SMART DOCUMENTS

THE FUTURE OF ELECTRONIC BID SOLICITATIONS (EBS)
FOR CONSTRUCTION and MANUFACTURING

While EBS has become well established in numerous large construction procurement organizations, the end-to-end use of EBS documents has been less successful. This white paper provides a brief history of EBS, discusses user needs that have arisen as a result of early EBS implementation experiences and the new advanced technologies including 'Smart Documents' that have been developed in response to these needs. The paper also discusses the importance of end-to-end EBS and the role these new advanced technologies and Smart Documents can play in achieving end-to-end buy-in on the part of document recipients to the ultimate benefit of the project owners who underwrite most of the costs of the bidding process.

BACKGROUND

How did Electronic Distribution of Bid Documents Originate?

The origins of the electronic distribution of plans and specifications (bid sets) in the United States, can be directly traced to a 1995 Tri-Service CADD/GIS Technology Center study involving the US Army Corps of Engineers, Air Force, Army and Navy resulting in a pilot project conducted by several Corps district offices. This initiative set about to distribute bid sets on CD-ROM using MaxView's original 16-bit Author/Viewer tools called 'SourceView".

The pilot avoided the printing of over 190,000 drawing sheets and over 1.6 million specification sheets (a stack of paper 47 feet higher than the Washington monument) and saved over $175,000 in printing and distribution costs. The project was so successful that the Corps was the recipient of the prestigious Hammer Award for greatest savings achievement through electronic data interchange in the US government.

By 1999 the Corps had eliminated paper entirely as a distribution media for its construction bid sets and by 2000 the US Air Force also standardized on 'SourceView" for it electronic distribution (primarily using the Internet) at all 130 of its bases worldwide.

Because of their size and the number of independent architects, engineers, contractors, subcontractors and suppliers they involve, these organizations quite literally established electronic bid distribution; by carrying-out the original pioneering and giving the practice widespread exposure and credibility.

Concurrently in the 1997-98 timeframe, some private construction plan room operators, such as Builders Exchange in Texas and the Valley Construction News in Virginia (who also both used the 'SourceView' technology for these implementations), pioneered early versions of electronic plan room facilities to augment their physical paper-based plan room operations. By the end of 2000, many independent plan room operators, the AGC organizations and both national plan room operators had in place some form of electronic distribution: CMD with CD distribution and F.W. Dodge with an Internet-based document ordering facility. Private industry participants such as Anheuser-Busch Companies and Cessna Aircraft were early adopters of electronic bid solicitation distribution on CD.

In the design/build sector, where bid sets were traditionally distributed either through an in-house print facility or through reprographers, by 2000, there was scattered adoption of electronic distribution primarily through information services such as Buzzsaw and Citadon in conjunction with their project management and collaboration capabilities.

What are the Benefits of Electronic Distribution?

Everyone involved with the construction and manufacturing bid process benefits from the use of electronic distribution:

- Owners realize major cost savings, reduced time required to complete the process and gain wider distribution and more competitive bids from the process.

- Contractors, subcontractors and suppliers save time and travel cost and are in a position to look at and bid more projects by having access to project information over the Internet rather than visiting a plan room.

- Architects and Engineers (A/Es) benefit from reduced costs and more accurate bid information distribution.

One study by the Army Corps of Engineers reported savings of paper costs alone to exceed $18,000 for an average project. In addition, process times were cut by an average of 24 days. Use of the Internet eliminates postal and courier costs and enables immediate notification and distribution of amendments.

This and numerous other examples have shown that electronic distribution of construction bid information is indisputably a reliable, less costly, faster, more accurate and convenient alternative to paper distribution.

What Technologies Enabled Early EBS Initiatives?

A number of characteristics of the original CAD formats used to create large scale drawings made those formats less than ideal for distributing plan documents to a mainly non-technical audience of contractors, sub-contractors and suppliers:

- Documents using the original CAD format are easily alterable and do nothing to protect the original copyright work of the author.

- Documents in the original CAD formats are typically large and do not compress very efficiently.

- Access to these documents using the CAD system requires technical skills not generally part of typical recipient's profile.

The Group 4 TIFF format (using the CALS superset) was selected as the DOD standard. This raster format offers a number of significant advantages:

- It is an open, non-proprietary format.

- As a read-only raster format, TIFF is not easily altered and protects the originators work in much the same manner as paper; in that it is not readily imported into a CAD system for use or alteration.

- TIFF is widely used and supported in the print industry.

- TIFF compresses very efficiently into a compact document.

- It scales correctly and can be used to produce accurate measurements.

Although TIFF can be and is used for the distribution of specification documents, other original text formats such as Word, Word Perfect or Rich Text Format or the proprietary PDF format are more efficient for text-based documents and are often preferred for this function.

As importantly, tool sets were needed to prepare the documents for distribution and to view the documents by their recipients. Text documents had their own free Viewers however available single-image TIFF Viewers were inadequate for a group of documents such as construction drawing sets. For this reason, MaxView's original SourceView product was selected for large-scale plans.

SourceView authoring organized TIFF files into an easily navigated structure and its free Viewer allowed end users to locally view and print the documents as well as perform some limited functions to assist in estimating tasks. SourceView also had an accompanying conversion capability to convert documents from their original format to TIFF or CALS.

By converting original CAD drawings into the more secure and compact TIFF format early adopters of EBS were able to effectively replace paper distribution with an electronic media. The early tool sets of SourceView alone or in conjunction with other text-oriented tools, made EBS documents easily accessible for the viewing and printing operations that non-technical document recipients mainly wanted to perform.

User Needs Unmet by Early Technologies.

Although early EBS technologies did much to improve the efficiency of bid distribution with organize-view-and-print capabilities, the simple structure of these documents and the limited design scope of the first generation of technology tools could not respond to a number of emerging user needs:

1. Growing Complexity of User Tools

As recipient users become more comfortable with electronic documents and seeing the benefits of going electronic could bring to their own operations, many of these users begin to demand more functionality. Viewer vendors responded with the addition of more sophisticated take-off and mark-up tools.

As a result of this enhanced functionality, novice users were now encountering a much more complex and intimidating user interface, largely defeating the simplicity that made these tools attractive in the first place.

With this growing complexity, there is clearly a need to segregate functionality so that novice users just entering the process can easily learn and use the tools but yet enable a relatively seamless transition as user sophistication grows.

2. The Need to Communicate More Information from the Original CAD Documents

The original CAD document structure contains a rich store of information regarding the drawing. Information such as the sheet identification and drawing description, the scale factors and a hyperlink between associated drawings would be very useful to the more sophisticated users working with the electronic documents to produce a bid.

In order to simplify the process for early users, CAD formats were abandoned in favor of the TIFF structure and most of this information was left behind. However, with the emergence of more sophisticated recipients described in Point 1 above; the availability of this information became desirable and useful at this level.

What was needed was a simplified method for early non-technical users to access the documents *and* a way for more advanced users to get additional selected information that originated from the CAD drawing when they wanted it, also in a straightforward non-technical manner.

3. Document Security

While the TIFF structure is more difficult to alter, it does not provide a way of guaranteeing the integrity of a document or a document set. Nor does the structure provide a way for a recipient to verify the authenticity of a document through confirmation of the originator.

4. The Need for the Recipient to Exchange Document Information with Others

In accessing the documents for purposes of developing a bid, users often have a need to perform information takeoffs such as counting elements and measuring areas and marking these elements on the documents themselves. They may also wish to annotate or place notes on the document for others to read. Later there may be a need for such information to be communicated to others involved in the process who may also wish to perform similar operations.

Advanced Technologies for Improved EBS.

In response to the above user needs, leading industry vendors have developed advanced technologies that go far beyond the simple organize/view/print applications that characterized earlier offerings.

These applications address more sophisticated recipient needs while not compromising the entry-level simplicity that is still highly desirable for novice users.

1. All-In-One Tool Sets

Early offerings either provided an all-encompassing single application or separate applications for basic viewing and other major functional classifications such as take-off tools for estimating and mark-up tools for document collaboration.

MaxView's state-of-the-art Viewer technology today places all these functions in a single application with more sophisticated functions configurable and turned-on only when the user requires these functions.

In this way novice users are presented with a very straightforward interface while more sophisticated users can easily migrate to higher levels without re-installing the base application.

2. Multiple Format Support

Early Viewer technologies offered discreet format support: meaning different document types had to be organized in separate file structures. This meant users, such as those using TIFF for drawings and PDF for specification documents, had to switch between file structures to go from one document format to the other.

Advanced Viewer implementations provide support for multiple formats within the same organizational file structure and the particular Viewer needed for the different document type is seamlessly launched by the advanced Viewer's master application.

3. Enhanced Document Creation and Online Viewing

Saving time and effort during the document creation cycle is a major objective in every project. An example of new creation functionality in advanced applications that provides major savings is the ability to create organized documents directly from standard Microsoft Windows directory structures, replicating the layout and automatically generating a document index with hyperlinks to the individual documents.

Advanced technology also provides a number of new functions that greatly improve the user experience in an online environment. To improve the speed of access to large documents a new 'preview' capability reduces the access time by up to 90%. This is particularly important for entry-level users who may only have a low speed connection to the Internet.

With this new technology, users can open the master index on-line and quickly 'preview' the documents to determine those that they actually wish to download. The selections can be 'book-marked' and then full resolution copies may be obtained in an unattended batch mode.

4. Smart Document Support

The single most important recent technological advancement for EBS document distribution has been the creation and implementation of the 'Smart Document' concept.

'Smart Documents' carry with them additional information that significantly enhances the usefulness of these documents to the recipient.

How do Smart Documents Work & What do They Provide?

Smart Documents are ordinary documents that carry with them an appendage that defines various attributes without altering the format of the original documents. In this way the original document is still useable in its native form but can reveal additional functionality or features when supported in the recipient's application.

1. CAD System Document Tools

Using familiar tools integrated into the originating CAD application, the CAD operator creates drawing files with information that can be extracted and transferred to the advanced Viewer's authoring application. This provides a method by which information is created once and made useable in an 'end-to-end' EBS environment.

The extracted information is transferred using an industry-standard XML format that is useable by any application implementing the XML schema and is not proprietary to any particular Viewer vendor.

Data currently supported by the structure includes scaling, indexing and hyper-linking from MicroStation DGN files. Support for AutoCAD is expected in the near future. The structure is also designed to be expandable to include other data elements as they are identified and implemented.

2. Annotated Document Layers

Using advanced Viewer applications, recipients can create additional layers to a document without changing the original format or content of the document. These layers can contain information such as element counts, measurements, as well as various markup and annotations to the documents. Layers can even be individualized to the particular discipline or individual involved. For example one layer could pertain to electrical while another could pertain to plumbing attributes of a drawing.

When completed, these layers may be transported, along with the original document, to other users for viewing, verification of counts and measurements, adding information or adding their own unique layers.

3. *Digital Signature Authoring & Verification*

A new capability in MaxView's technology is the creation of an encrypted authentication key that identifies the originator and provides a data integrity check sum as the final step of the authoring process. This information is appended to the document as a digital signature.

A counterpart application at the recipient (Viewer) location interrogates the digital signature and compares the check sum with a locally calculated check sum to ensure the document has not been altered since its creation.

4. *Document Based Feature Codes*

Advanced technologies have implemented new features enabling document originators to invoke higher level software capabilities at the recipient's location without the recipient having to purchase a higher level software package.

The originator, who decides to distribute documents with the higher level capabilities, purchases and obtains a special authorization code over the Internet. This authorization code travels with the document and then turns on the recipient's Viewer software to a higher level for that document only.

Alternatively, a document recipient who needs the higher level features of a software package can purchase this functionality through an e-commerce website, and receive a special authorization key for use with that specific single document.

Benefit of Smart Documents.

Early implementations of EBS unquestionably did much to improve bid distribution by eliminating paper and speeding up the process particularly for large-volume originators.

However, many recipients regarded these implementations as simply a means of shifting the cost of producing the paper from the originator to the recipient since, for most of these recipients, the process culminated in the production of paper. By reverting to paper after receipt of the document in electronic form, recipients dilute the benefits of EBS implementations and the additional cost at this level inevitably returns to the project owner in the form of unnecessarily higher bids.

It is only with the full implementation of end-to-end EBS that all the benefits of going electronic are realized. Since the project owners are the ones that ultimately pick up the majority of the costs involved in bidding, it is just as important to them that effective implementation of EBS and the use of electronic documents occurs at the recipient's location as well as their own.

In order to replace paper as the preferred media of choice and achieve major buy-in on the part of the contractor, sub-contractor and supplier communities, electronic documents must be more convenient, easier to use and more useful than paper.

The new advancements in Viewer technologies and the advent of Smart Documents do much to achieve these goals:

- New preview and selective transfer techniques make electronic documents convenient to obtain even with slow speed connections.

- Multiple format support within a single document organization structure and all-in-one configurable Viewer tools make electronic documents easy to use for novice users while also making it easy for advanced users to access more sophisticated functions.

- Integrated tools within the originating CAD applications and other automated document creation capabilities make the new Smart Documents far easier to create than earlier generations of tools.

- Providing more information from the originating CAD documents, including encrypted digital signatures and allowing user annotation layers to be appended makes new Smart Documents more useful and secure than paper for all users.

By helping accomplish these goals, the new advanced Viewer technologies and Smart Documents establish themselves as the future of EBS.

MaxView Corporation is a Washington State company located just north of Seattle in Mukilteo, Washington. MaxView was an early pioneer in movement towards paperless bid solicitations with its original 'SourceView' product and since its formation has been dedicated to the development, distribution and support of advanced software technologies and services for electronic bid set distribution industry. MaxView's products are used by a wide cross section of both public and private organizations including the USACE, the USAF and many private sector service firms. For more information please visit www.maxview.com or call (425) 423-0777.