AUTODESK UNIVERSITY 2013

360 degrees of Field BIM

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Real life examples on how the BIM 360® related processes and their implication in the field are profoundly changing the way we document and transfer project related information. Ability to streamline day to day activities, organize the entire team around the next generation knowledge sharing platform and incise to actively participate in shaping collaborative solution are some of the benefits resulting from effectively deployed mobile technology solution like BIM 360®. At Clayco Inc. the "Long View" associated with digital technology enable integrated practice, has resulted in pragmatic and efficient use of BIM enabled processes for design, construction with the purpose of supporting and innovative practice. This lecture will focus on the best practices of BIM 360® deployment and the use of information rich design and construction models.

Learning Objectives

At the end of this class, you will be able to:

- Autodesk BIM 360® successful deployment and best practice
- Typical roll-out strategy and focus on clearly defined objectives
- Use of BIM to improve communication and overall project understanding in the field and ability to facilitate instant feedback
- Potential and desired future improvements of BIM 360 platform form the end user perspective

About the Speaker

Tomislav Žigo

Over the past 19 years Tomislav Žigo has been an advocate of digital technology implementation as a researcher, designer and for past five years as a designer - builder. His experience includes work in the vanguard of BIM implementation on large healthcare projects; research work in the field of Virtual Reality and Building Performance Analysis; and mentorship positions in a number of local and national architectural firms while transitioning toward BIM adoption. As the director of Virtual Design and Construction for Clayco Inc. of St. Louis, he leads a multidisciplinary team of talented individuals tirelessly conducting in house R&D, training, professional services, marketing, sales assistance, partner and client management. Tomislav holds a Master of Science degree in Mechanical Engineering from the University of Rijeka in Croatia and a Master of Architecture degree from Washington University in St. Louis.

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Nick Bristow

Nick Bristow PE, is a member of Forum Studio's Technical Assurance Group and is administrator for BIM 360 Field and responsible for implementation and training at parent company Clayco Inc. Nick oversaw the transition from the unlimited-licensed contract with Vela Systems to the new limited license agreement with Autodesk. Clayco is on the third generation of projects for implementation of BIM 360 Field® and Nick continues to increase utilization of new and existing features of the application. Nick also serves as a Green Building Consultant for Forum Studio, and is LEED AP BD+C, LEED AP O+M, a Green Globes Professional, and a Certified Building Commissioning Professional.

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Corporate Strategy Alignment

Clayco Inc.

Founded in 1984, we partner with our clients, consultants, suppliers, subcontractors and communities to deliver building solutions of the highest standard. With more than 1,000 employees across the country, Clayco generated revenues exceeding $1,100 million in 2013 and is currently working on, or has completed, major projects in 43 states and three countries. Clayco has dramatically set new standards for design, quality and craftsmanship, efficient project management, cost containment and worker safety.

We've integrated the building process from head to tail and adopted new technologies that bring state of the art design-build opportunities to clients and the communities they serve.

We have nationwide reach and reputation, with offices in Chicago and St. Louis, and we break ground across each of the business units we serve.

Change is inevitable

Focus on Cost and Efficiency in an ever competitive market place. Design and construction processes are facing ever increasing reduction in available fees and shrinking profit margins. The higher level of integration as a countermeasure for compressed schedules reality and increase demand for quality calls for better and more efficient distribution of project related information. Integration also means increase in speed at which business decisions need to be made in order to stay relevant in today's marketplace. In that regard we at Clayco have realized four years ago that the mobility in the key to infrastructure and process integration

One can argue that in the Construction industry that might be regarded as commoditized, and that in today's marketplace the client's approach toward fungibility of products and services as the relate to AEC companies, calls for greater ability for differentiation.

This differentiation can certainly come from the use of technology and the way it relates to the overall project or product (read commoditization) delivery cycle. In the case of the ultimate deliverable it is hard to separate the contractual project type from one's ability to control all of the aspects of the project and one way of exercising such control if through the integration of services.

Past two decades have witnessed an increase in the number of design- build and IPD projects where if a team truly acts as one entity, the concept of master builder very often comes to mind.

Such approach has the potential to close in on a less transactional procurement cycle and move more toward a closed loop procurement cycle that will inevitably lead to manufacturing like deliverable.

Paradigms of manufacturing efficiency are already becoming the vocabulary of construction industry future.

- Concurrent Engineering
- Product Lifecycle Management
- Lean project delivery

Technology as a change Factor

If owners have more information about the contractors and construction process, contractors need to have more information about their potential customers. At the same time, contractors need a deeper understanding of their own processes, methods and all costs.

Buyers need to have confidence in their contractors. They need better ideas of how to accomplish their goals. Contractors must understand those needs and more, long before estimating and bidding a job.

The wholistic approach toward the utilization of Information Technology is start thinking of it as a competitive and profitable advantage center, and not just a group that fixes computers and installs new software.

Understanding and using BIM has become a necessity rather than just a nice-to-have gimmick. Improved communication in the form of software and hardware from smart phones and tablets to jobsite cameras and regular discussions among project man-agers, the field and clients will not only help build relationships, but also reduce the time it takes to get things done. Even installing and making full use of a CRM system will help track business development efforts and customer information.

Avoiding being treated as a seller of commodities, calls for becoming the best-in-class specialists. Such contractor with a keen sense for process integration may start thinking about positioning products and services, as a value added alternative beyond the traditional realm of deliverables, this carving out its own market niche with few competitors.

Self-performing contractors are often the most profitable. They offer benefits to customers in having more control over schedule, price and quality and, if they are productive, can make greater margins with their own labor. As labor shortages return with the economy, those companies that can best recruit, manage and mobilize labor will have the edge.

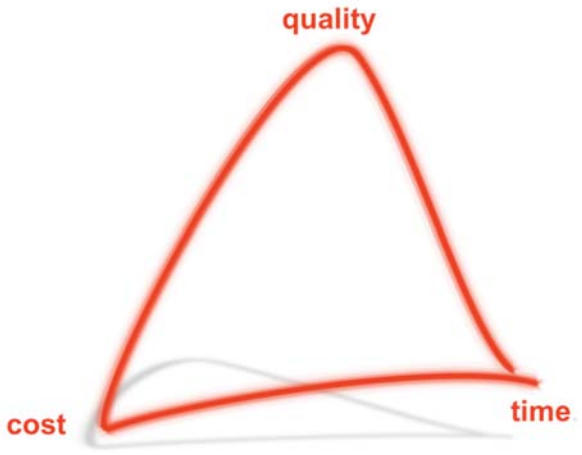
The modern trend in business has been to avoid as much risk as possible by shifting it contractually or otherwise to others who in turn move it on to others and so on. While it is important to avoid risk, the cost of shifting risk can be expensive. More contractors are working to get a deeper understanding of all the sources of risk in their work and, wherever possible, accept and manage the risk themselves. When done effectively, risk management can become another profit center.

Most of the firms that were surprised by market changes were either not paying attention or ignoring what they knew was happening. Sometimes one has to believe his or her own eyes and data and make the necessary changes to adjust to market forces. It is important to have a company culture and a reputable company history, but if the firm is to have a great future, it has to make changes. Recognizing those needed changes early can mean the difference between a competitive edge and falling in line with the low bidders.

The construction industry is often chided as being unproductive and behind the curve of high-tech manufacturing sectors. However, more contractors are breaking out of that mold and looking for ways to employ technology and processes like BIM, prefabrication and modularization to gain on productivity, safety and workforce changes.

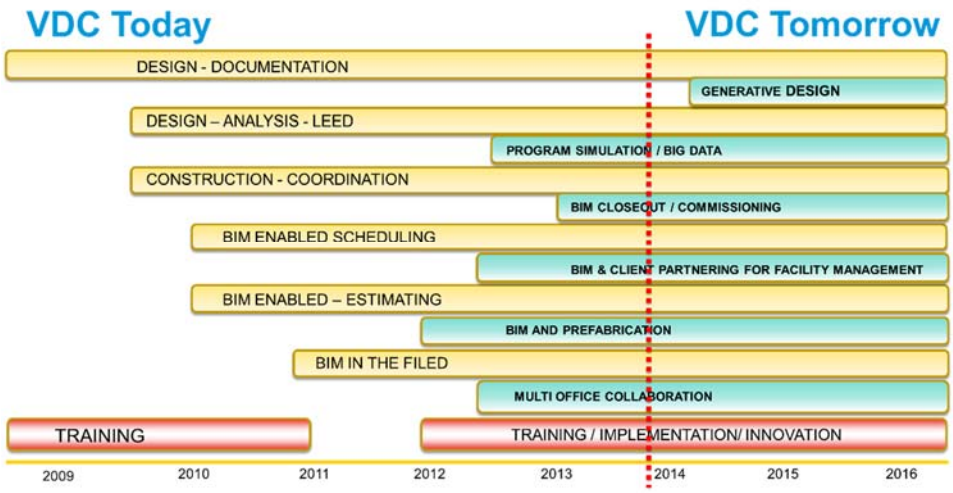
It is not only important to understand owner needs and wants for more sustain-able projects, but it is also time that contractors learn how to be more sustainable in their own business. Reducing waste and carbon footprint will not only provide a good example for others, but also reduce cost in a world where key materials are becoming scarcer and regulations stricter.

While it seems to go against the grain of low-bid, price-slashing markets, thinking more like partners and service providers will be an advantage over time.



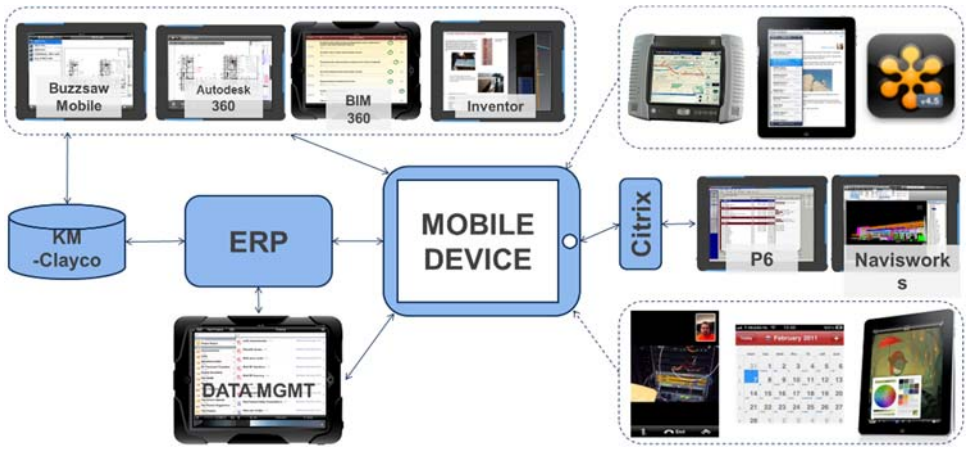
This paradigm of cost effective, high quality and expedient project delivery is defining a new kind of stress test for any of our new and mature technologies, evaluating their ability to successfully leverage all three variables in the engineering triangle while creating the prerequisite for a more competitive organization.

As the company that through the nature of our internal structure relies on uninterrupted flow of information and providing that same information to the right person and the right time, Clayco had to operate within the set of objectives whose purpose beyond competitiveness, was to instigate a focused effort toward implementation and adoption of new technologies.



The essence of Clayco approach is in recognition that a comprehensive deployment of digital domain relies on our ability to map our process and recognize where and how bridging silos will occur.

If one is to see a 10,000 foot view of our corporate strategy when it comes to mobile devices, one can easily visualize and understand the importance of centralized and mobile access to data.



We also know that this picture of yesterday is not quite the picture of today and will most likely be an outdated concept one or two years from now. With this realization in mind, if we look at

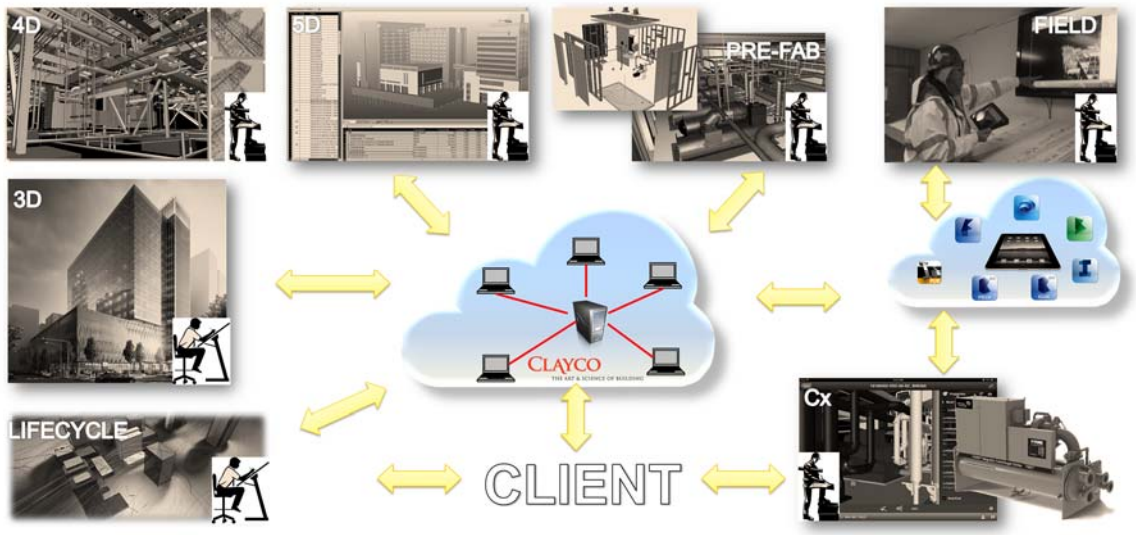
the range of different datasets currently at use with the majority of AEC companies, the need for platform that will provide a data continuum is a logical strive.

Clayco mobile deployment path started in 2009, by an early attempt to bring desktop applications to the field via Citrix technology, and soon enough we realized that this was an intermediate step, but a step in a right direction as our knowledge about the following has increased:

- Level of interaction on the job site
- Importance of up-to speed/date information
- Ability to participate and deliver model related information remotely
- Understand the limits of technology.
- Construction trailers versus back-offices

First set of mobile rollouts were focused on deployment of best practices and the delivery of coordination results to Clayco job sites. Applications like virtual mockups and prescriptive installation sequences gave us the opportunity to investigate new technology, seek the potential efficiencies and recognize the need for the Big I approach through Client Centric Initiative.

Client Centric Integration Paradigm



Focus on mobility calls for the greater understanding of the available software ecosystem and in particular those applications that can support enterprise wide sharing of information.
The reliance on Cloud technology is nothing new, and in one shape or another it was utilized within AEC industry for past ten years. What changed over past couple of years is the clear intent by the software industry to bridge different independent information repositories, introduce the notion of infinite computing and make the project related information readily accessible across the multitude of devices.

But what really needs to be accomplished on the level of any organization is to recognize when a cloud based data is too decentralized at the point where management of that data exceeds the benefit of collaboration.

Autodesk BIM 360® successful deployment and best practice

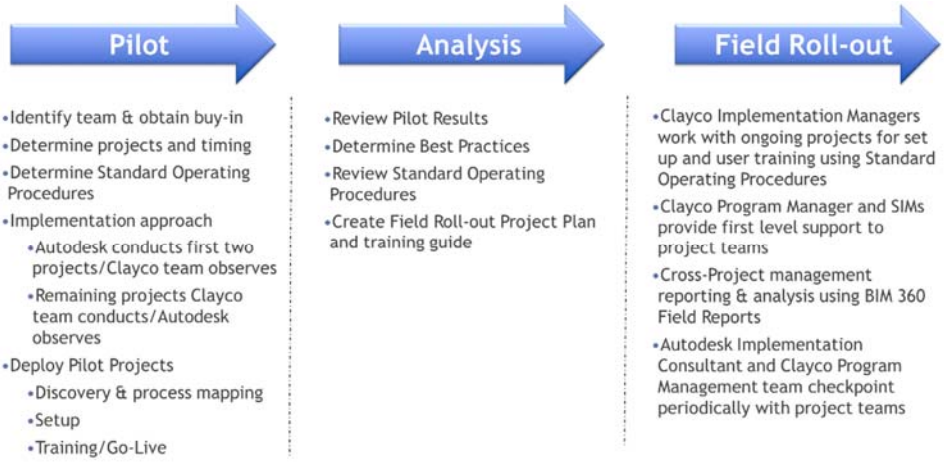
The Objectives and the Strategy

The change calls for recognizing the deficiencies and the opportunities. The nature of Clayco's Design Build approach envisions the level of collaboration that cannot be executed without the software platform that assure management of field data as defined through:

- Need
  - Leveraging shrinking profits and quality of deliverables
  - Managing ever increasing amount of job related information
- Value
  - Focus on reduced construction cost and increase in efficiency
  - Eliminating silos
- Integration
  - Integration of project related processes and documentation
  - Getting operations buy-in
- Results
  - Benchmarking through reduction of costly rework and decreased feedback time

Each organization is quite idiosyncratic in regard to their processes and their level of technological knowhow, construction and information management wise. When bringing consultants on board, including their broader insight into cross-section of the industry, their primary job should be to be open minded and evaluate each client independently.
This creates the specific set of requirements for any organization that is seeking to define their strategy when it comes to new technology deployment:

- Identify the level of executive commitment
- Structure internal adoption process
- Define the testing period and suitable project type
- Organize the adoption around people championing the process change
- Identify points of infection in regard to current project delivery cycle
- Establish benchmarking points
- Evaluate internal ability to reengineer established processes
- Focus on issues resolution



A New Start

At the beginning of this year Clayco was faced with renewal of the BIM 360 Field® Enterprise Agreement or switching to other competing applications. Key players from across the organization came together to evaluate options and utilization of existing tools, and to choose a path forward. BIM 360 Field® had been implemented on the first round of pilot projects (First Generation), had been rolled out companywide to a second generation of projects that were well under way, and a third generation was just starting. Reports from BIM 360 Field® were run on all projects to show exactly how much it was being used in the field. Usage data was less than stellar, and if it were not for the fact that the other options under consideration were not quite ready for company-wide implementation, we possibly could have not renewed the Autodesk agreement. After the pilot phase and the company wide rollout, BIM 360 Field® was not actively pushed and it became another tool in the toolbox that a few people were using but the majority was regressing to older tools such as spreadsheets. In order to justify the expense we would need to make serious deployment efforts to increase usage. In 36 months there would be stiffer competition.

After the contract was renewed we set out on a path to increase usage.

- BIM 360 Field® Team
- Targeted Training
- On Boarding & Project Setup Process

- Finding the Pioneers
- Increase Access
- Planning for future Developments

Challenges

There were some speed bumps. We did not have full buy-in from the IT Department, but a true testament to the ease of use of BIM 360 Field® was not needed. The team in charge of this technology deployment had engineering and architecture backgrounds. IT even developed their set of own in-house apps competing with BIM 360 Field®, but ultimately did not commit full resources to see it through.

Another challenge came from Clayco only deciding in the 11th hour to renew the enterprise agreement. For the first quarter of the year before the commitment was made, uncertainty was created and rumors swirled that the use of BIM 360 Field® was going to be discontinued. As much as concerns were assuaged, there was a temporary divestiture of BIM 360 Field® until the contract was signed.

Also, during the pilot phase and the company wide rollout the early adopters were easily captured, but not many inroads had been made into reaching the users more set in their ways. The low hanging fruit had been picked, now every new convert would take more and more effort.

BIM 360 Field® Team

Two groups of BIM 360 Field® champions saw the potential and were invested in seeing B3F through to the full deployment. The Technical Assurance Group (TAG) is a group of architects and engineers responsible for Peer Reviews, QA/QC during construction, and Commissioning. This group saw an immediate benefit with direct payoff with full implementation.
The Virtual Design and Construction (VDC) team could see the big picture and the value BIM 360 Field® brought to the table with BIM at the fingertips of the project managers and superintendents in the field.

TAG & VDC came together in an *ad hoc* team to increase the deployment of BIM 360 Field®. Before, there had only been only one champion of BIM 360 Field® who could only do so much, but putting together a team of people provided an internal sounding board and just by sheer numbers and different backgrounds increased the reach into the organization.

During the evaluation of BIM 360 Field® before renewal of the agreement, extensive data was evaluated from the various project reports. If it were not for a few “super users” or pioneers of BIM 360 Field® then there would not have been much data at all. The super users were sought

and became the new BIM 360 Field® pioneers. The B3F team met periodically with them individually, introduced any new features, and held exit interviews when their projects were finished to evaluate what went right and what could have worked better. These pioneers also became advocates of B3F and mentors for other users.

Start-up, On-boarding, and Training

Existing projects were evaluated and determining factors identified for projects with above average usage of BIM 360 Field®. The differences between high usage and lower usage projects were glaring. A high usage project had several characteristics including: full list of project locations, a variety of checklists, a well-organized library, and high rates of subcontractor and A/E participation. The BIM 360 Field® team looked to capitalize on this information and give every project what they needed to be successful. Formalizing the startup process included setting up all project locations from the start, setting up a clear structure for the library, and importing the most commonly used checklists. The team also had a process for on boarding subcontractors and the A/E team.

The same team visited projects sites and met with the subcontractors, trying to win subcontractors on the ease of use and simplicity brought by the use of the application. The subcontractors were encouraged to bring an iPad or laptop to the meeting, and before the meeting started an issue with attachment assigned each subcontractor. At the meeting, the subcontractors were walked through the process of accessing the issue, viewing the attachment, and marking the issue as work completed. The team also demonstrated other features of BIM 360 Field®, and held similar sessions with the A/E team focusing most effort on adoption by the architects.

Another and somewhat obvious way to increase usage was to increase access. Getting iPads into the hands of more and sometimes younger users was a catalyst for increased usage of existing iPads. iPad 1's which did not have a camera on the back were also replaced; this was a barrier to creating issues with photo attachments. These old iPads were reissued to project administrators so they could get a feel for how BIM 360 Field® worked as they were the ones updating the library and preforming other project setup. Unexpectedly, this provided another layer of support, the construction administrators were often the first ones called when users were experiencing issues and they found that they were able to answer a lot of the questions because they had their own iPad.

Subcontractor foremen are the typically the people in the field responding to issues and accessing drawings yet they are lagging in technology on hand. Loaner iPads and workstations for them to access issues and print their own reports from BIM360Field.com were provided. This reduced barriers for subcontractor participation and increased overall usage.

Broad-brush training sessions were proving to be less fruitful as time went on, and so the target audience was narrowed, material tailored, and hands-on demonstrations provided. The training sessions were shortened and focused on only features particular user groups would encounter.

Short training with smaller groups kept the audience easily engaged and provided yet another opportunity for users to provide feedback and for the B3F team to adapt or find solutions to problems that were not known to exist.

Use of BIM to improve communication and overall project understanding in the field and ability to facilitate instant feedback

For Clayco Inc., especially when we consider contractual nature of a DB project, it makes a perfect sense to exercise the role of information manager / gatekeeper and repeat this process from project to project. To realize this within the context of this integrated project approach the solutions like BIM 360 Field and Glue are essential for the streamlined process of data capture, documentation and distribution.

This represents that the complementing platform to the following opportunities:

- FOCUS ON PROJECT LIFECYCLE (DESIGN / CONSTRUCTION/ OPERATIONS)
- INTEGRATED / COLLABORATIVE MODEL HANDOFF
- MEANS AND METHODS BUILD MODEL (ESTIMATE + SCHEDULE)
- COVERS 75 % OF PROJECT LIFECYCLE
- LOD 400 COORDINATION
- BEST CHANCE FOR SUCCESSFUL AS-BUILT MODEL
- EXCELLENT OPPORTUNITY TO CREATE DATA RICH FM/CMMS MODEL

As workflow as envisioned through BIM 360® platform is being identified as one of the most important paradigms of our approach to project management.

The actual organizational structure with the system requires a robust project centric model, and in the case of BIM 360® the location based document management is that a concise vehicle for integration of documentation and model based data.

Current ability of BIM 360 Field® portal is reflected via the following functionality:

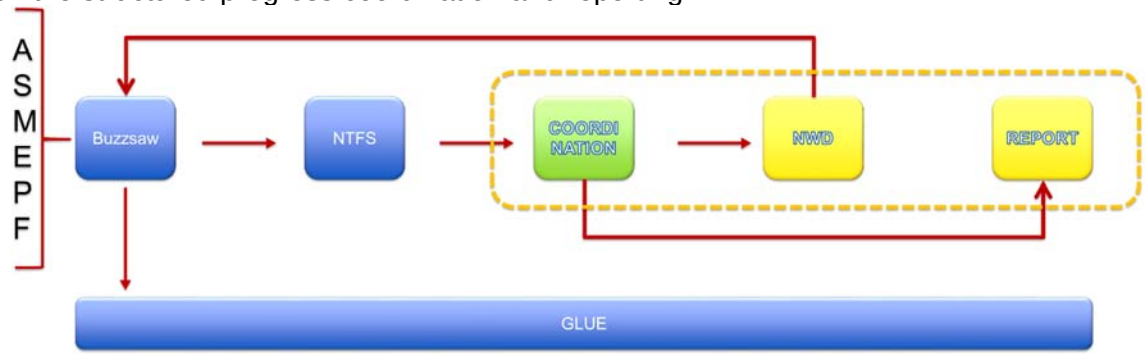
- Centralized model repository
- Datasets diversity
    - Models & Properties
    - Construction Documents

    - Specifications
    - Submittals
- Location/model driven issues creation
- Equipment
- Checklists
    - QA/QC
    - Safety
    - Commissioning
- Issue types
    - Punch Lists
    - Work Lists
    - QA/QC
    - Safety
    - Commissioning
- Tasks
    - Coordination
    - Inspections
    - Tasks

Model Based Project Communication

The concept of multiple disciplines, concurrently executing design changes, reviewing them and providing almost instant feedback has for past several years existed within the framework of a cumbersome and highly orchestrated paragraphs of ever changing BIM execution plans.

With BIM 360 Field® and BIM 360 Glue®, Clayco Inc. has increased the level of transparency and trades involvement, to a new level. The level that allows for a greater autonomy for each subcontractor, while maintaining our ability to have a dynamic insight in a cross discipline model coordination, and therefore alleviating the need for micromanagement thus allowing us to focus on the structured progress coordination and reporting.



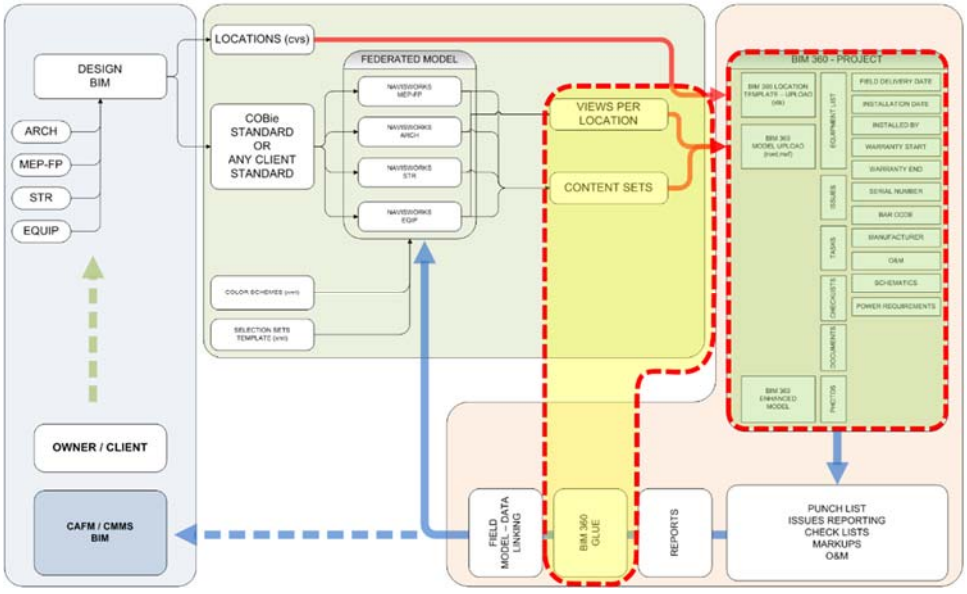
In the example of Clayco's recent project, Sctott McKinley Research Building, as Washington University School of Medicine, the coordination models are distributed via project Buzzsaw site,

viewed and commented between the team members independently using BIM 360 Glue® and the coordination reporting and official coordination resolution is consistently maintained within Navisworks 2014.

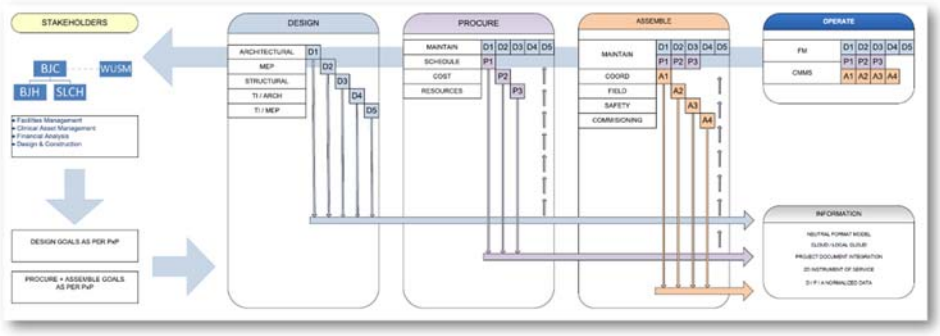
Another convenient aspect of sharing the BIM 360 Glue® platform with the rest of the team is the ability to distribute nwd reporting models, with its associated views, between all of the stakeholders that need to access this model on the mobile platform.

Model Based Project Information Handover

The federated model with the fully executed coordination cycle is only the first step toward the delivery of as Built deliverable, beyond three dimensional representation of project geometry. The process of association of project cycle relevant information and its intricacy calls for a presentation in itself, however some of the principles deployed on previously mentioned Scott McKinley Research Building need to be mentioned in order to understand the fill potential oh BIM 360 Field® model based process.



If communication is of the utmost importance, for all of the stakeholders in this process, it needs to happen in a highly standardized and hierarchical way and the whole process starts with plan whose main contributor is the client's facilities leadership.



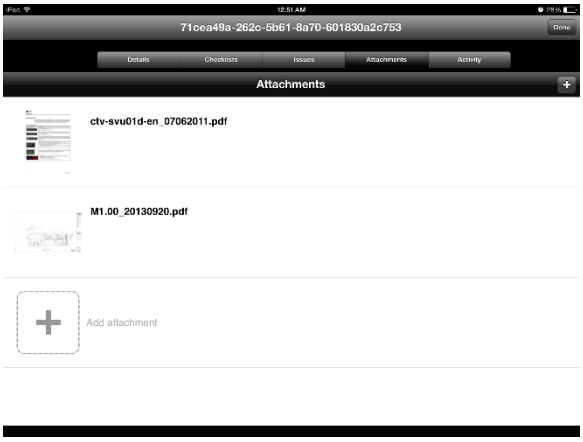
Once the plan is in place, every other activity becomes the measure of team's ability to execute the following steps toward CMMS data and model integration:

- Defining BSOC (Basic Scope of Services) as part of the BxP
- Defining LOD 500, or even better Minimum Client Requirement for information exchange
- Defining or using the existing maintenance data standard
- Defining the as Built modeling process and identifying responsible parties
- Extracting model based locations and tying them to BIM 360 Field location Structure
- Utilizing OmniClass equipment coding
- Utilizing OmniClass BIM 360 Field content coding, checklists, library content
- Utilizing OmniClass BIM 360 Field equipment classification
- Assuring the consistency of model properties transition to BIM 360 Field
- Setting the visual Appearance standards for Navisworks nwd file utilization
- Associating views with equipment location
- Defining the standard selection sets and properties mapping template for BIM 360 Field

The typical documentation that will be associated with model elements as part of the Field capture process falls in two categories:

- Field Capture data
  - Name
  - Type
  - Description
  - Location
  - Status
  - Manufacturer
  - Model Number
  - OmniClass
  - Barcode
  - SerialNumber
  - Tag Number
  - Asset ID
- Field Even Data
  - Issues
  - Checkilst
- BackOffice (Library) data
  - O&M
  - Submittal
  - CD-Location

- Submittal
- Installation Date
- Warranty Start Date
- Warranty End Date



Potential and desired future improvements of BIM 360 platform form the end user perspective

Concerns

- The abundance of job related and site captured information has its challenges. This is often reflected through lengthy data synchronization process, complicated and not always worry free concurrent work flow, and most importantly through the non-standardized procedures that should introduce checks and balances

- Reaching the consensus on defining the minimum amount of information that is required for an efficient, timely and safe project delivery, and determining when the additional information represents the added value.

- Who is responsible for content and its quality, when and why the field information matters, and establishing the firm workflows for distribution of project related information.

- Security of information is an issue, and is the cloud enable access the answer

- File formats and their future, in respect to fully functional deliverables.

- Ability to adapt and re-engineer the internal process as well as the supporting platform.

Recommendations

- More robust analysis and reintegration of analysis data into job planning process.
- Procurement opportunities and non-transactional supply chain could be a key to tangible success of field management.
- More proactive client involvement into extending lifecycle of field data into CAFM and CMMS.
- Capitalize on the potential of enterprise agreement.
- Root cause analysis as the basis of a comprehensive knowledge management system!
- Even closer integration of BIM data into day to day workflow
- Tighter integration between current “Cloud” silos

- Work toward better enterprise-wide reporting
- How to bridge the gap between those that do or do not embrace technology
- BIM methodologies converting toward a true PLM process

What should be next step for BIM 360 Field® / Glue®

- Increase use of checklists & Equipment
- Root Cause development
- Enterprise Wide Reporting
- More advanced us of Tasks & Filters

Tighter integration with BIM and Document management

Conclusion

To any reader of this presentation summary, regardless of their level of investment in BIM 360 platform, it is our hope that Clayco Inc.'s four years of experience in deploying and utilizing this solution can serve as a positive reminder that technology advancement needs to be paired up with corporate vision and determination for successful execution. In retrospect, although we might have taken a few wrong turns, at the same time those wrong turns have allowed us to fully comprehend the functionality and the potential of mobile computing when it comes to project data management in the field and beyond.

Now, after getting the full taste of this solution, we can say with a significant level of certainty that the future of collaboration and successful information management is within our reach, and that the unified platform of BIM 360 is the key component of digital project delivery at Clayco Inc.