10 REASONS WHY IFC IS THE CENTRAL KEY TO SUCCESSFUL BIM PLANNING

WHITE PAPER

ARCHITECTURE GRADUATE FROM ETH ZURICH, DANIEL ZUPPIGER,
MEMBER OF THE MANAGEMENT BOARD AND BIM MANAGER AT STÜCHELI ARCHITEKTEN AG
INES MANSFELD, ARCHITECT AND PRODUCT MARKETING MANAGER, ALLPLAN GMBH

Building Information Modeling (BIM) characterizes the construction industry and is increasingly being required globally for the contracting of construction services. The aim is to deliver construction projects efficiently. This requires transparency, good communication, and cross–discipline cooperation. The focus is on the digital building model, which contains all information from all disciplines.

BIM is not software, but rather is a working method for the construction industry where people, processes, and tools interact in a goal-oriented manner. Theoretically this sounds simple, but it presents a major challenge for planners. Exchanging CAD data, in particular, has proven to be faulty in the past with conventional working methods. Exchanging different file formats of various software between disciplines has often led to losses of information.

A neutral data format was developed to ensure a smooth BIM process: the Industry Foundation Classes (IFC) format. In the following ten sections, read about the powerful tool the planners at Stücheli Architekten from Switzerland use and how they efficiently process BIM projects with the help of the IFC data exchange.

1. IFC improves interoperability through optimized interfaces.
2. IFC is constantly optimized and developed further through the buildingSMART initiative.
3. BIM is a massive opportunity for the construction industry, and IFC will become the catalyst that ensures success.
4. IFC enables cross–manufacturer and cross–software communication.
5. IFC supports numerous applications within construction and offers great benefits.
6. Simple work with subsets: only key planning information is handed over.
7. IFC supports the important standardization of the BIM workflows.
8. The BCF format simplifies data exchange in the IFC data model.
9. IFC is committed to open data exchange as an internationally accepted language.
10. Practice has shown: IFC and openBIM thinking are firmly anchored in planning.

„BIM MAKES INFORMATION VISIBLE"
Architecture graduate from ETH Zurich, Daniel Zuppiger, member of the management board and BIM manager at Stücheli Architekten

1. IMPROVED INTEROPERABILITY THROUGH OPTIMIZED INTERFACES

All BIM-capable planning solutions on the market, especially Allplan, ARCHICAD, Vectorworks or Autodesk Revit, work with proprietary file formats. A uniform file format—or common language— was therefore required in order to lay the foundation for making data transfer and exchange in today's BIM process as smooth as possible. The foundation was already laid for this in 1995 with the „International Alliance for Interoperability" (IAI). There was no mention of BIM. The first vector-based 3D models emerged at the time among the early adopters in a few planning offices. However, transfers of planning data from one CAD software to another, or into a tendering program, were necessary at this time and could already be achieved with the first IFC versions. Since then, IFC has accompanied planners through the changing building process, and with the establishment of BIM, is becoming more important than ever in everyday planning.

IFC INTERFACE
Data from various proprietary software applications is exchanged via the IFC interface.

2. CONSTANT OPTIMIZATION AND CONTINUED DEVELOPMENT

IFC and buildingSMART are closely linked with each other. The predecessor organization, IAI, was created on the idea of leading planning and building software companies. It was founded in order to advance the model-based planning methods that were still new in the 1990s and 2000s, and to improve data exchange through optimized IT interfaces. In 2005, the name was then changed to buildingSMART. Today, the international organization has 550 members and is active in 24 countries. In addition to the important task of optimizing the interface, the members work closely together on the continued development and standardization of open exchange requirements for a cross-software information exchange in BIM projects. IFC is crucial to delivering this aim. The buildingSMART International Spring Summit in April 2017 heralded in a new era for the IFC format. One of the highlights was the adoption of a „Memorandum of Understanding" (MoU) in which the rail companies from seven countries decided to develop an IFC standard for railway engineering trades by mid-2019. In addition, work is currently being done on the standards and interfaces for the low-loss and comprehensive flow of interface in engineering projects.
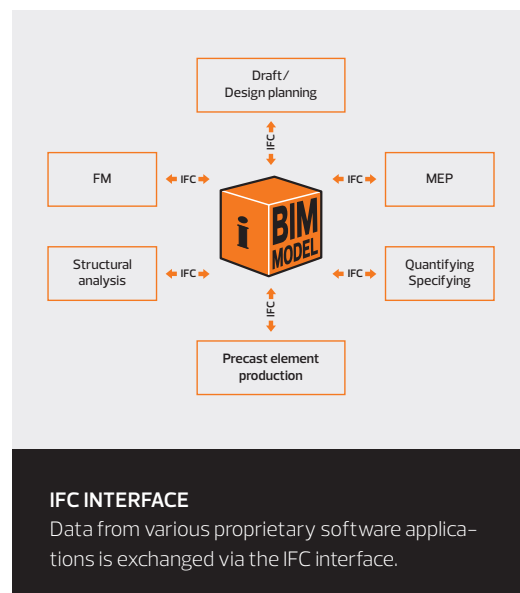
3. IFC AS A DIGITAL CATALYST FOR BIM

Digitization is, without doubt, a global development that will continue to grow. And artificial intelligence is about to follow on its heels. It is currently still in its early stages, but autonomous communication of machines with each other or independent computerized problem solving should be possible in a few years. The construction industry is by no means closed to such technologies and developments, even though it has previously been characterized as such. Various influencing factors, such as digitization, globalization, or specialization, greatly affect industrial production processes today. However, thus far the planning and construction process has not developed as rapidly in comparison. On the other hand, the tools have become

3

more efficient. There was already a change in the construction industry with the first digital wave in the 1990s and the associated introduction of CAD programs in planning offices. The analog drawing board gave way to the PC with its CRT display and CAD software – based on bits and bytes, the coordinate plane and the polyline. We are currently in a second digital wave that is reaching planners, just like in the 1990s: the international establishment of Building Information Modeling (BIM). The model-based planning method has already been sufficiently described and offers many advantages, such as planning security or efficiency and cost control from the outset. It was not always this way. Previously, CAD-based planning in particular suffered when it came to low-loss data transfer and cross-platform, collaborative work. However, this was often not due to the software, but to the barriers imposed by the users, or rather the non-users. BIM requires a transparency and open cooperation that is supported by IFC. Otherwise the advantages of BIM cannot be efficiently utilized.

4. CROSS-MANUFACTURER AND CROSS-SOFTWARE COMMUNICATION

So that the cross-software exchange of information can be achieved in BIM projects, a uniform and cross-manufacturer interface is required, which today forms the IFC interface. IFC is an open standard for the digital description of building models (BIM models.) and that is the key to the low-loss transfer of geometry information, building structures, and associated properties (attributes) of a

three-dimensional component. A lot has changed since the IFC released version IFC 2x in 2000, which first enabled the data exchange across manufacturers and software. Currently IFC4 is available as version IFC4 Add2. The supplement ,,Add2'' indicates that there are already extensions and it describes which release this is. The formats IFC2x2, IFC2x3 and IFC2x4 (or IFC4 for short) are distinguished depending on the structure, release date, and contents. The format IFC2x3, which has been the standard for many years, will now be gradually replaced by IFC4.

5. SUPPORTS NUMEROUS APPLICATIONS

In the BIM process, IFC generally supports the cross-planner and cross-software flow of data between the BIM model and the sub-models of the project disciplines, and considers the working method and necessary flows of information of the participants. As an example: the architect primarily works in a BIM-capable design program in order to create a plan, the engineer uses different software to calculate the loads, show the gradients of forces or torques, and for reinforcement design, while the building services engineer also works in a specific program solution. The different sub-designs must then be merged back into the BIM model. IFC is the means of doing this. For quantifying and specifying, the IFC interface is also available in tendering and calculation programs to import tender-specific information and interpret it. In addition, relevant information for scheduling and for cost and construction process control from BIM-capable
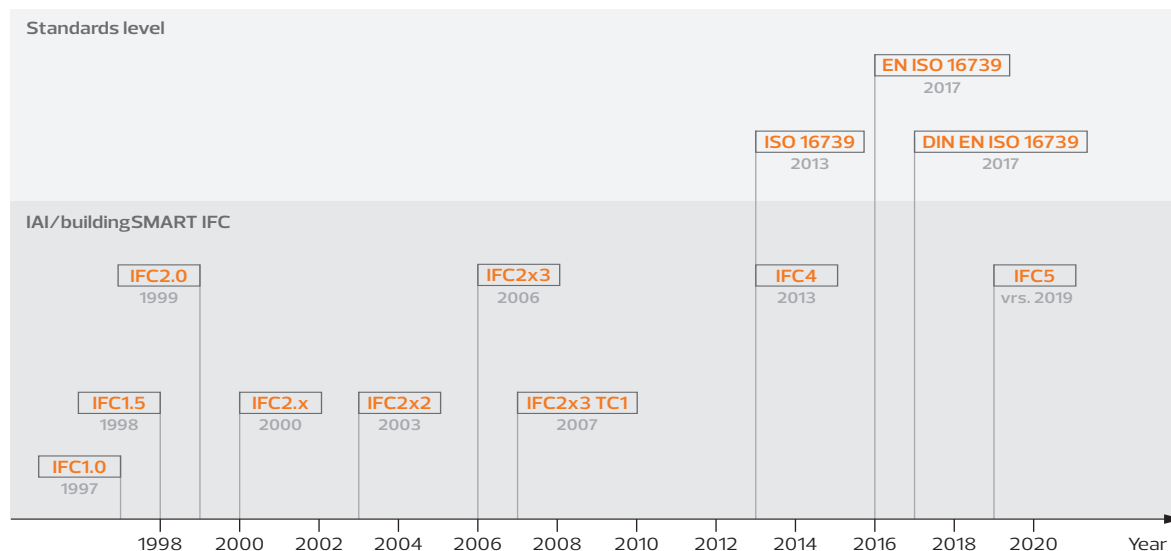
IFC DEVELOPMENT
The adoption of IFC in European standardization shows the importance of openBIM.

Standards level					
				ISO 16739 2013	EN ISO 16739 2017
					DIN EN ISO 16739 2017

IAI/buildingSMART IFC					
IFC2.0 1999		IFC2x3 2006		IFC4 2013	IFC5 vrs. 2019
IFC1.5 1998	IFC2.x 2000	IFC2x2 2003	IFC2x3 TC1 2007		
IFC1.0 1997					

1998   2000   2002   2004   2006   2008   2010   2012   2014   2016   2018   2020   Year

planning software (e.g. Allplan) is also output in time and scheduling tools, which is enabled in the BIM process via the IFC format. The advantages of the BIM planning method and the IFC interface extend to the production of prefabricated components or CNC-milled components. The machine control programs linked via IFC evaluate the modeled geometry, interpret it for the machine's working processes, and then translate it into a real product. Computer-aided facilities management (CAFM) programs for the building's operation complete the applications of BIM and IFC. This is based on a simplified operating model, which contains only the relevant component information of the exact as-built model after construction is complete. This combines all the important information about technical installations, statics, components, maintenance statuses as well as the service life of wear parts, such as lights or filters in ventilation systems. Databases are the source for such FM systems or CAFM programs, which are based on a consistent BIM model as a database. It is crucial here that the data of the operating model is transferred to the FM systems without much loss. To ensure this, work is ongoing to improve the FM interfaces and the transmission standards.

6. FILTERING KEY INFORMATION WITH SUBSETS

The wide range of systemic integration of IFC that is available to planners shows how impressively powerful the tool is. However, it is not for every dis-cipline, as shown by the aforementioned summary as well. The entire building model is necessary. This complete package transmits all of the information it contains — both geometric and alphanumeric — via the IFC format, and passes it on without exception. However, so-called „subsets" can be selected in BIM-capable software for the transmission of individual sub-groups. These contain reduced and filtered information for the respective user and discipline in order to ensure an optimal exchange of information. This has three decisive advantages: 1. It reduces the transferred amount of data, 2. The processing speed of the filtered data model is increased (because less data is imported), and 3. Every discipline only accesses a part of the model information, which simplifies identifying the sources of errors (and when these were introduced) in the BIM model and the overall planning. The architect thus is indirectly assigned a critical responsibility through IFC for the entire planning, which was traditionally handed over to the project manager years ago: the role of coordinator. Because with BIM and IFC, the architect now manages the entire model.

7. STANDARDIZATION OF THE BIM WORKFLOW

IFC defines a „Model View Definition" or MVD (IFC CoordinationView, IFC StructuralAnalysis- View and IFC FMHandOverView) in order to create a uniform basis for the data exchange between disciplines. They are guidelines or agreements that, among
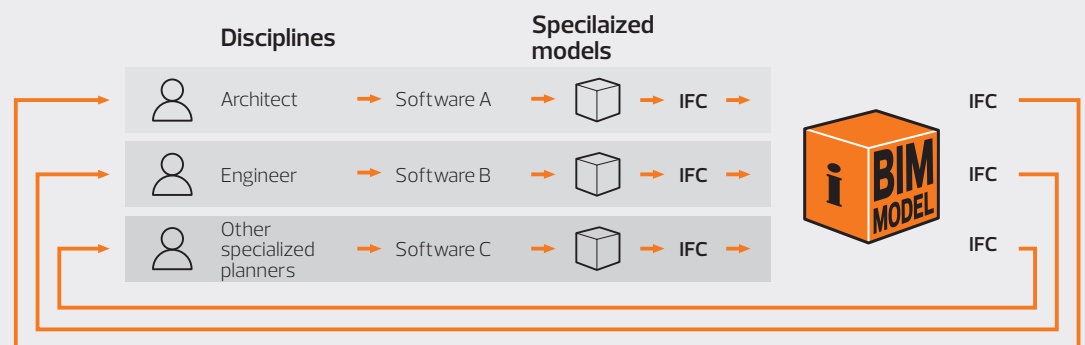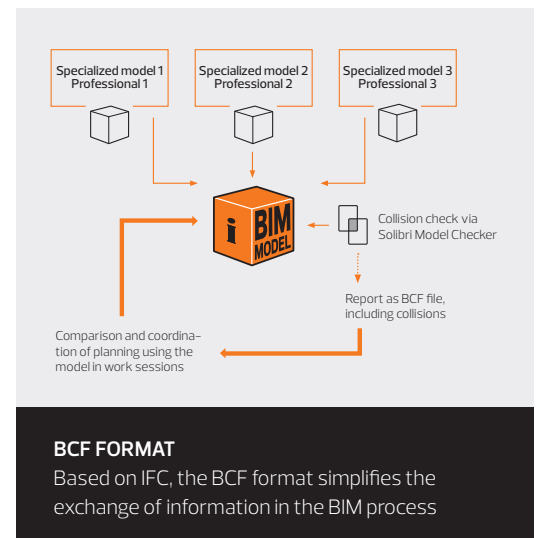
other things, include component classes, specific attributes and properties, or quantities for the implementation in the IFC data model. Two new MVD are added with the introduction of IFC4: the IFC4 Reference View and the IFC4 Design Transfer View, which are intended to standardize key work processes (BIM workflows). In addition, there is the option to implement collision checks between the sub-models developed by the various disciplines. However, this is not possible through IFC and the interface itself, but rather through the components that are exchanged via IFC and that are subjected to a collision check in the BIM-capable program. Additional features in IFC4 are intended to optimize the BIM planning work processes and to standardize them where appropriate.

8. SIMPLIFIED DATA EXCHANGE IN THE IFC DATA MODEL WITH BCF

The Open BIM Collaboration Format (BCF) is used for communication between the BIM overall coordinator or the BIM manager and planner. The BIM overall coordinator or BIM manager is responsible for coordinating and managing the BIM model, which contains the individual sub-models of the project team and is not exchanged between parties. BCF makes it possible to mark changes within a BIM model and to pass on supplementary information to the other design teams. It consists of a view of the objects (camera setting and camera position, a text description, screenshots and supplementary excerpts from the BIM model). This means that only these mark-ups are exchanged between the planning participants. As a result, only the marked elements are changed and adapted. Unlike the IFC exchange, this is only a coded message – a virtual BIM memo – about problems or ambiguities in the model, which is sent between the different disciplines. A BCF-based information exchange is suitable for drawing attention to overlaps in the BIM model (collisions or modeling errors), which primarily arise from several IFC models from different designers and programs.

9. INTERNATIONALLY ACCEPTED LANGUAGE FOR OPEN DATA EXCHANGE

The idea behind all of the efforts of buildingSMART, software manufacturers, and users is the continuation of the ,,openBIM'' planning approach. OpenBIM is intended to ultimately enable the low-loss data exchange between all planning participants and a consistent BIM model which covers all conceivable applications, from planning to construction, building operation to demolition, and component and material recycling at the end of the building's lifetime. However, this goal is far from being reached. The changes that go hand in hand with BIM require open and collaborative work by architects, designers, contractors, clients, and operators. IFC will be the important and recognized international language in this process in the coming years, and well beyond.

BCF FORMAT
Based on IFC, the BCF format simplifies the exchange of information in the BIM process

10. IFC AND OPENBIM AS AN ESSENTIAL PLANNING COMPONENT

Interoperability in digital planning, i.e. cross–platform working without the loss of information and data if possible, is crucial for a successful BIM project. It is a guarantee of a successful project, especially for major projects with a building and planning time that lasts many years and for comprehensive planning services across many design disciplines. This is also shown by how Stücheli Architekten from Zurich use openBIM and IFC. The office with over 80 employees specialize in the design of office and commercial, education, research, and residential buildings. Their broad portfolio is ideal for exploring the potential of BIM. Ursula Strasser is a project architect and BIM coordinator at Stücheli Architekten and sees IFC as an important contribution to cross–platform planning and building: ,,We work with many BIM planning solutions in Switzerland. There are also the special programs from building services engineers or structural engineers. The IFC data model creates the common ground here for the low–loss exchange of planning information.'' Regarding the obstacles that BIM could pose when being introduced in an office, she adds: ,,IFC is a powerful tool and the established BIM planning programs are making good use of today's opportunities. However, it is noticeable when importing and exporting in parti–cular, and in simple planning programs, that many programs cannot sufficiently utilize the interface. This results in a loss of information during planning.

The IFC tool often cannot use simple programs at all. This should be changed.'' Stücheli Architekten determines during every new project whether it makes sense to use the BIM method. If the decision is made to use BIM, then the method is implemen–ted when the project starts. However, the traditional design tools of hand sketches, physical models, etc. are still important tools in the development process in the office, even with BIM projects. Ursula Stras–ser: ,,We think it is dangerous to plan on a compo–nent basis at too early a stage. The abundance of information in the BIM model reflects a level of detail that is not reasonable for the project status.'' The workflows in the office and on the building site gre–atly influence the BIM method. BIM requires trans–parency and openness on the part of the planning partners, which can ultimately make the coordina–tion more efficient. This is where Ursula Strasser sees the strength of the method for the work of architectural firms: ,,The BIM workflow allows for the continuous coordination of the designs of building services, structural engineering, air conditioning, and sanitary engineering. This means that the sub–plans can constantly be adapted via the BIM model and via IFC. In addition, our design meetings now occur via ICE Sessions on the BIM model and we can respond to problems directly and together.''
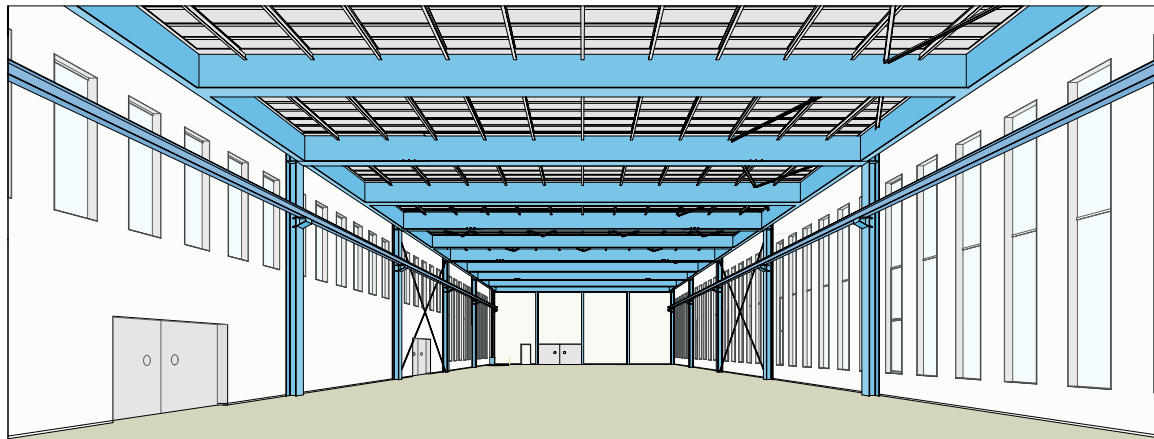

EXAMPLE OF AN OPENBIM PROJECT

Stücheli Architekten works with Allplan Architecture in 3D during the planning stage. The data exchange occurs via IFC and BCF.

General rehabilitation and expansion of HIF, ETH Zurich, Hönggerberg

Client: ETH Zurich

Architecture/overall management: Stücheli Architekten AG, Zurich

CONCLUSION

Data exchange has now taken on a central role due to the change in cooperation in building projects associated with BIM. The actual added value of BIM can only be generated if the openBIM method is used. For only if cross-software data exchange is possible can the individual models of different disciplines be compared with each other in the central BIM model. A truly important milestone was set for openBIM with the start of the development of IFC in 1997. IFC has no longer been just a topic for the early adopters for quite some time.
IFC has established the implementation of standardization in everyday planning. The relatively new format is not a universal cure for stumbling blocks in the BIM working method, but the constant and rapid continued development through the neutral organization buildingSMART, in cooperation with software manufacturers and experts from practice, supports the BIM working method better and more specifically. Anyone today who does not have an IFC interface and thus is unable to exchange their digital models across software will be less competitive in the future.

INTERVIEW

This white paper is based on an extensive conversion with Daniel Zuppiger, architect graduate from ETH Zurich, member of the management board and BIM manager, as well as project architect and BIM coordinator Ursula Strasser from Stücheli Architekten in Zurich, Switzerland. Daniel Zuppiger and Ursula Strasser use the example of the project „General Rehabilitation and Expansion of The Research Building HIF, ETH Zurich, Hönggerberg" to provide a comprehensive insight into the BIM working method and project work at Stücheli Architekten.

ABOUT THE COMPANY

ALLPLAN is a leading European vendor of open Building Information Modeling (BIM) solutions. For over 50 years, the company has been supporting the construction industry with a pioneering software portfolio and is playing a key role in promoting the digitalization of the construction industry: innovative, customer-oriented, and created with German quality.

ALLPLAN GmbH
Konrad–Zuse–Platz 1
81829 Munich
Germany
info@allplan.com
allplan.com/contact

ALLPLAN
A NEMETSCHEK COMPANY