Bring Your BIM Horse Power to the Field: Fully Capitalize On BIM 360 Field and Its API

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CS10467

This class gives firsthand insights into the application and documented quantified benefits of bringing Building Information Modelling (BIM) technologies to the field at Max Bögl Group, Germany's largest privately owned construction company. We will discuss how we were able to deliver construction management workflows with higher quality and in significantly less time than before, and we'll share best practice workflows for Navisworks, BIM 360 Glue, and BIM 360 Field software. As a highlight we will share how we enriched the regular BIM 360 software platform by creating a custom document-management system integration, linking 3D elements to detailed 2D CAD documents. The result is an automated, rule-based integration of 2D plans for 3D models with web and mobile access. A 3D object is then linked to its CAD metadata, checklists, issues, tasks, and respective (plan) documents, and it can be tracked with a QR code.

Learning Objectives

By the end of this class you will have:

- Learnt how to quantify the benefits of using BIM 360 products with regards to construction management workflows
- Learn how to fully capitalize on BIM 360 Field, including issues, checklists, tasks, equipment, QR codes, daily updates, and reports
- Discovered how 3D model objects and 2D CAD documents can be integrated together to offer comprehensive information on site
- Learnt how BIM 360 Field library and equipment API services can be used for data exchange with document management systems

About the speakers

Maximilian Schütz is an IT and process consultant for Building Information Modeling (BIM) in the corporate development of the Max Bögl Group (MB). He is leading the company's strategic implementation of BIM2Field and mobile BIM solutions. Furthermore he is in charge of corporate BIM standards and research collaborations. Prior to his appointment at MB, Maximilian worked as a visiting researcher at the Center for Integrated Facility Engineering (CIFE) at Stanford University. During his graduate studies he led his own research project on multimodel-based change order management. His bachelor's thesis on the implementation of 5D technologies received multiple national awards. For his undergraduate studies he underwent a dual-studies program at MB, including an integrated apprenticeship as a concrete worker and assistance in project management of numerous construction projects in Germany. He holds a master of engineering in international construction management from the Technical University of Nürnberg, Germany.

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Karina Borges Pagan works as Technical Consultant for Autodesk for over 10 years. Prior to joining Autodesk, she has worked as a software engineer at the Brazilian Telecom (Telebras) research centre, with emphasis in geographical information systems for utilities. Within Autodesk she has continued to work in large geographical information solutions, data management and system integrations supporting BIM workflows. Karina is based in the Autodesk office in Farnborough, United Kingdom.

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Introduction

Germany's largest privately owned construction company, Max Bögl is committed to adding value for clients at every step in the construction process. The company embraced Building Information Modeling (BIM) more than a decade ago. As BIM has advanced, so has the firm's innovative use of intelligent models.

Max Bögl is also one of the first construction firms in Germany to take BIM into the field with the Autodesk® BIM 360™ Field cloud-based service. After piloting BIM 360 Field on a shopping mall construction project, the firm is excited about the way the software empowers its people and increases visibility into projects.

Maximilian Schütz, BIM manager in Max Bögl's corporate development and BIM department, explains: "Our processes were already based on BIM. We've used it in the office to understand, plan, and improve projects for years. But the intelligence didn't extend into the field, where many processes were based on paper. We've always been committed to innovation, and the next logical step was to extend the intelligence of BIM throughout the construction site with BIM 360 Field."

The challenge

As Max Bögl began constructing a shopping mall that the firm would own and operate, Schütz saw an opportunity to pilot using BIM in the field. The company wanted to see if BIM 360 Field could improve two crucial but inefficient processes: quality assurance (QA)/quality control (QC) and safety inspections. These traditionally paper-based processes rely on checklists and communication with subcontractors to resolve issues. According to Schütz, safety inspectors could spend as much as 40 percent of their time documenting and communicating inspection issues.

“Getting information to and from the point of construction typically requires people walking back and forth to the construction office with paper,” says Schütz. “It’s quite time consuming. Then, there’s the frustration of having all this intelligence in the BIM model, but you can’t share or access it in the field. You see the inefficiencies caused by these issues clearly in inspection processes. We decided to find out if BIM 360 Field could provide an answer.”

The solution

The Max Bögl team began by linking BIM 360 Field to an aggregated project model. Maintained in Autodesk® Navisworks® Manage software, the model brings together multiple file types, including Tekla, Autodesk Revit, and Siemens NX and SketchUp files. This model is then uploaded to the cloud using Autodesk BIM 360™ Glue® and linked to BIM 360 Field. When used with an Apple iPad mobile device, BIM 360 Glue lets Max Bögl share the model with the team, and BIM 360 Field delivers anywhere, anytime access to the project model along with data related to issues, tasks, project updates, and checklists.

The firm saw winning support from the construction management team as crucial to the success of the pilot. Schütz explains how the firm presented the solution the team: “We asked the construction manager what his top problems were on a typical job. We explained and demonstrated the challenges BIM 360 Field could address. He realized the solution was designed to solve his problems, and that helped him to identify with the software.”

Schütz adds, “Field data management can be a big time drain on any job. BIM 360 Field brings data together, and lets the construction management team and inspectors take it with them throughout the site. It’s like a portable project management toolbox.”

QR codes link models to the site

The Max Bögl team realized that having access to the project model at the point of construction would save inspectors and supervisors time. To accelerate the flow of information even more, the team has installed more than 350 QR (quick response) codes on site.

“By scanning a code with the iPad camera, BIM 360 Field takes the user to the equivalent spot in the 3D model,” says Schütz. “Data and objects are linked to the 3D model. You can gain instant access to CAD attributes, issues, checklists, photos, and drawings relevant to where you are on the construction site.”

Faster inspections and better visibility

By managing its QA/QC processes in BIM 360 Field, Max Bögl has been better able to maintain the pace of construction. Inspectors use checklists within BIM 360 Field as they review completed tasks for compliance with the firm’s quality standards. They can take photographs and then notify subcontractors of issues from within BIM 360 Field. Subcontractors see the notifications and mark resolved issues as complete within the solution. The inspector checks the issue in the field, and for resolved issues, lets construction proceed.

“Inspectors have their checklist, the model, and 2D drawings at their fingertips,” says Schütz. “They can send notices to subcontractors immediately. BIM 360 Field saves a tremendous amount of time, and issues that could slow construction are resolved more quickly.”

According to Schütz, the safety inspection process has improved as well: “Safety inspections required quite a bit more documentation. Inspectors were forced to spend too much time in the office on paperwork. Now, much of that documentation occurs remotely using BIM 360 Field, with 20 percent of their time or less spent in the office.”

The result

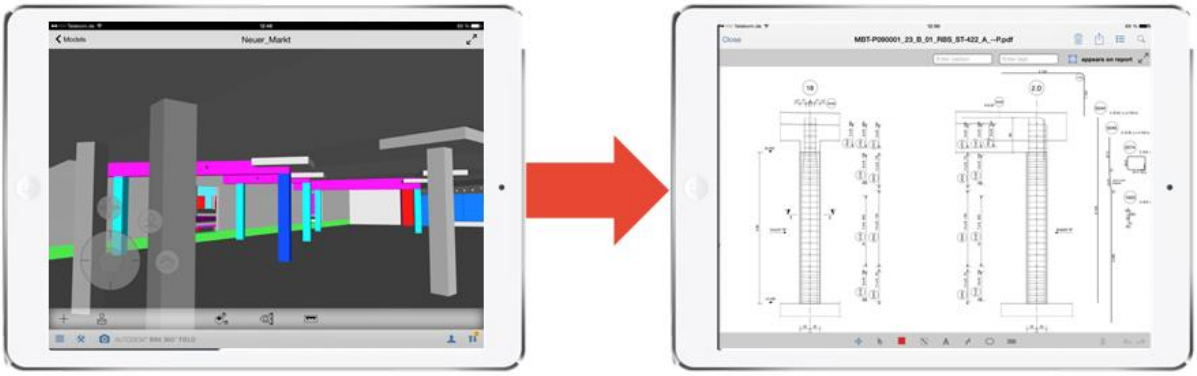
Since launching its pilot, Max Bögl has expanded the use of BIM 360 Field to more projects. “BIM 360 Field improves the way we manage construction projects,” says Schütz. “Now, we can track issues easily and see how subcontractors are performing. If there’s a problem with the building in the future, we can research what happened during construction easily. All issues are linked to specific locations in the model.”

He continues, “BIM 360 Field saves the construction management team and inspectors substantial time every day. It adds quality while subtracting time from construction management.”

Integration of 2D plan management documents in the 3D Model

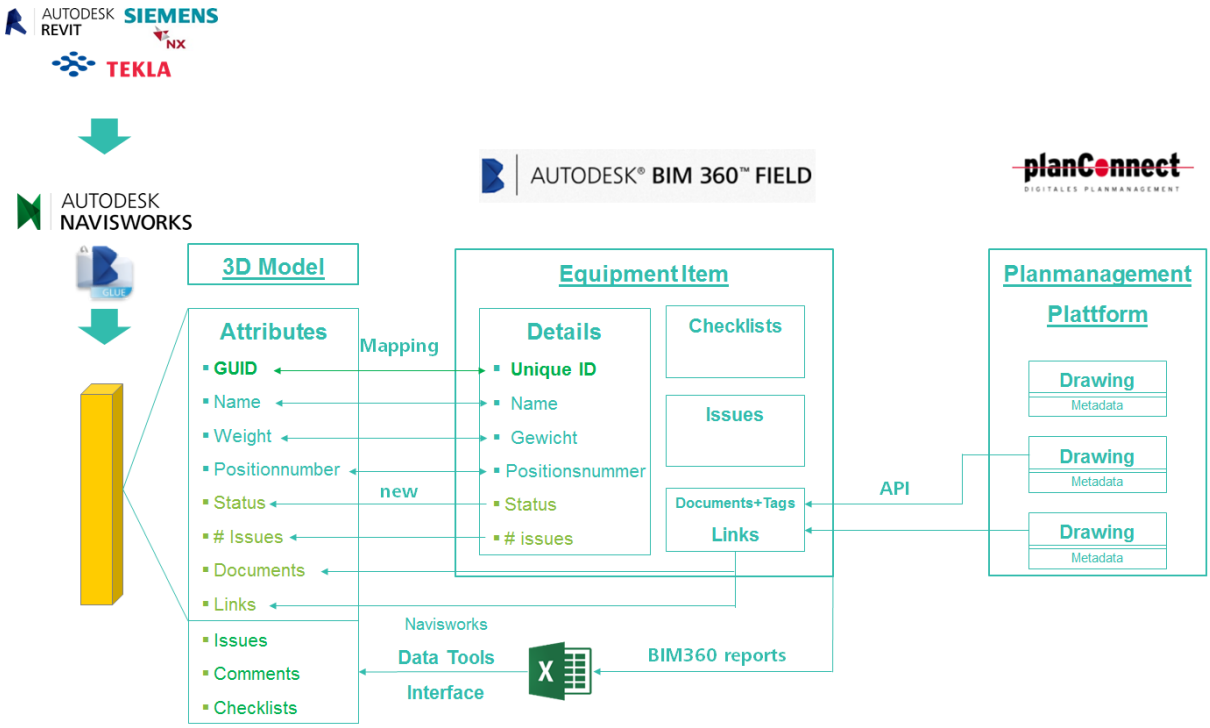
Max Bögl uses planConnect service to manage 2D plan documents in their construction projects. With the objective of bringing these documents to the project site, an integration solution between planConnect and Autodesk BIM 360 Field was envisaged.

The rule-based integration of 2D plans into the BIM 3D model automatically imports the 2D documents in the Autodesk 360 Field document library and links the documents to 3D model elements.



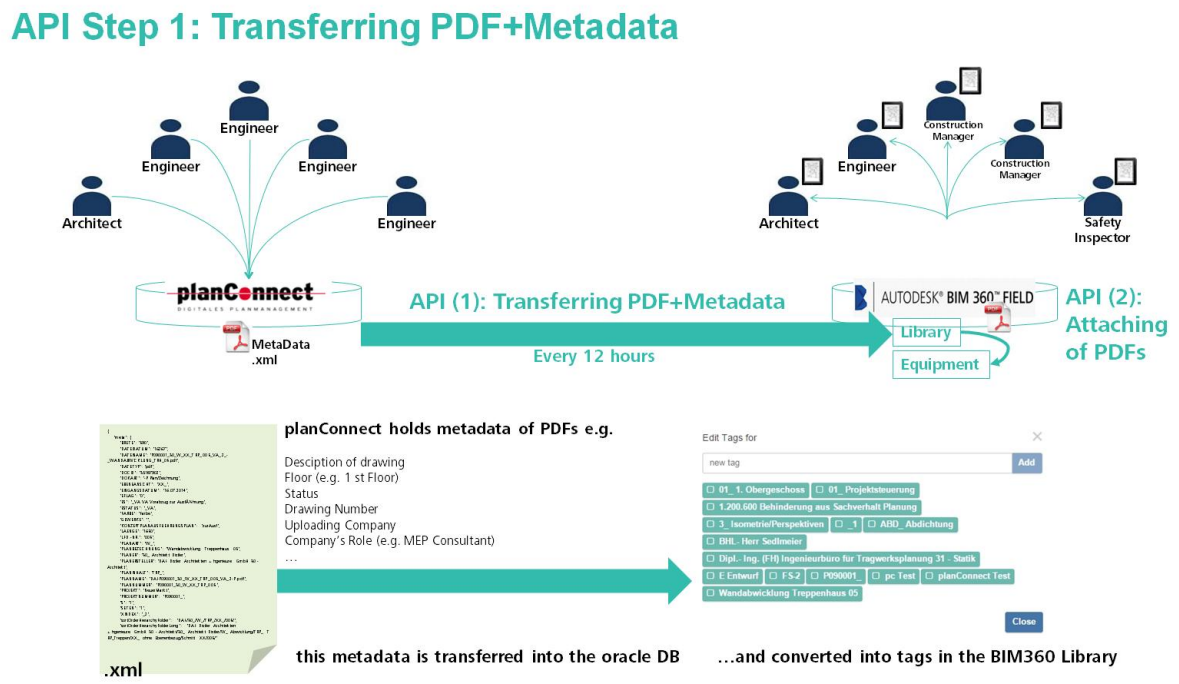
Mapping 3D element to Field equipment to 2D CAD document

A mapping between 3D model element attributes and Autodesk BIM 360 Field equipment properties has been established. The mapping allows transfer of information between the model source tools (Navisworks, Revit) and Autodesk BIM 360 Fields.



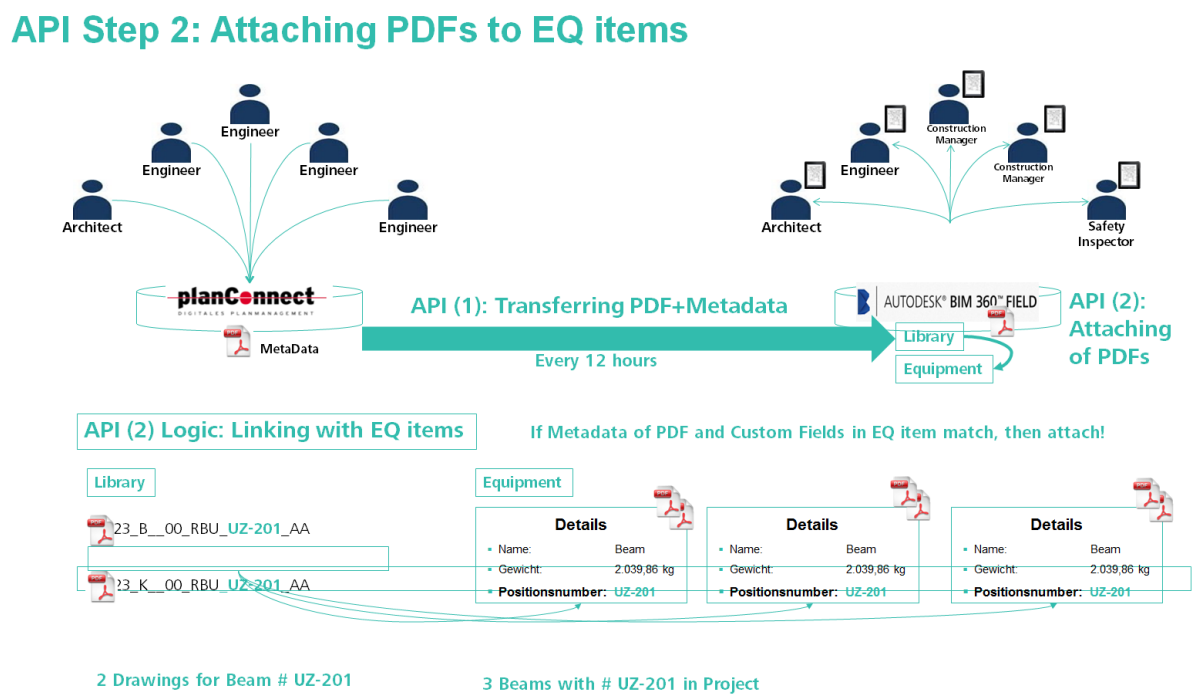
Integration Step 1 – Extract data from planConnect

Documents are extracted every 12 hours from planConnect as PDF files and their metadata is extracted in a separate XML file. Documents are then uploaded in Autodesk BIM 360 Field document library and metadata is used as document tags. In order for the document to be attached to equipment item, the document must have a *Plannummer* tag.



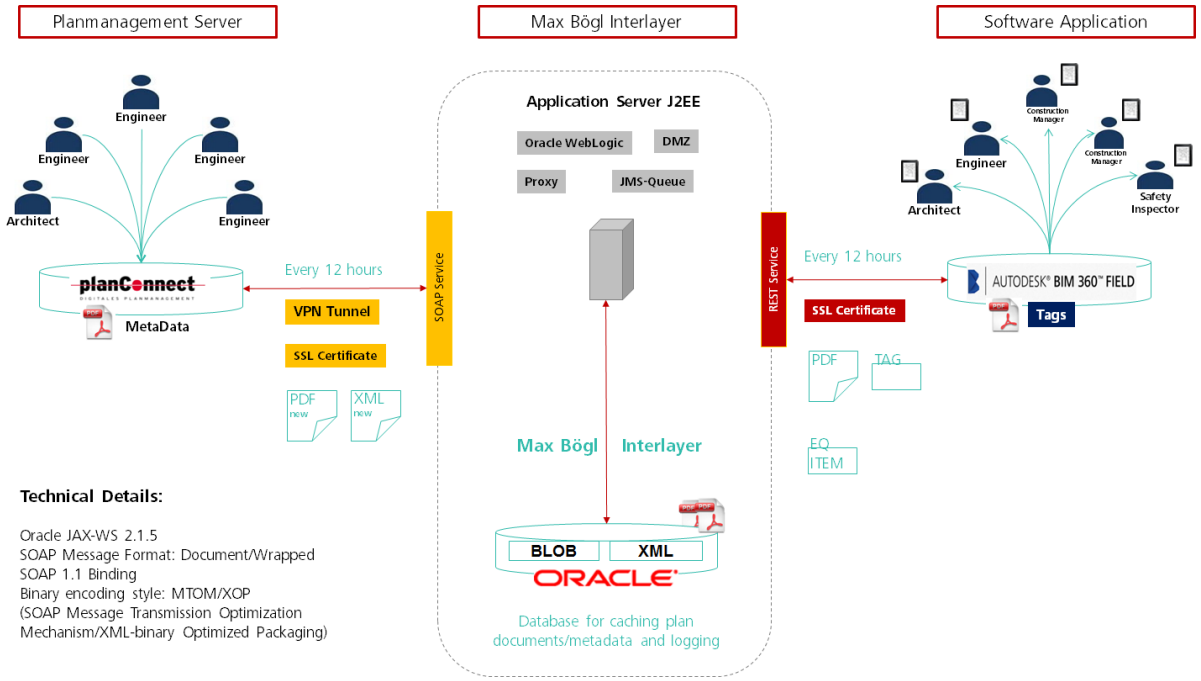
Integration Step 2 – Attach 2D documents to Equipment

Following the extraction process, the solution matches documents to equipment items. The solution looks for matches between document tag Plannummer and equipment custom field *Positionnummer.* Multiple documents can be linked to a single equipment item and the same document can be linked to multiple equipment items.



Solution Architecture Overview

The solution has been developed using Java technologies, Oracle and Autodesk BIM 360 Field API.



Autodesk BIM 360 API Overview

Autodesk BIM 360 Field API provides a RESTful interface to interact with the Field cloud database. This is basically a data access API that supports Create, Retrieve, Update, and Delete (CRUD) operations allowing developers to query and modify various data objects within the Field platform. Being a RESTful interface means that the API can be used by integration solutions coded in any language/platform with capability to access REST services.

The BIM 360 Field REST APIs are grouped into different services groups, as below:

- Mobile API: these services originated to support the Field mobile application. This original API was not envisaged to be used by integration solutions and it is recommend that whenever an equivalent service exist in the newer API, those should be used instead
- Library API: this set of services provide capability to interact with the Field document library
- Admin API: this set of services provides administrative capabilities with regards to projects, companies, filters, locations, etc.
- Issues API : this set of services is used to manage issues
- Checklists API: this set of services is used to manage checklists
- Companies API: this set of services is used to manage company information
- Daily Updates API: This set of services is used to manage daily updates information
- Equipment Changes API: this set of services allows to retrieve status change history for equipment items
- Issue Changes API: this this set of services allows to retrieve status change history for issues
- Project Export API: this set of services allows to export project data from BIM 360 Field cloud and check the status of the export

Mobile API is the older generation API methods that follows the structure **/api.** The newer API methods follows the structure **/fieldapi**.

Mobile API should not be used unless the **/fieldapi** does not provide the required functionality. Login method is one such API call that is still provided by **/api**.

References

- Autodesk BIM 360 Field API documentation: https://bim360field.autodesk.com/apidoc
- BIM 360 API Forum:

  http://forums.autodesk.com/t5/bim-360-api/bd-p/115

Additional References

- BIM 360 Blog by Manu Venugopal

http://the360view.typepad.com/

- AEC DevBlog

  http://adndevblog.typepad.com/aec/

- Introduction to Field API SDK:

  http://the360view.typepad.com/blog/2013/12/bim-360-sdk-part-1-bim-360-field-api.html

- Field API Introduction Labs with sample code:

  http://the360view.typepad.com/blog/2015/04/field-api-intro-labs-overview.html

BIM 360 Field API in the Max Bögl PlanConnect-Bim Field Integration

The library and equipment API services are at the heart to the integration solution developed by Max Bögl.

/api/library/all_folders	Retrieves all path information for a project's document library	
/api/library/all_files	Retrieves a listing of document metadata. If the **directory** parameter is specified, only documents from that directory will be returned	To specify files in the top-level folder, use '' as value of the **directory** parameter.
/api/library/publish	Publishes a document into a project's library.	Specify **document_id** of the base document to create a new revision of an existing document. If no **document_id** is specified and a document already exist in the same directory, with the same name, the document in the library will be replaced by the new one. Optional tags parameter defines a set of comma

		separated tags which can be used to categorize this document.
/api/get_equipment	Retrieves a list of equipment	Specify optional **filter_id** (filters must be created via Field Portal) Specify offset and limit to retrieve batches of data Specify list of **equipment_ids** (to restrict data to list of ids, specify **ids_only**) Specify **max_date** to retrieve equipment updated or changed after this date
/api/document_references	Creates a link between an object (Equipment, Issue. Etc.) and a document in the library	When defining document reference parameter, specify **id** (id of the document reference), **document_id** (Id of the document in the library), **container_id** (id of the equipment to be associated to the document), and **container_type** (“Equipment”)