January-February 2012 • Vol 104 • Number 675

TME

The Military Engineer

SOCIETY OF AMERICAN MILITARY ENGINEERS

Cloud Computing & BIM

When it comes to understanding the latest innovation to hit engineering and architecture, a basic primer is plenty complex.

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The increasingly competitive financial and environmental landscape requires public and private institutions to further maximize facility planning and management.

Technologies such as Building Information Modeling (BIM) and Cloud Computing (Cloud) are disruptive technologies converging to significantly alter traditional construction and facility management practices. Both technologies also embed associated business process rules and components that will enable enhanced life-cycle management of the built environment, alignment of structures with organizational mission, and better consideration of general community impacts.

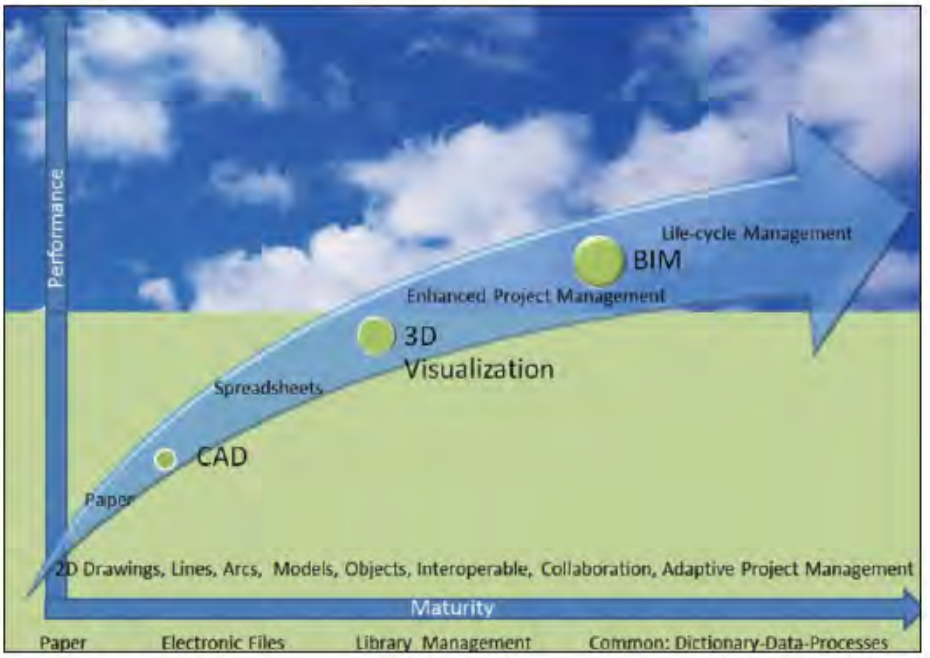
Leading organizations already are investing in the formalized definition and creation of robust business process frameworks, cultures, workflows and capabilities to support collaboration, continuous improvement and lean practices needed to achieve higher productivity within the architecture, engineering, construction, owner and operator (AECOO) sector.

BIM and Cloud provide the digital backbone to support the cost effective, scalable development and deployment of adaptive and efficient facility life-cycle management practices.

DEFINING BIM

BIM is the life-cycle management of facilities supported by digital technology and can be applied at various levels. Currently, its most common use is as proprietary 3D visualization software for the purpose of supporting the design and construction phases of the facility life-cycle. At this level, BIM's value is primarily to architects, architectural engineers and business development professionals, as well as owners working to design, market and construct new facilities. Case studies have documented the cost and time savings offered at this level of BIM application; however, BIM's ability to fully support the facility life-cycle—planning, design, procurement, construction, operations, repair, renovation, sustainability, adaptation and deconstruction—is where the highest value will be realized. Attaining this advanced life-cycle implementation of BIM on a widespread basis will require the following to occur.

- Major cultural change within the AECOO sector.
- Standardized taxonomies and data architectures.
- The availability and integration of secure technology to promote collaboration and the integration of currently disparate business processes and knowledge domain specific software applications such as: capital planning and management systems; computer-aided facility management; cost estimating and project management; efficient construction delivery methods (Integrated Project Delivery, Job Order Contraction); computerized maintenance management systems; geographic information systems; and building automation systems.



DEFINING CLOUD

Cloud computing, or cloud technology is, according to the National Institute of Standards and Technology, "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Cloud allows users to access parts of virtually limitless application and computing resources at their fingertips. Access is faster and easier than traditional "client-server" or "web-based" applications. While some software vendors may have it host their legacy applications and call them "cloud apps"—a practice known as "cloud-washing"—true cloud applications offer each of the following:

- ***On-demand self-service.*** A user can sign up and receive services without delay.
- ***Broad network access.*** Ability to access the service via multiple platforms, including desktop, laptop and mobile devices.
- ***Rapid elasticity and scalability.*** Computing resources are available to meet requisite demand.
- ***Measured Service.*** Metered or time-based billing based upon computing resource levels and/or storage levels versus time.

There are several levels of cloud computing, which may appear distinct but tend to blend, even become transparent, based upon the type of usage.

- ***Software as a Service (SaaS).*** SaaS is the "end-user" level of cloud computing. Access to software application, such as Microsoft Excel, is provided on an on-demand basis via a web browser. Applications are available via the Internet on a "right to use" and "pay-as-you-go" subscription model. There is no additional annual fee for software maintenance, or any need to worry about upgrades or patches. Users simply pay a monthly or annual fee for access based upon time or usage.
- ***Platform as a Service (PaaS).*** PaaS is the set of tools and services designed to make coding and deploying SaaS applications efficient. While transparent to most end-users, it is the power to create and deploy applications exponentially faster within a standardized, secure environment that is driving the adoption of Cloud.
- ***Infrastructure as a Service (IaaS):*** IaaS represents all the hardware and software infrastructure—servers, storage, networks and operating systems.

BIM AND CLOUD CONVERGENCE

To better understand the explosive power of mixing BIM and Cloud relative to removal of the traditional process and technology silos within the AECOO sector, it is important to look at cloud computing in more detail.

SaaS is tailor-made for applications where there is significant interplay between the user organization and the outside world; for applications that have a significant need for web or mobile access; for software where usage may be intermittent, or demand spikes occur frequently. Each of these is common within all phases of construction, repair, renovation and sustainability projects.

PaaS also offers several key capabilities. Tools and services to test, deploy, host and maintain applications are provided within one integrated development environment. Brower and web graphical user interface (GUIs) creation tools also are a part of PaaS platforms to speed up the ability to create, modify, test and deploy client-specific applications.

Each is accomplished within a "multi-tenant architecture," where developers can work concurrently within the application. This translates into being able to build and deploy massively scalable, secure applications at a fraction of the time it would have taken for traditional software deployments.

Additionally, this is all accomplished within a set of common standards, assuring the ability to "talk" to virtually any other application. Multiple developers can be working on a development project or other external parties can easily become part of development process. This is critical where multiple professionals have existing data sources—cost data bases, project information, contract information—and need to enhance the ability to pull and maintain knowledge from these sources. A notable example of PaaS is Microsoft Azure™.

Cloud computing allows facility stakeholders throughout the world to work concurrently with the same data. For example, take the creation of cost estimates for a major facility renovation, that is located in a foreign country, but part of a large real estate property portfolio owned and managed by a U.S.-based operator.

Anyone asked to participate is simply invited by the owner, or the owner's representative. The invite can be sent in any language automatically. Invites also can be built to allow access to information to a specified level of granularity. Once invited, and upon acceptance, the invitee will see only the subset of information enabled by the "host." Perhaps the owner is providing full access to a general contractor, or the general contractor may be providing limited access to a sub-contractor. Invited parties may be allowed to conduct work on the information, such as prepare a construction cost estimate, or work jointly on an existing cost estimate.

Regardless, changes can be made at any time, and at any level, as defined by the account administrator. Each change can be done in local language and currency. Each change is then automatically recorded and tracked right down to time and user, with full "undo" and "redo" capability. This is real-time collaboration and transparency. This is BIM.

As the technology solution provided by cloud computing enters the AECOO sector, standardized life-cycle process definitions and associated exchanges of information take front stage to insure that various domain-specific meanings are consistent and apparent at all levels.

Robust and proven business process, such as Integrated Project Delivery and Job Order Contract will be easily and cost-effectively implemented and consistently deployed throughout organizations regardless of type or location.

Owners, architects, engineers, contractors and subcontractors alike will be empowered to access these and other methods to significantly improve productivity.

The fact that business process and workflows of these efficient project delivery methods, and all other components of a BIM Framework, are embedded into the cloud technology is central to the empowerment and success of all built-environment stakeholders. Using traditional technology and methods, these capabilities would be limited to organizations that could afford the associated "front-end" implementation and ongoing technology and process management costs. And even then, success would not be assured, given that collaborative and "real-time" monitoring, as well as adaptive response, would not be readily available.

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