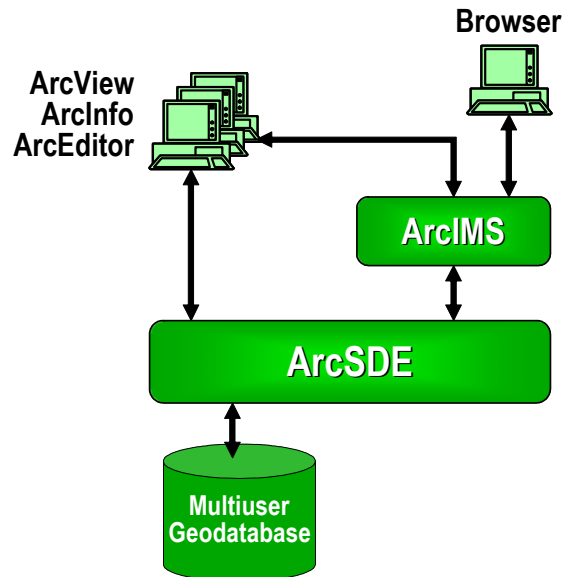
This integration will provide a managed environment for AEC users to seamlessly access geospatial content stored in ArcGIS formats along with other content stored in DGN, DWG and other formats. This integration also makes it possible to effortlessly distribute geospatial information, regardless of the format, to AEC content users via Bentley's content publishing solution.

Another aspect of this interoperability is to enable ArcGIS desktop applications, including ArcCatalog and ArcMap®, to interoperate with the Bentley content management & publishing environment. ArcGIS clients therefore will benefit from the same functionality for change management and collaboration that is available to Bentley users.

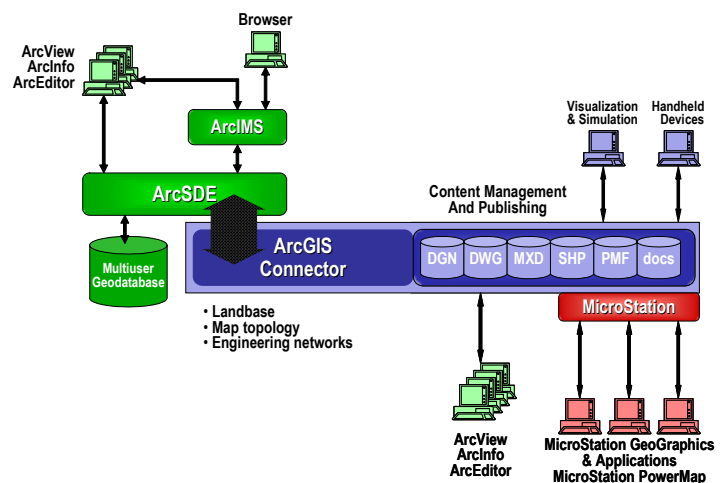
Bentley and ESRI will exchange the technology necessary to facilitate this integration.

Planning and Analysis Workflows

Now, consider the interoperability requirements of ArcGIS professionals who have implemented the ArcGIS geodatabase capabilities for a continuous GIS database and ArcIMS® for publishing GIS content.



Interoperability in this case is achieved through an "enterprise connector" between Bentley content management & publishing environment and ArcGIS - the Bentley ArcGIS Connector.



This connector enables direct population and updating of a geodatabase based on AEC content created by MicroStation (and AutoCAD) users

managed by Bentley's content management & publishing platform. This connector enables automated synchronization based on the state of the files and components managed by the Bentley solution. The connector can be used to extract or post information to support the creation or update of landbase, map topology and engineering networks, among other things.

This integration also enables MicroStation users managing their AEC content within the Bentley content management & publishing environment to automatically generate DGN representations of land bases from the geodatabase. These representations can be used as background information in creating and editing AEC content with any of Bentley's integrated discipline specific application solutions.

A Unique Approach

The Bentley/ESRI relationship will result in AEC/GIS Interoperability that is unequalled and unprecedented. This integration will ...

1. Enable MicroStation to read ArcGIS maps / data and enable ArcGIS clients to read DGN & DWG files.
2. Provide support for ArcGIS files (SHP, MXD, coverage, etc.) within Bentley's Content Management & Publishing environment
3. Result in an "Enterprise Connector" with ArcGIS that...
 - Synchronizes relevant AEC content with the ArcGIS Geodatabase.
 - Retrieves relevant GIS information from the ArcGIS Geodatabase.

The Bentley/ESRI Interoperability paradigm leverages the best of both worlds and does not ask users to work with lowest common denominator tools or data to accomplish their tasks.

This work began in 2002 and will be realized with commercial delivery staged throughout 2003. Further details will be provided at the Bentley International User Conference in Baltimore, May 18-22 (see www.bentley.com) and at the ESRI User Conference in San Diego, July 7-11 (see www.esri.com).

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