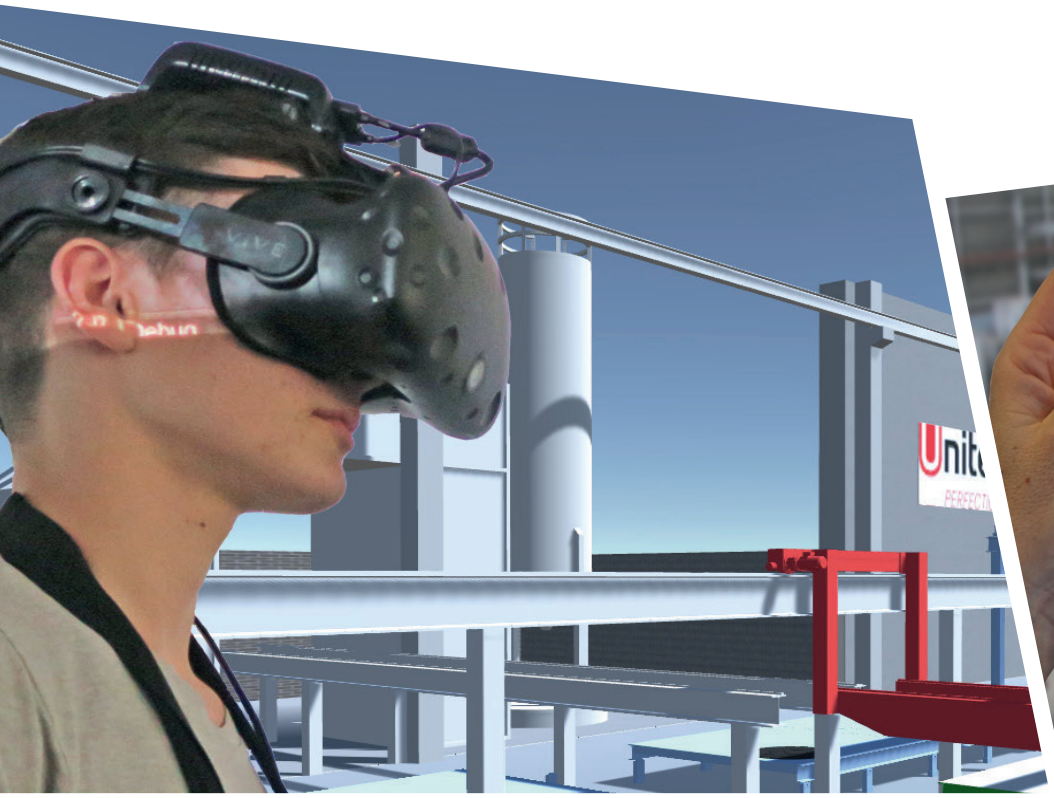
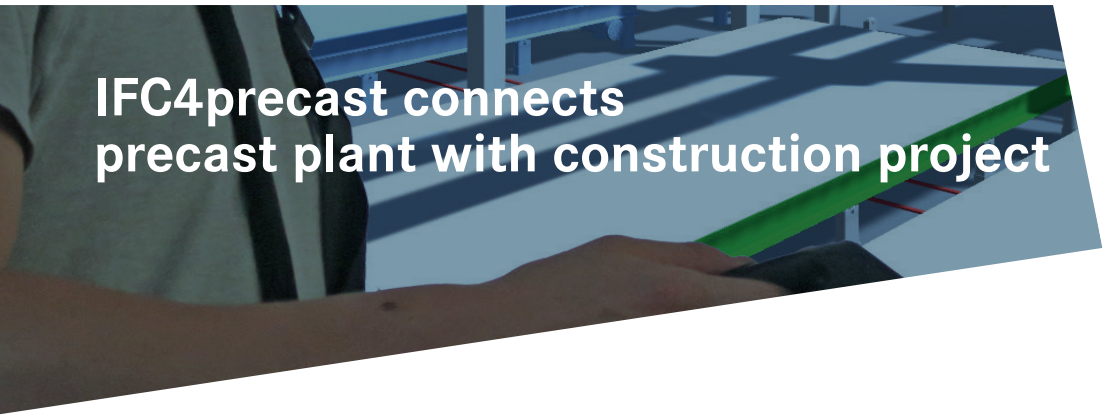
WHITE PAPER

Digitalisation calls for interface standards





IFC4precast connects precast plant with construction project

Unitechnik

PERFECTION AUTOMATED.

Content

1 Introduction

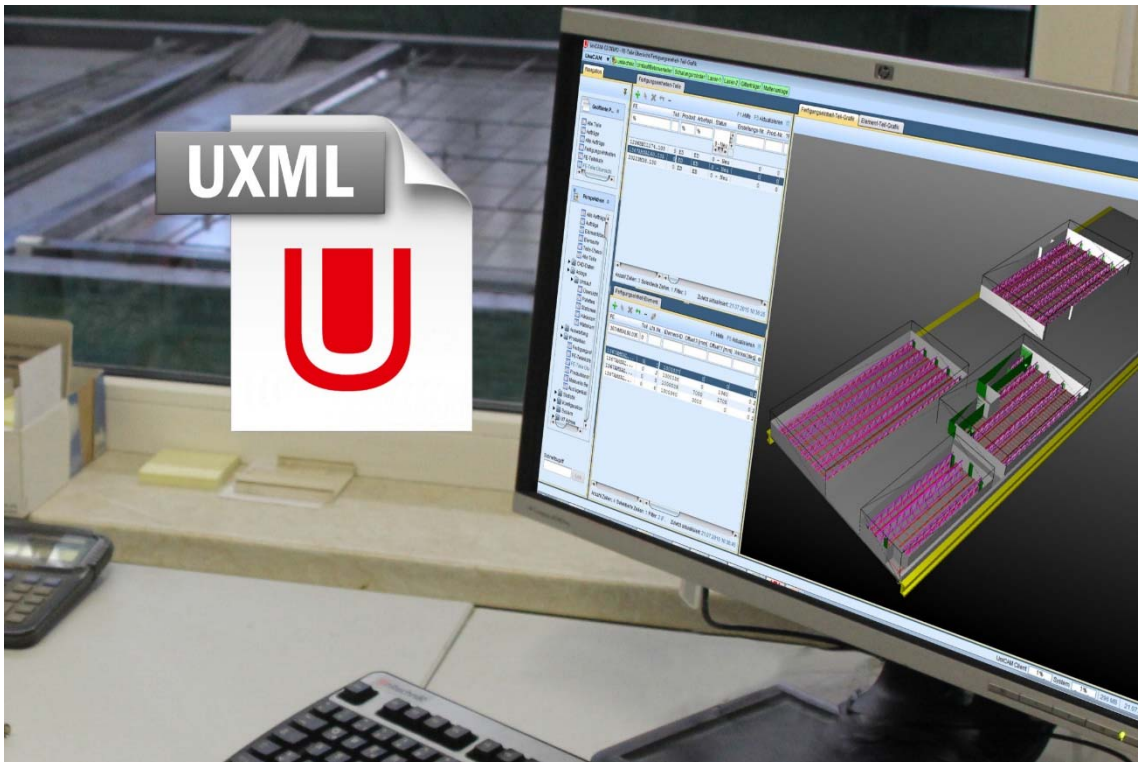
A key factor in the digitisation of value creation chains is the ability of differing systems to communicate with one another. Transparency, speed and added value can only be created for all parties involved if data can be exchanged without media discontinuities. The definition of interface standards is therefore an important prerequisite for digitisation. In the automated production of precast concrete elements, interface standards are of particular importance in two ways. In the CAD-CAM-controlled factory, a large number of systems exchange data with each other: CAD system, production control computer, robots, subsystems for reinforcement production, etc. On the other hand, these works are suppliers and part of the construction industry. Building Information Modelling (BIM) creates a standard that encompasses all trades in a building and allows the interaction of the parties involved in the construction. The initiative IFC4precast has set itself the task of developing an interface that does justice to internal and external communication.

In the CAD-CAM-controlled factory, many systems exchange data with one another. ©Unitechnik

2 History of the standards in the precast concrete industry

In the 1980s, no public standards existed in the precast concrete industry for the interface between CAD systems and production control systems (CAM). CAD manufacturers had their own interfaces. These were not disclosed to the public. This meant that the CAD supplier was the only one who could implement uninterrupted communication between CAD and the production control system. Consequently, the choice of providers for equipping precast concrete plants was highly restricted. This prevented the market from developing freely.

At the end of the eighties, manufacturers and suppliers to the precast sector decided to develop an industry standard. Unitechnik, one of the newcomers to the sector, took on the challenge of creating a draft design for an interface definition and of coordinating it with all participants from the sector. It was very important for Unitechnik that the interface might find broad consensus. CAD producers, automation companies, machine manufacturers and design engineering offices were all implicated in the coordination process. At the beginning of the 1990s, the first version of the Unitechnik CAD-CAM Interface was launched. Up to the present time, Unitechnik still regularly asks participants from the industry about their requirements and after that publishes a new version of the Unitechnik CAD-CAM Interface. The current version is the 6.1 or UXML 7.1.

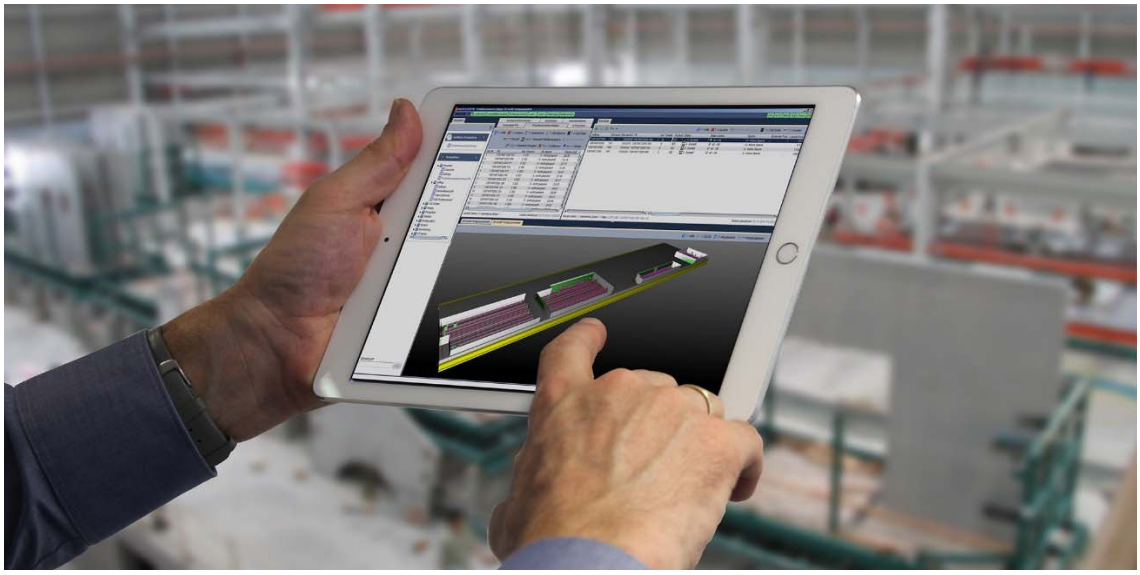


The current version of the Unitechnik CAD-CAM Interface is 6.1 or UXML 7.1

3 The CAD-CAM interface in the precast plant

Wall and floor elements are designed based on a construction drawing on a CAD system in the technical office of a precaster. All information relevant to producing these concrete elements must be transferred to a production master computer in the form of a product description. The CAD-CAM interface defines the formal structure of this description. It contains, for example, geometric shapes and dimensions, concrete qualities, cut-outs, edge properties, inserted components and reinforcement set-up. The production master computer thus receives a comprehensive picture of the products to be manufactured on the system and can control its automated machines accordingly.

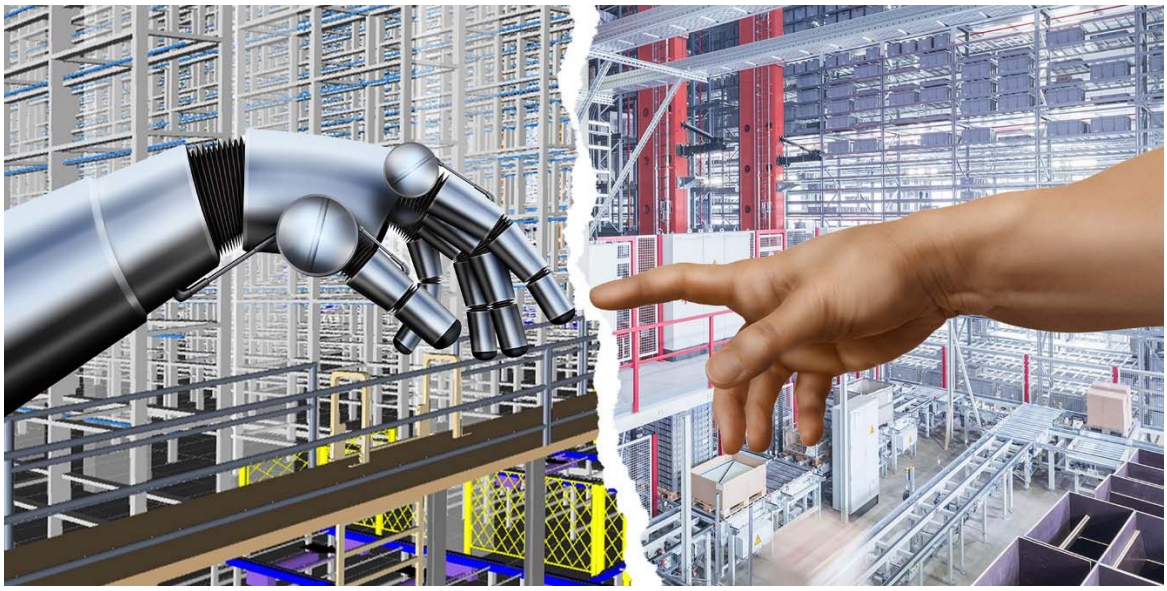
Thanks to this standardised product description, it makes no difference on what CAD system the description was created. The master computer can itself, in turn, transfer production data to machines. The reinforcement production line has need of all information for the reinforcing in concrete elements. The standardised product description can also be employed for this purpose. The machine takes all the data it needs for its work and ignores the rest of the description. Different parts of a precast production facility can also be combined at will with one another because all parts can speak the same "language". This again leads to more competition and more innovation. Therefore, the degree of automation in precast facilities has risen substantially since the nineties.



The production control computer (here UniCAM.10) receives a comprehensive picture of the products that are to be produced on the system. ©Unitechnik

4 BIM, the digital twin of a building

The vision is not new. Wouldn't it be wonderful if all information concerning a building could be brought together in one virtual model - from the foundation to the lightening conductor, from the wall to the electric socket, from the window to the ventilation control unit, and so on? The model would contain the geometric measurements, material properties and all manufacturer specifications for the products installed. This digital twin accompanies the building through its ongoing stages: planning, construction, operations. It comes in good use even when the building is demolished. BIM (Building Information Modelling) is, however, much more than all-embracing documentation. BIM is the common model of all parties involved in planning, constructing and operating a building. The buildingSmart Organisation has developed a description language called IFC (Industry Foundation Classes) so that all parties can interact with the model. With IFC, all partners involved in the building can speak the same language.



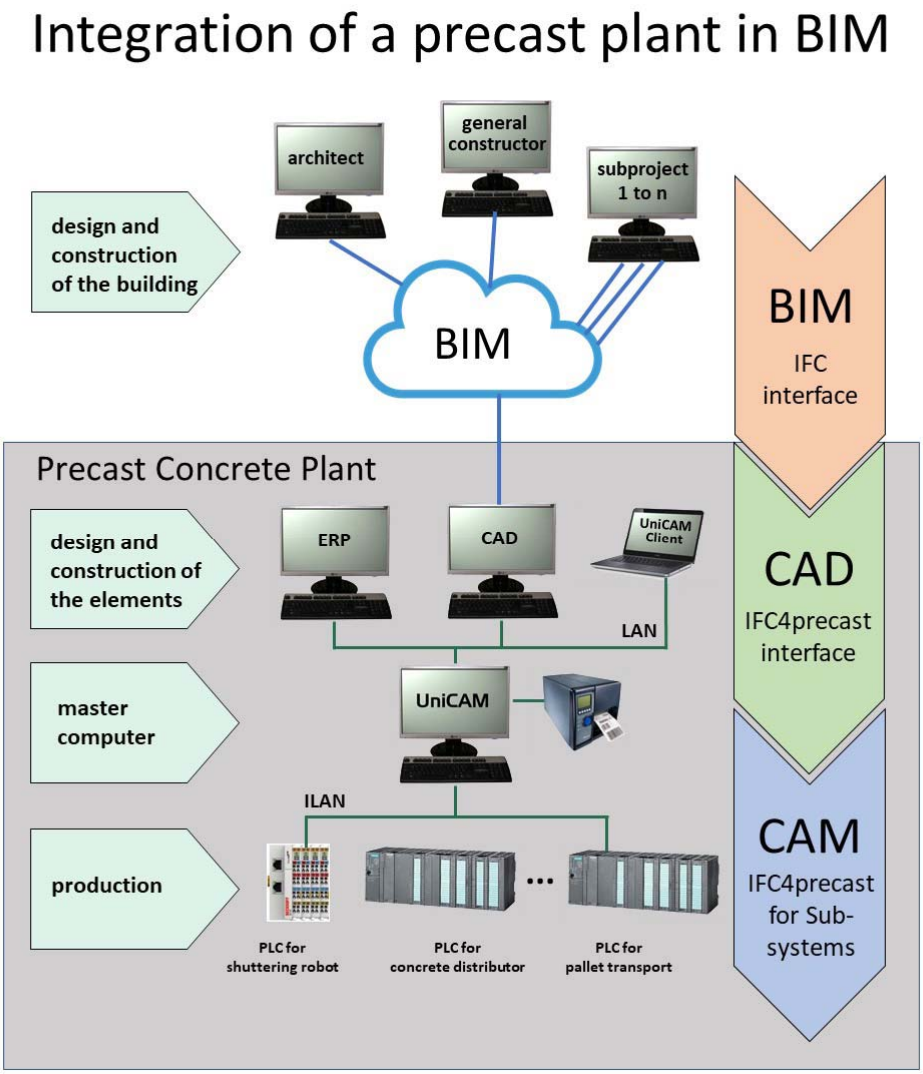
5 Differing languages hamper the exchange

At the current time, it happens that some CAD systems in precast production facilities can read in the IFC format but cannot employ it towards production. A concrete factory creates individual wall and floor elements with all the data needed for production in its own CAD system. This data is then sent in the Unitechnik CAD-CAM format to the production line. The Unitechnik CAD-CAM Interfaces cannot simply be re-placed by IFC because much specific production information is lacking in the general IFC. The differing interface formats also make it impossible to let additional information about the concrete elements flow through into the BIM model. The production status cannot be accessed online as well. From the viewpoint of a BIM model, a precast production facility is nowadays mostly a one-way street.

6 IFC4precast to provide the answer

Three years ago, precast production operators, CAD manufacturers and automation companies got together once again in order to define an interface that would do justice to both worlds. They founded the IFC4precast working group inside the buildingSmart Organisation. The interface is to be compatible with IFC to contribute to an enhancement of the BIM model. On the other hand, it must contain specific information needed for production, i.e. data relating to individual concrete elements, such as connecting reinforcement, edge properties, assembly sequence and much more. Attempts are being made to describe the product to be manufactured and not the manufacturing process (the "what" and not the "how"), to remain as independent as possible from one specific precast production system.

At the present time, initial pilot applications are being carried out in precast production facilities based on the current design state of the I FC4precast. First steps have been made towards a future vision.



The future could look like this. The digital twin's strengths can be exploited to the full once the new interface has been implemented in all CAD and master systems. Any precast facility commissioned with an order for producing floors and walls gains access to the BIM model and receives all available 3D data about the floors and walls via IFC. This data is loaded into the CAD system, broken into elements and enhanced with specific production data in the factory's own technical office. The data is then sent to the master computer via IFC4precast. In an ideal situation, the connection to the BIM model will be maintained. This means that the contracting party can call up the status of individual construction components at any time. The party can see whether a construction component has been manufactured and when it is expected to be delivered. Precise data concerning the manufactured element flows into the BIM model, e.g. dimensioning and positioning of the reinforcement and the exact type of inserted components. This again means that all installed components are precisely documented and can be easily traced.

7 Summary

In times of digital transformation, it is only logical to make BIM models the standard for larger construction projects. BIM models are the perfect tool for complex projects, in which many different companies work together and exchange data with one another. It makes good sense for precasters to place themselves in a position, in which their products become an integral part of this digital twin. In the end, this will lead to precast being designed more simply and being utilised more frequently in major projects. The IFC4precast interface is creating the most important basis for this - a common language.

8 Detour: Reiner Medgenberg honoured for his lifetime's achievements

Reiner Medgenberg was appointed honorary member of the IFC4precast board at bauma 2019 for his lifetime's work and achievements with the interfaces of the precast industry. An engineer for electrical engineering and data processing, he was a major driving force in the development of a standard CAD-CAM interface for the precast concrete industry. At Unitechnik Systems, he is responsible for developing the UniCAM master computer and IT consulting. He is now retiring after more than 35 years employment with the company.

During bauma 2019 the IFC4precast working group honoured Reiner Medgenberg for his lifetime's achievements, from left to right: Richard Hellrigl, Valentin Hellweg (both Progress), Benno Strack (BWB), Robert Neubauer (SAA), Dr. Ralf Lüning, Reiner Medgenberg (both Unitechnik), Stefan Maier (SAA), Reinhard Lackner (IDAT) ©BWB

About Unitechnik

Based in Wiehl, Unitechnik Systems GmbH has been one of the leading providers of industrial automation and computer science for four decades. The family-owned company plans and implements tailor-made systems for in-house logistics and production for the second generation. Unitechnik acts worldwide as a system integrator and overall supplier. Professional project management as well as the competent support of the realized plants are the basis of long-term business relations and secure the investment of the customers. In the precast concrete industry, we have been one of the innovation drivers for over 30 years with our production control computer UniCAM and state-of-the-art control technology. The references of Unitechnik include renowned companies such as BE Beton-Elemente, fdu Group, Fehr, Heidelberger Betonelemente, Kemmler, Kerstoel, Laing O'Rourke, Mischek, Rector Lesage, Thomas Group and Züblin.

Kontakt
Unitechnik Systems GmbH
Fritz-Kotz-Str. 14
51674 Wiehl
Germany
+49 (0)2261 987-0
precast@unitechnik.com
https://www.unitechnik.com/betonfertigteiltechnik