

# STANDARDS AND INTEROPERABILITY FOR THE AEC MARKET

## BIM: Building Information Model

A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a building. Construction and management of buildings involves many stakeholders, so that proper sharing of information over the entire lifecycle of a building is very important. The Open Geospatial Consortium (OGC) is developing BIM standards that promote efficient web-based information sharing in the Architectural, Engineering, Construction and building Ownership and Operation (AECOO) markets.

BIM standards are crucial for increasing productivity, more and more important in a world struggling to recover from problems related to real-estate financing. Standards reduce costs in design, construction and management throughout the lifecycle of capital projects such as office buildings, bridges and airports. Project lifecycle phases include concept, design, construction, operation, management and decommissioning. BIM standards also improve public safety and minimise disaster management risk.

### Shared Source

A Building Information Model (BIM) involves integration of CAD drawings, geospatial data and other graphical and non-graphical data, and may represent the view of a building from any practitioner perspective: architect, specification drafter, engineer, fabricator, leasing agent, lender and general contractor. As such, it serves as a shared source of information on a building, forming a reliable basis for decision making during its lifecycle. Pushing users in the direction of discovering, accessing and 'fusing' information to support decision-making throughout this lifecycle is the technology enabler of network-based distributed computing. It shifts the focus from isolated drawings and project-specific data files and software systems to drawing, seemingly spontaneously, on information and software services residing on countless servers. Key to this development is interoperability and standards.

### Interoperability

For interoperability many stakeholders have to agree on common interfaces, schemas and best practices addressing specific requirements. The US National Building Information Model Standard (NBIMS), for example, lists the following requirements:

- ubiquitous access to reliable, user-driven, decision-quality information
- immediate availability of data to those needing it
- data discovery without pre-existing knowledge
- priorities for establishing relevance, timeliness and accessibility
- freedom to tailor implementation and output and allow deployment to be scaled appropriately
- mix-and-matching of software vendors' capabilities and performance distinctiveness
- reliability, fault tolerance, and security.

### Standards

Players in the global, multi-trillion dollar AEC market have for years grappled with the problem of how to develop and ensure vendor adoption of market-driven information standards promoting sharing and efficiency. Recent studies such as 'Interoperability in the Construction Industry, Smart Market Report - Design and Construction Industry' document AEC business concerns on interoperability.

### Old Milestone

In the current OGC AECOO-1 Testbed AEC stakeholders are using the OGC consensus process to begin the transition from BIMs based on file conversion, or data transfer, to BIMs based on web services. Building information standards such as Industry Foundation Classes (IFC) are text-based data representation standards used to support information exchange and sharing of lifecycle data. IFC addresses geometry and properties of buildings, but it is essentially a conversion standard similar to the Spatial Data Transfer Standard (SDTS) introduced to the GIS industry in 1992 by the US Geological Survey. Like SDTS, IFC is cumbersome, and vendors have received little guidance or incentive to ensure consistency of implementation. The construction industry now finds itself in the same 'data transfer phase' experienced by GIS in 1994, when the OGC started an interoperability approach based on open interfaces rather than data transfer. OGC's first Web Mapping Testbed, which started in 1998, was an important milestone in the development of interface-based 'many to many' interoperability. The AECOO-1 testbed, in which sponsors and participants are currently defining the types of information necessary for certain tasks, forms a similar milestone in the progression from file-based towards service-based interoperability within the AEC community.

## **New Testbed**

Participants in the testbed are developing document types for building performance and energy analysis, including an Information Delivery Manual and a Model View Definition. Sponsoring the testbed are not only American companies, agencies and organisations, but also Statsbygg of Norway. It is organised by the OGC and the buildingSMART alliance (bSa), a North American organisation with an active membership of more than two hundred vendors, practitioners and universities aiming at open interoperability and full lifecycle implementation of BIM. The bSa participates in the worldwide International Alliance for Interoperability (IAI).

## **Two Threads**

Geospatial information is one component of a BIM, and previous OGC testbeds have involved BIM 'threads' that clarified CAD/3D/geospatial interoperability issues.

For example, in OGC Web Services Testbed 4 the use of BIM was demonstrated in the siting, design and outfitting of an emergency field hospital. The OGC has also worked with organisations such as the Simulation Interoperability Standards Organization (SISO) and the Web3D Consortium to facilitate simulation interoperability and communication of real-time 3D across applications and XML web services, and this work is pertinent to BIM development. But the main reason that bSa and a list of 'blue ribbon' sponsors chose to work with the OGC is that it provides the fastest and most inclusive process within which stakeholders can define market-driven interoperability solutions and global IT-based standards for the AEC market. Geospatial integration is, in fact, not addressed in the present testbed, but it will be so in follow-ups and/or interoperability experiments. The two threads chosen by the sponsors are primarily building performance and energy analysis, and secondly quantity take-off; that is, standards-based ways to derive more accurate quantity information and cost information from the model. All OGC core service interface standards and encoding standards have some relevance for AEC. Geospatial standards ready for introduction to the AEC market are summarised below.

## **Ready for Introduction**

One key standard for geospatial integration in BIM will be CityGML, an open-data model framework encoding standard for the storage and exchange of virtual 3D urban models and application schema of Geography Markup Language 3 (GML3). According to Carsten Rönsdorf of Ordnance Survey UK, chair of the OGC CityGML Working Group, "CityGML will play an important role in creating Virtual Cities to improve interoperability among the information systems used in many domains of activity that involve design, construction, ownership and operation of infrastructure." The OGC Geo Rights Management (GeoRM) Domain Working Group has developed a framework for purchasing, managing and protecting rights to digital geospatial content so as to tailor offerings implementing the policies of providers and their users. The GeoRM Reference Model under development is expected to result in OGC adopting interface and encoding standards and to be useful in the development of standards for purchasing, managing and protecting rights to AEC content. The aim is to create a system that can accommodate all data sharing agreements: public library models, emergency access, purchases, licenses, control of derivative products and so on. Access control is a necessary complement to rights management.

A standard for access control in the geospatial domain is provided by the OpenGIS Geospatial eXtensible Access Control Markup Language (GeoXACML) Encoding Standard. This defines a geo-specific extension to the XACML Policy Language 2.0 (eXtensible Access Control Markup Language (XACML) Version 2.0), as standardised by the Organization for the Advancement of Structured Information Standards (OASIS).

The testbed results will be reported in early 2009, and we invite comment and additional participation.

## **Further Reading**

McGraw-Hill Construction, 2007. Interoperability in the Construction Industry, SmartMarket report. Design and Construction Intelligence. 2007 Interoperability Issue.