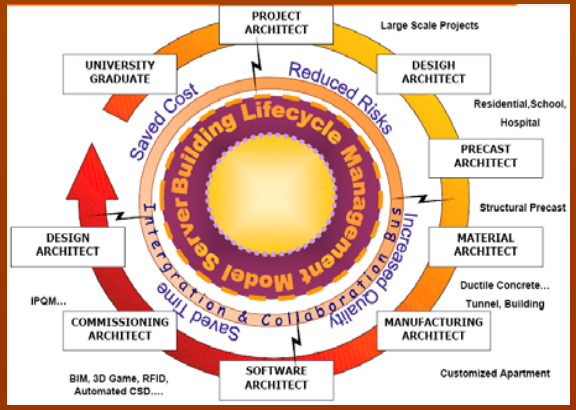
From BIM To FIM

Business Requirements

Building Information Management To Facility Information Management

Presented By Tecton Limited

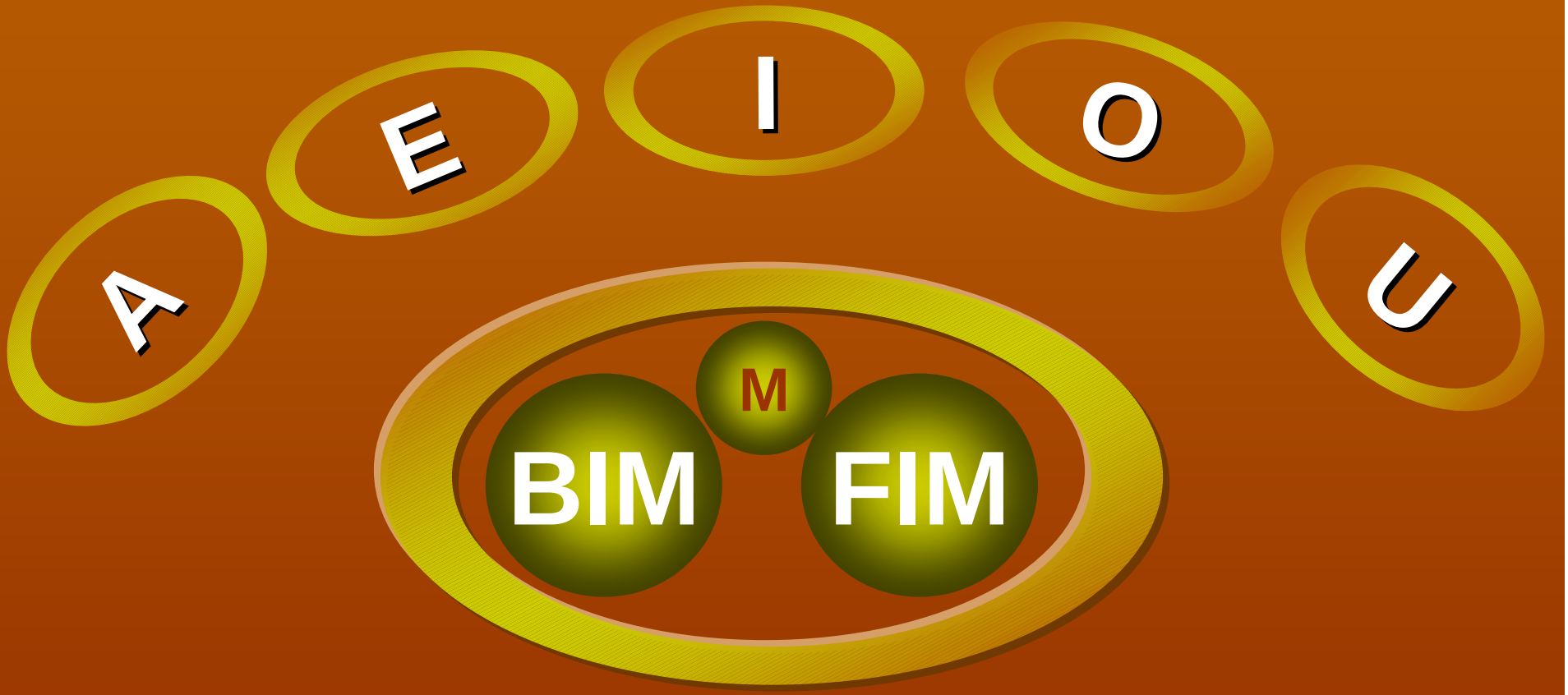
Speaker : Calvin Wong



Tecton Limited

BxM • Virtual Construction• Mass Customization • Logistic

Content



Asset Virtualization – Evolution – Implement – Operation Data - Ubiquitous

A:Asset Virtualization

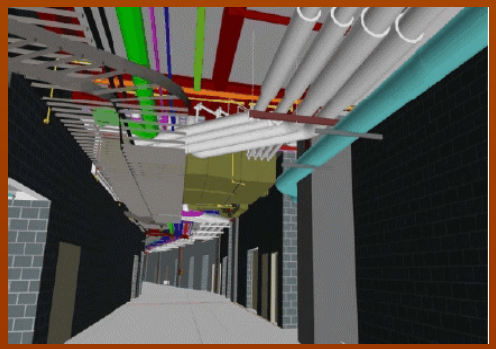
The Management Process

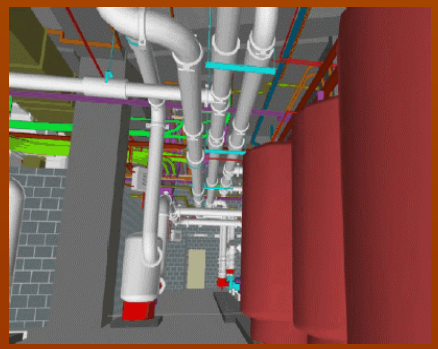
The Real Estate Cash Flow-25 years

- Setting realistic expectations of BIM from the facility maintenance operation team's perspectives.

“Bringing Reality To Your Asset Management”

- Need for a Common Game Changer ?
- Document based approach is not enough.
- Model-based approach is needed for more efficient access to data and documents
- Virtualization can provide a simple and easy access to facility data for engineering, operation, inspection and maintenance applications

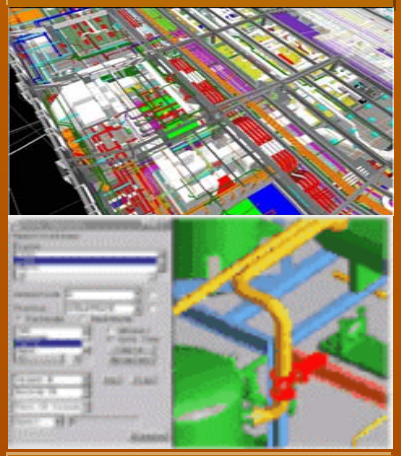


Virtual Asset	Physical Asset	Physical Asset	Virtual Asset

Virtualization As An Anchor Point

As-Built Data



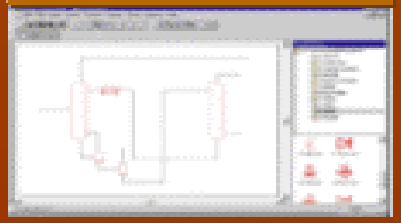
Inspection Data

Operation (DCS/PI)

Virtual Asset Portal

Engineering Drawings

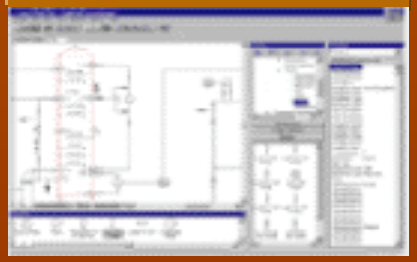
Intelligent P&ID



FI HR CRM KM

Maintenance

Operation Safety Procedures



Bring BIM To Site For Asset Construction and Operation

Building Component Management S.S

Barcode & RFID

Delivery Instruction Sheet

Factory

Inventory

QA/QC

Shop Drawing CAD

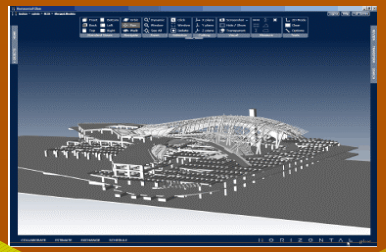
3 D Building Model Data

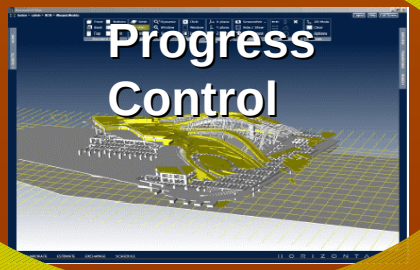
Material Plan S.S

Material Management Database

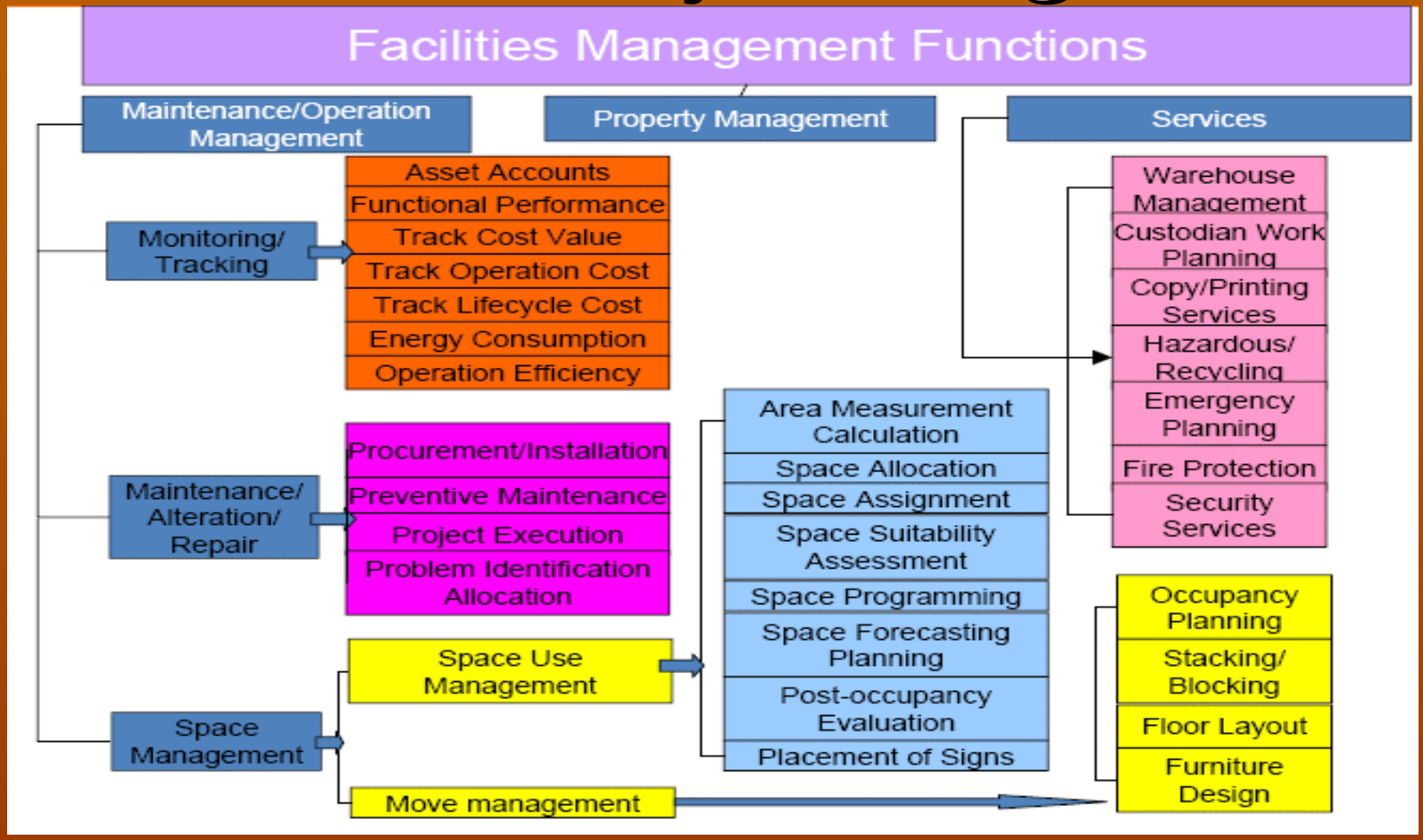
Erection Site Management S.S

Actual Management S.S



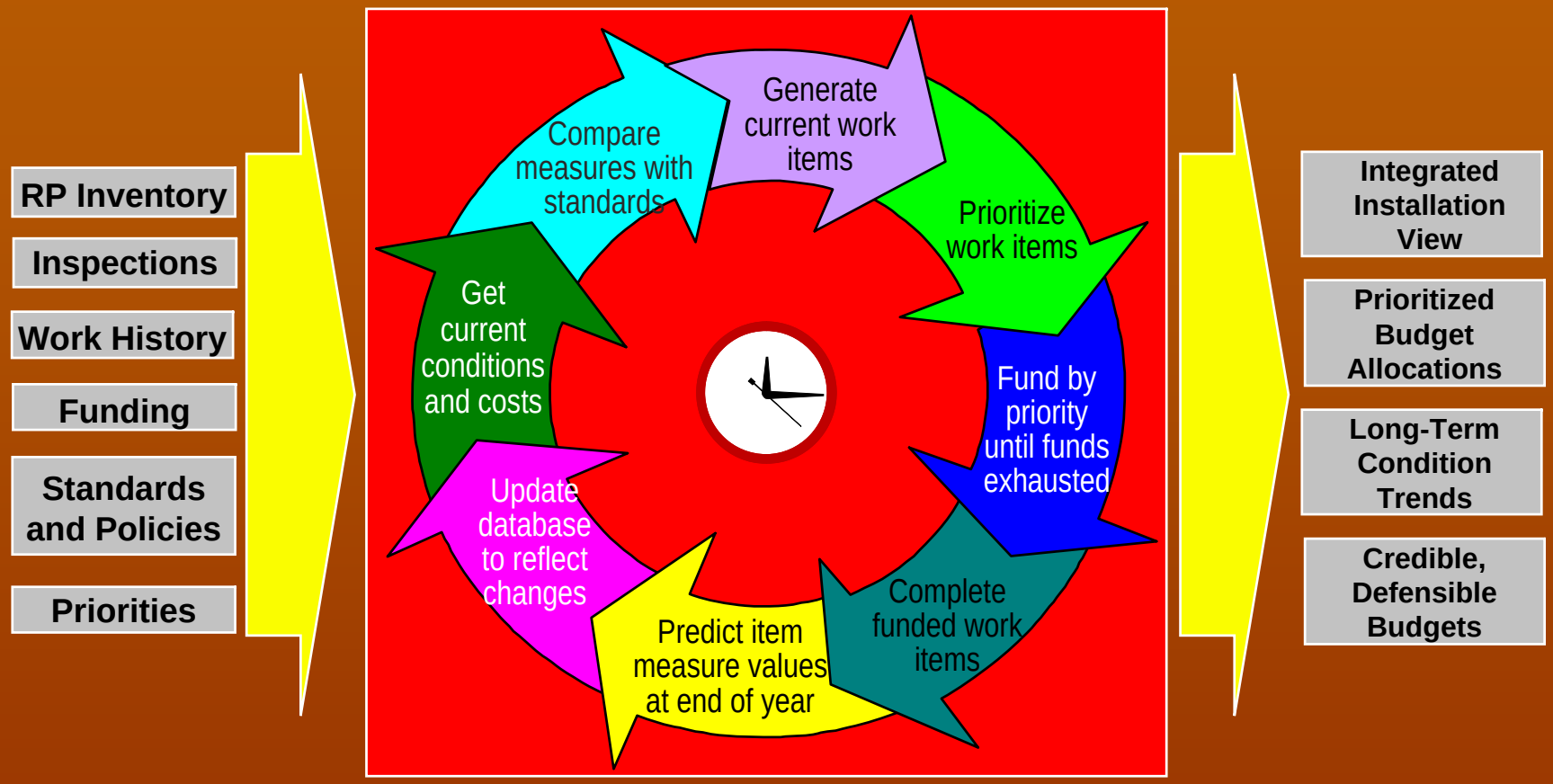


What is Facility Management?



- A significant focus for facility management is to make sure an existing facility runs smoothly and safe for its intended purpose.

FM PLANNING-CYCLE



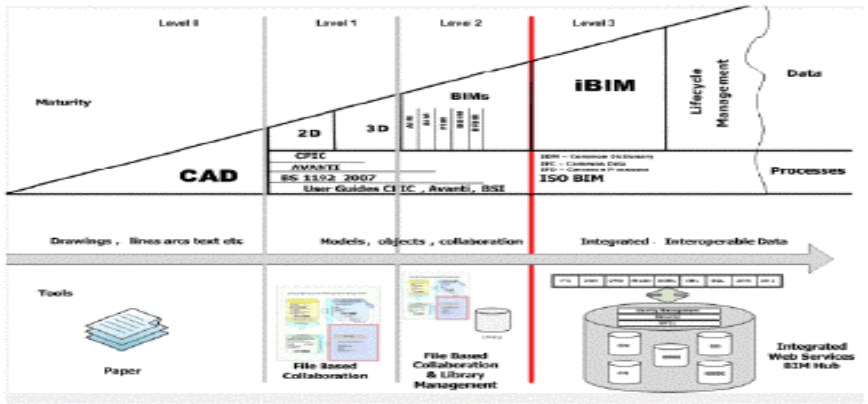
E: EVOLUTION

THE BIM PROCESS

BIM Evolution- Next Step

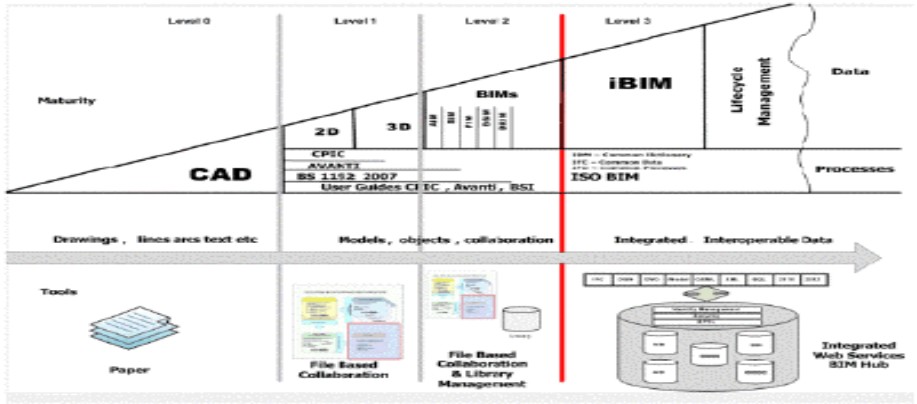
Where We Were	Where We Are	Next Step	Where We Are Going
0 – 2D	1 - Modelling	2- Collaboration	3- Integration
Representation		Prototype	Full Information Capture

Managed Evolution 2011



0% 75% 25% 0%

Managed Evolution 2012

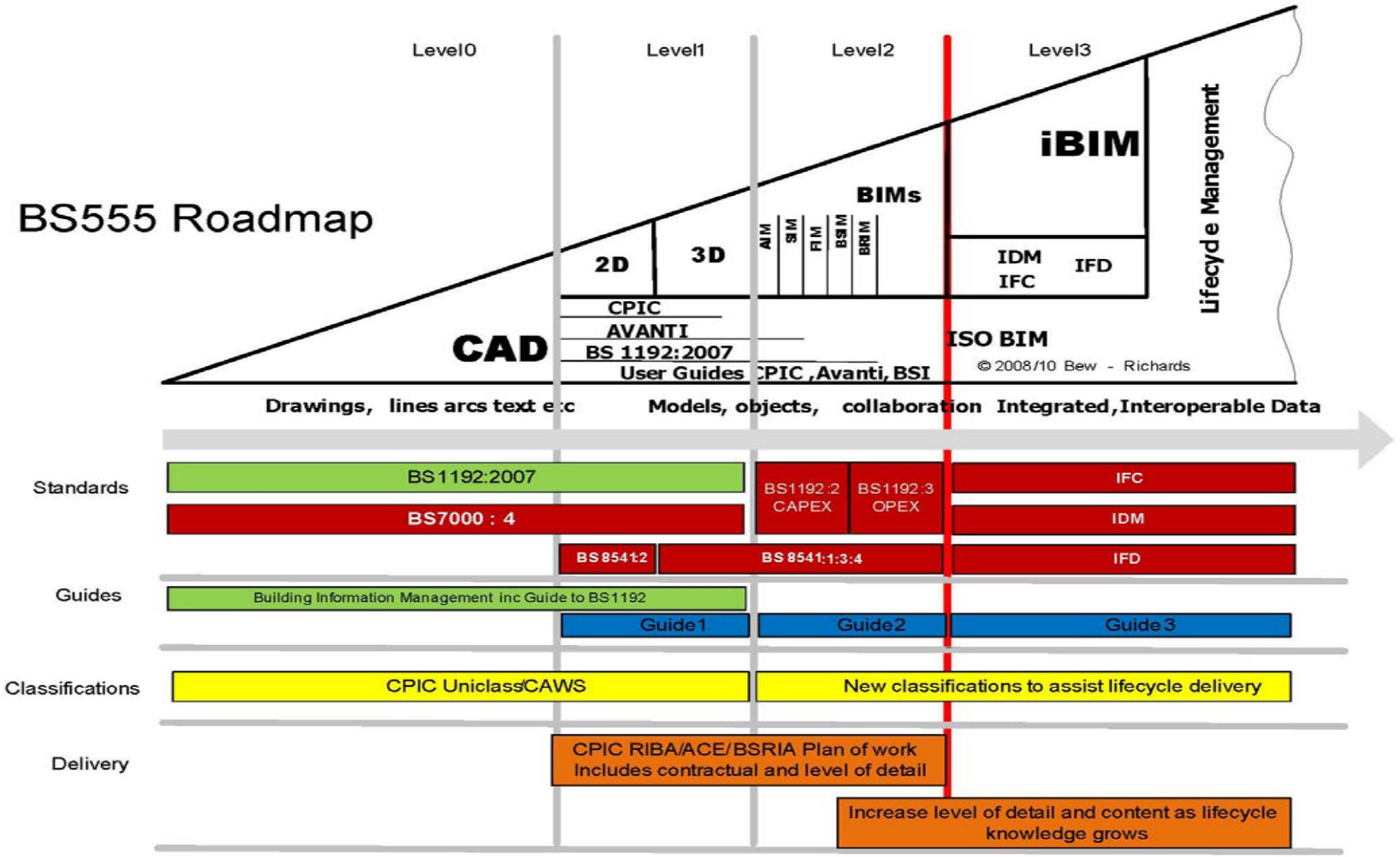


0% 60% 35% 5%

2D CAD	3D / BIM	One Way	Two Way	Local Server	Web Server

ISOLATED	COLLABORATIVE	INTEGRATION

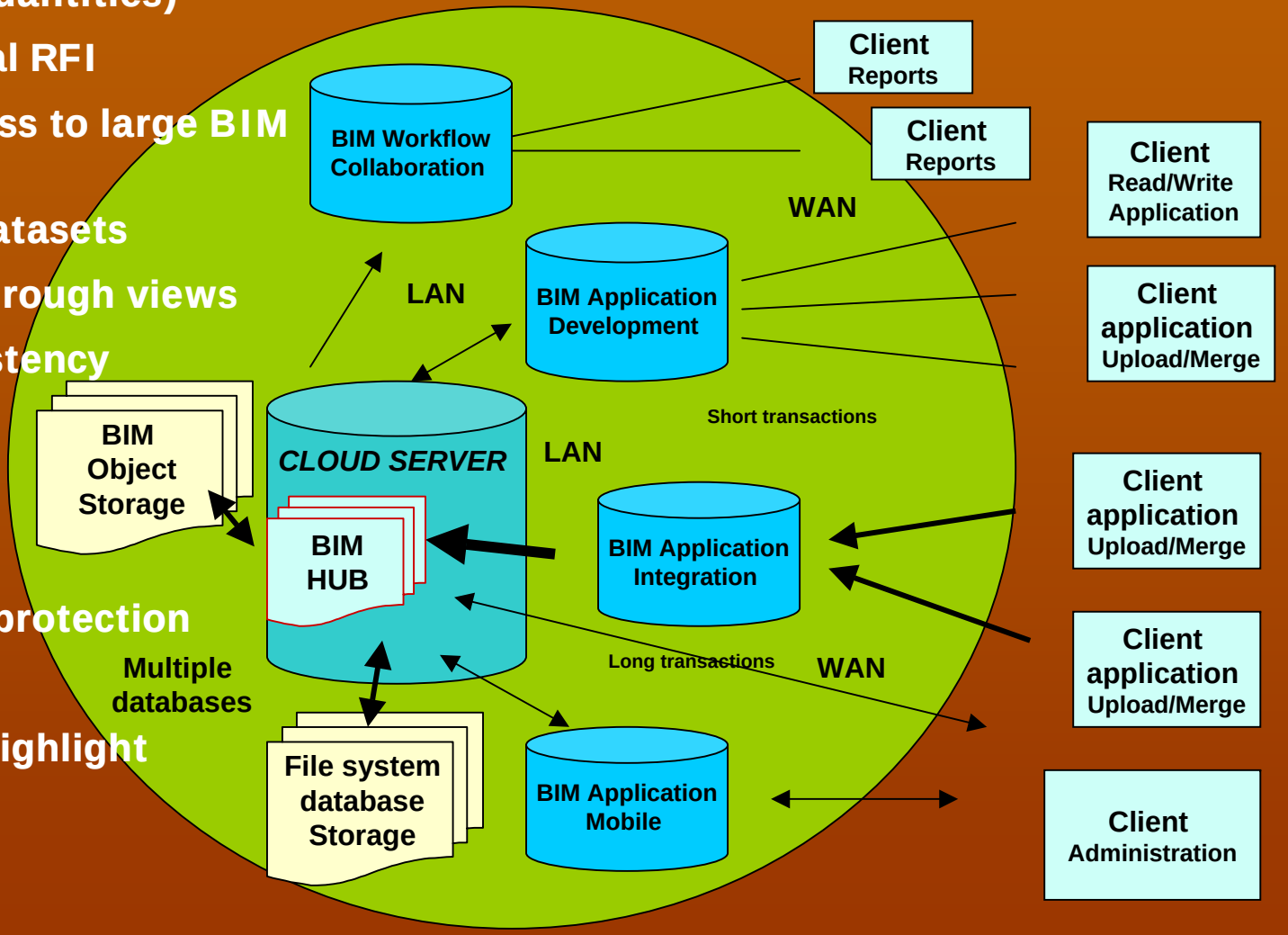
BIM Evolution- Next Step (Ref:BS555)



BIM ModelServer Requirements

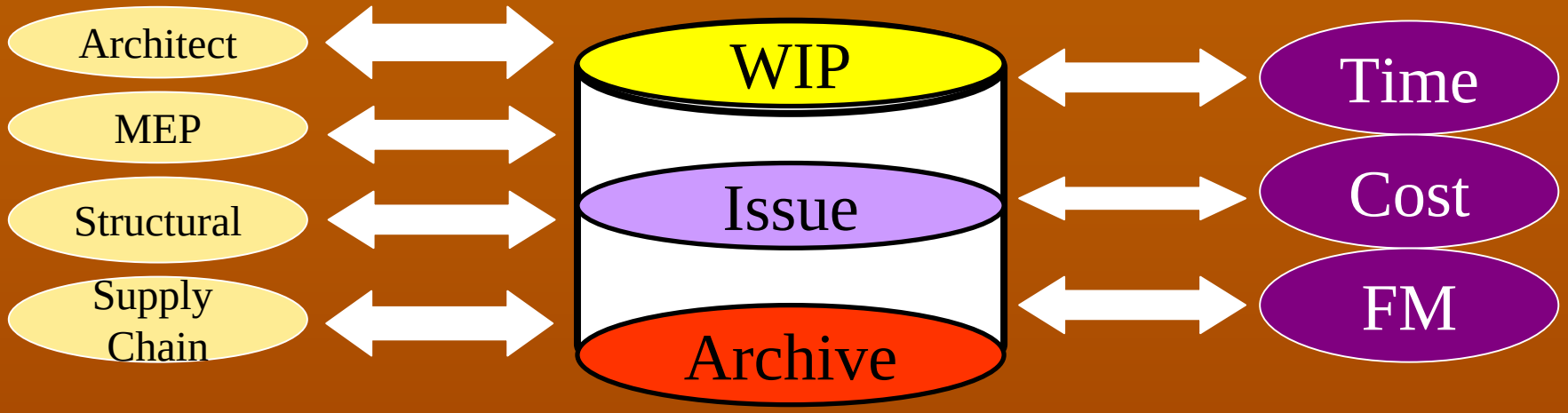
Scalable system/Load balancing

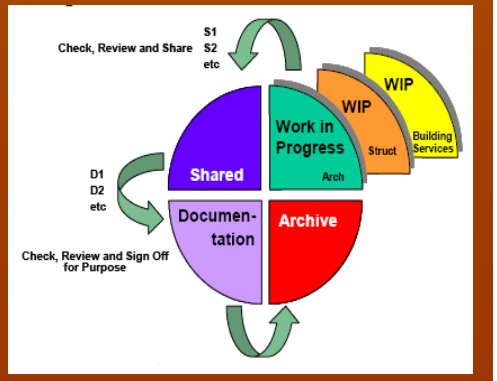
- Storing (large quantities)
- Sharing & Virtual RFI
- Immediate access to large BIM models
- Views, partial datasets
- Extract direct through views
- Integrity, consistency
- Validation
- Merge
- Search engine
- Ownership and protection
- Workflow
- Clash Reverse Highlight
- Schedule
- Versioning
- Transactions



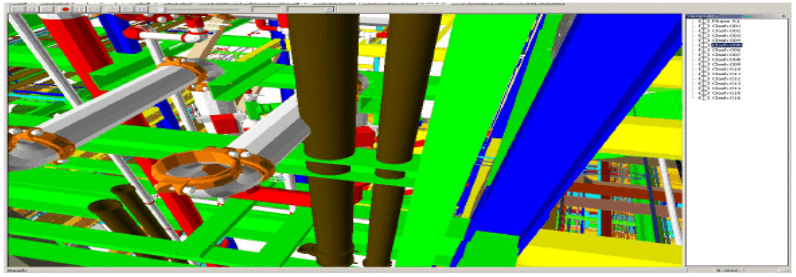
Building Information Management- BS 1192

Web Collaborative Server used to maintain Data through lifecycle of project

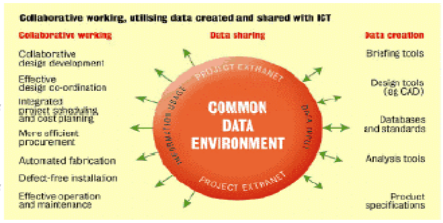


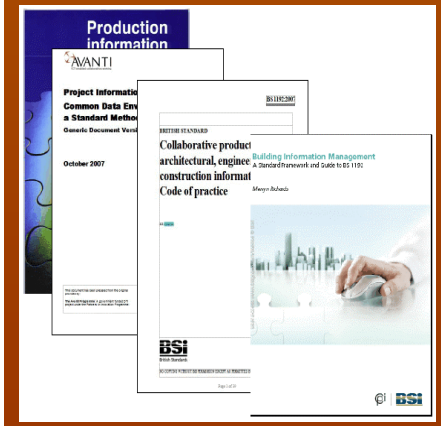


Without processes it 'will' go wrong

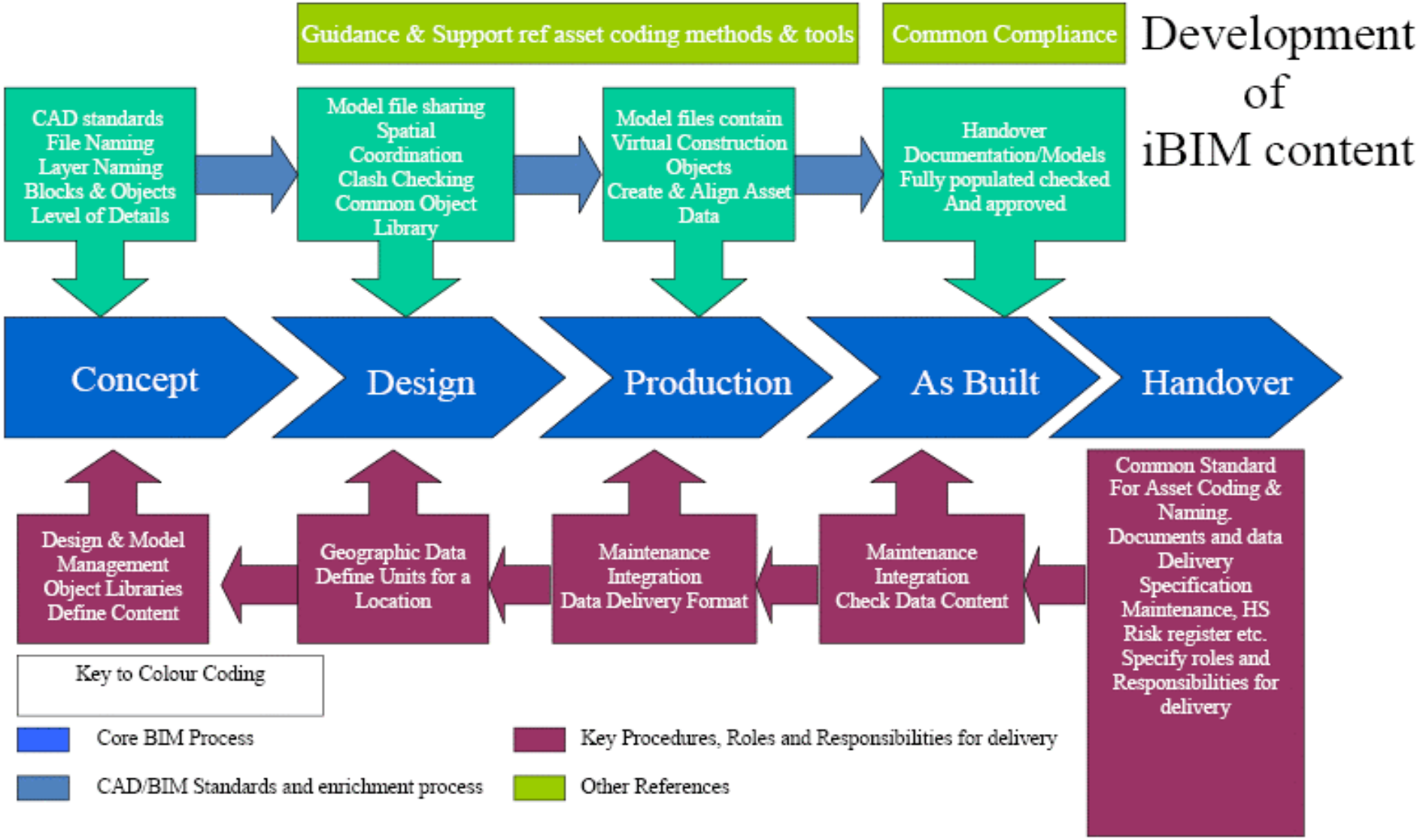


- Fully integrated, object-based Common Data Environment
- Co-ordinated exchange of project data at 3-D
- Co-ordinated exchange of project data at 2-D



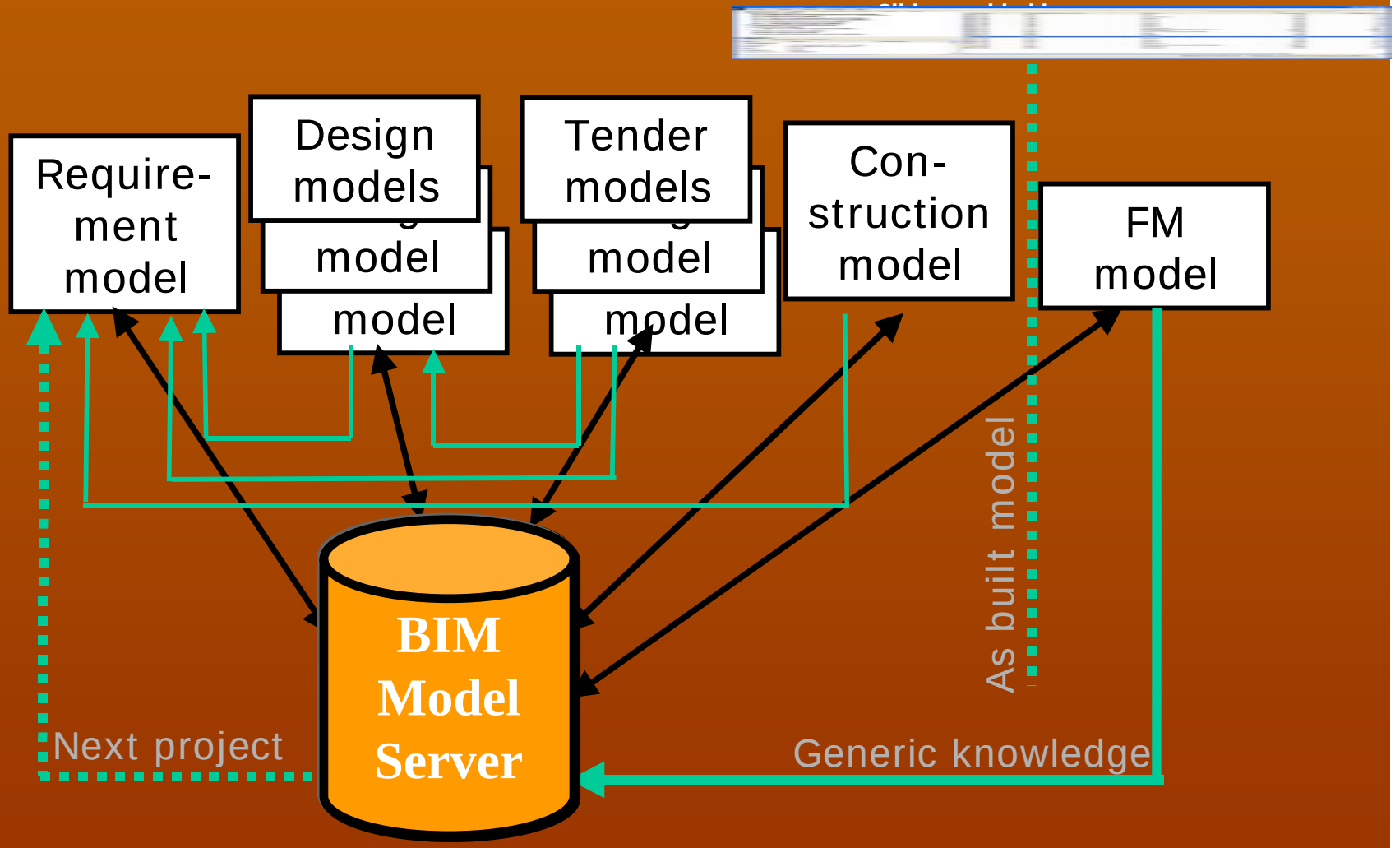


BIM Evolution -Information Flow



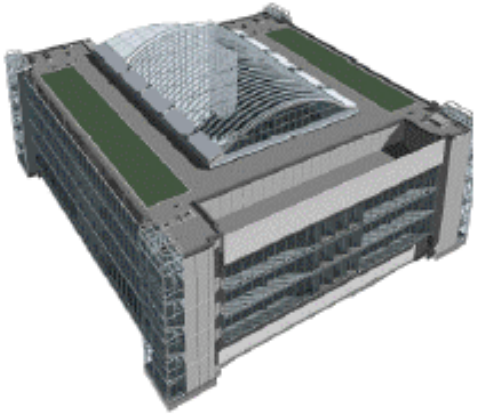
BIM Evolution -Information Flow

Different Models at different stages

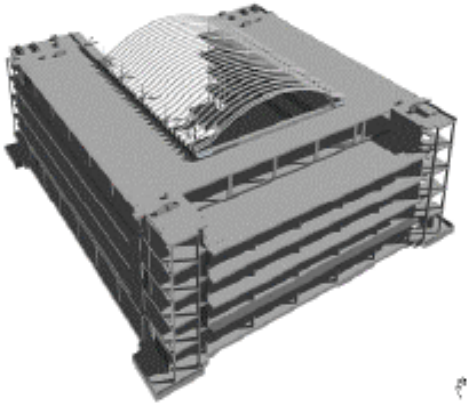


BIM Evolution – BIM TODAY

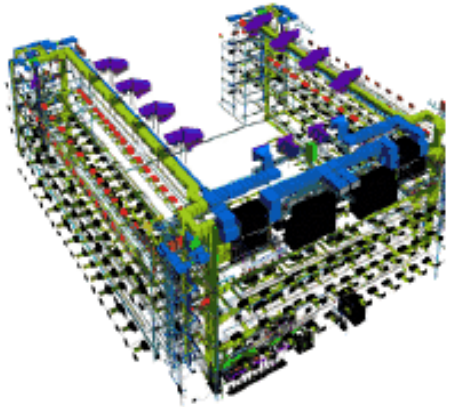
Where are we today - Architecture



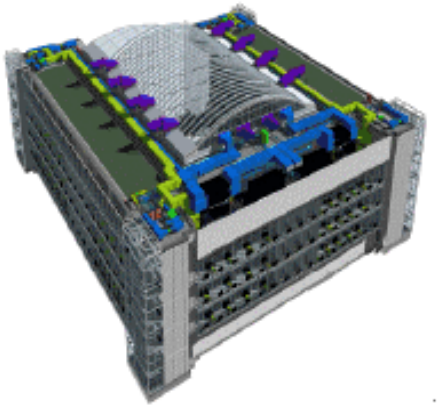
Where are we today - Structures



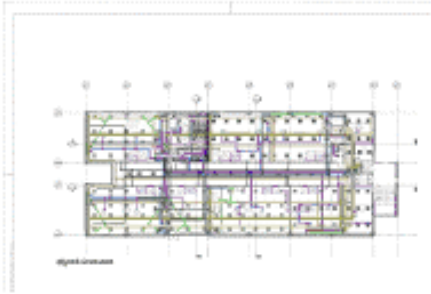
Where are we today - MEP



Combined Spatial Co-ordination - BIM

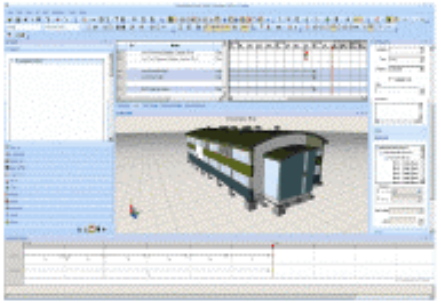


BIM - Drawing Generation

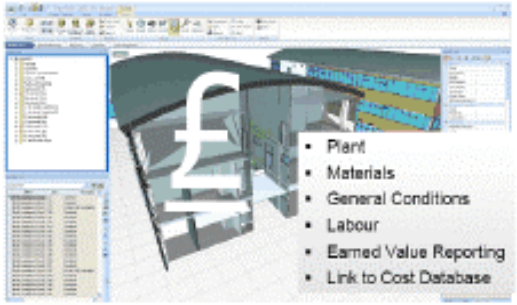


BIM - Material Scheduling

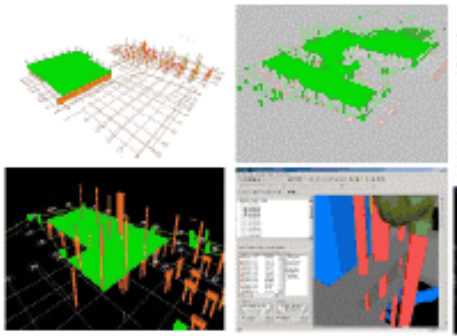
BIM - 4D Construction Phasing



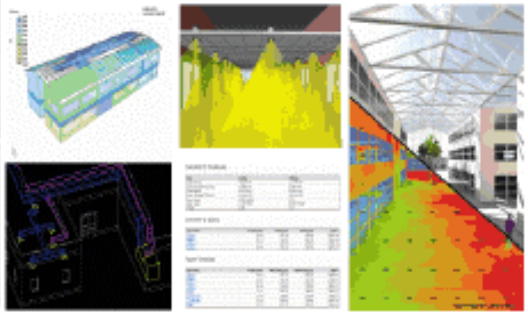
BIM - 5D Cost Scheduling



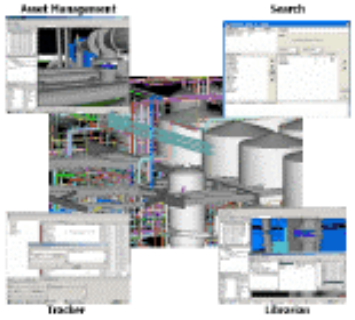
BIM - Communication



BIM Output - Design Analysis/Simulation



BIM - Linking FM data



BIM - Visual Media

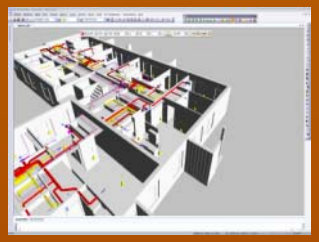
BIM Evolution – ONE MODEL

Applications of BIM (Roadmap Approach)

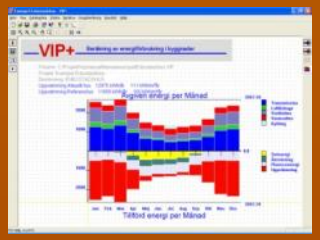
One Model supporting from Sales to Facilities Management

Visualizations

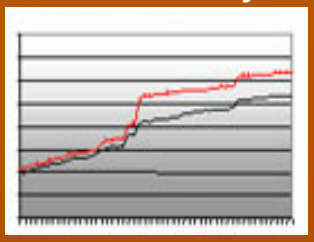
Intelligent 3D modeling



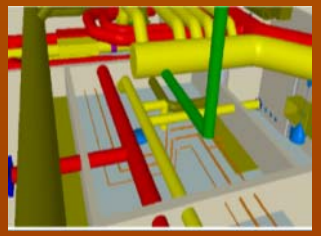
Simulations, energy, etc



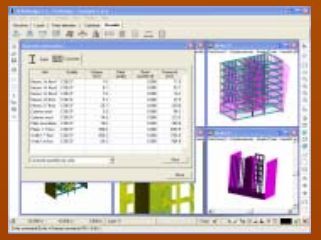
LCC/ LCA analyses



Clash detection



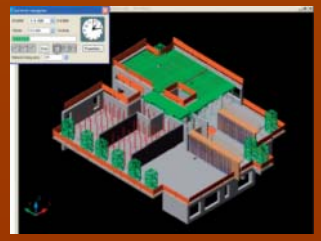
Quantity - Costing



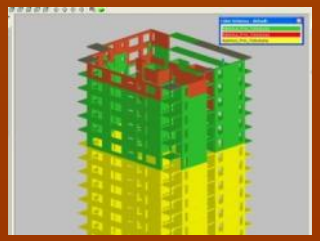
4D - Scheduling

Safety planning

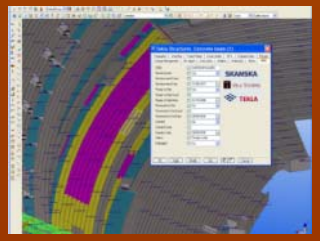
Virtual construction



Supply chain management

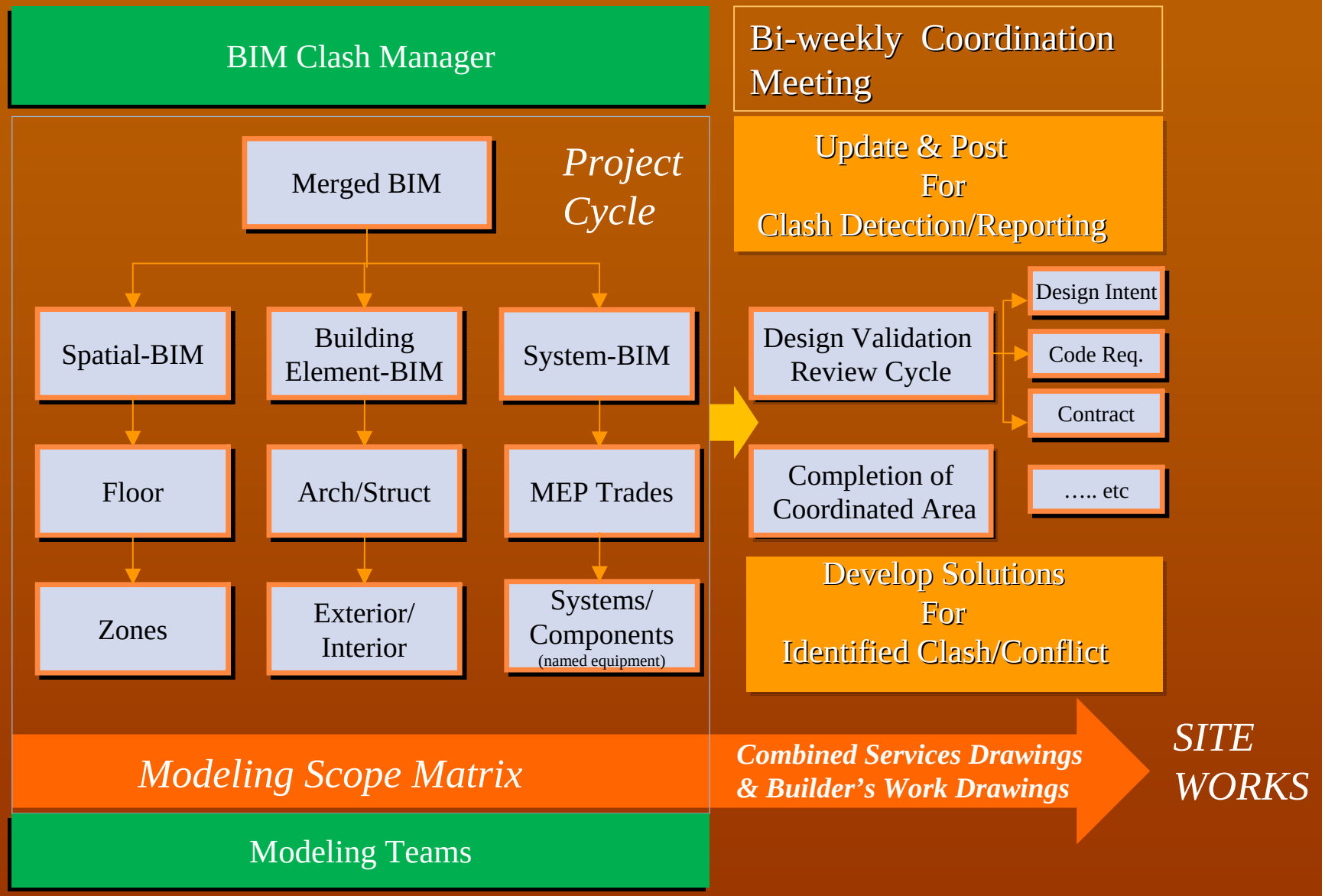


Procurement



Facilities Management

BIM Trade Collaboration Workflow

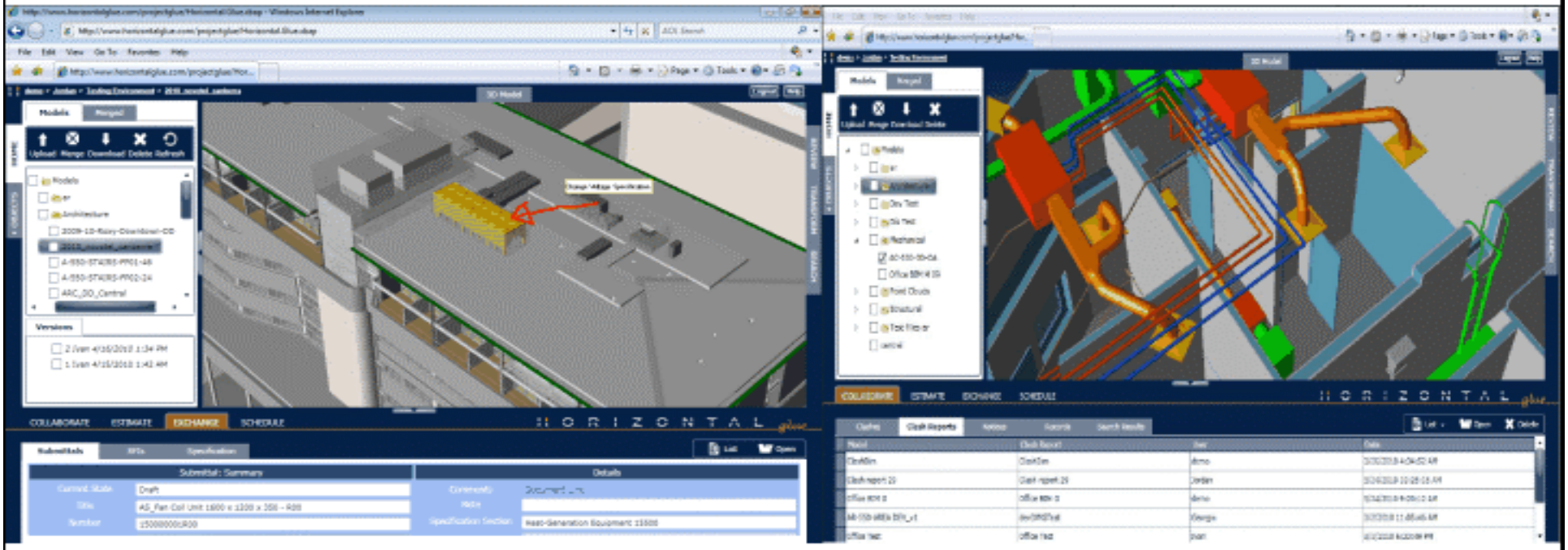


Web Based Collaboration Platform

Bringing it all together

Integrate object attribute information with project/facilities management

All users, projects and models can be managed through a web browser



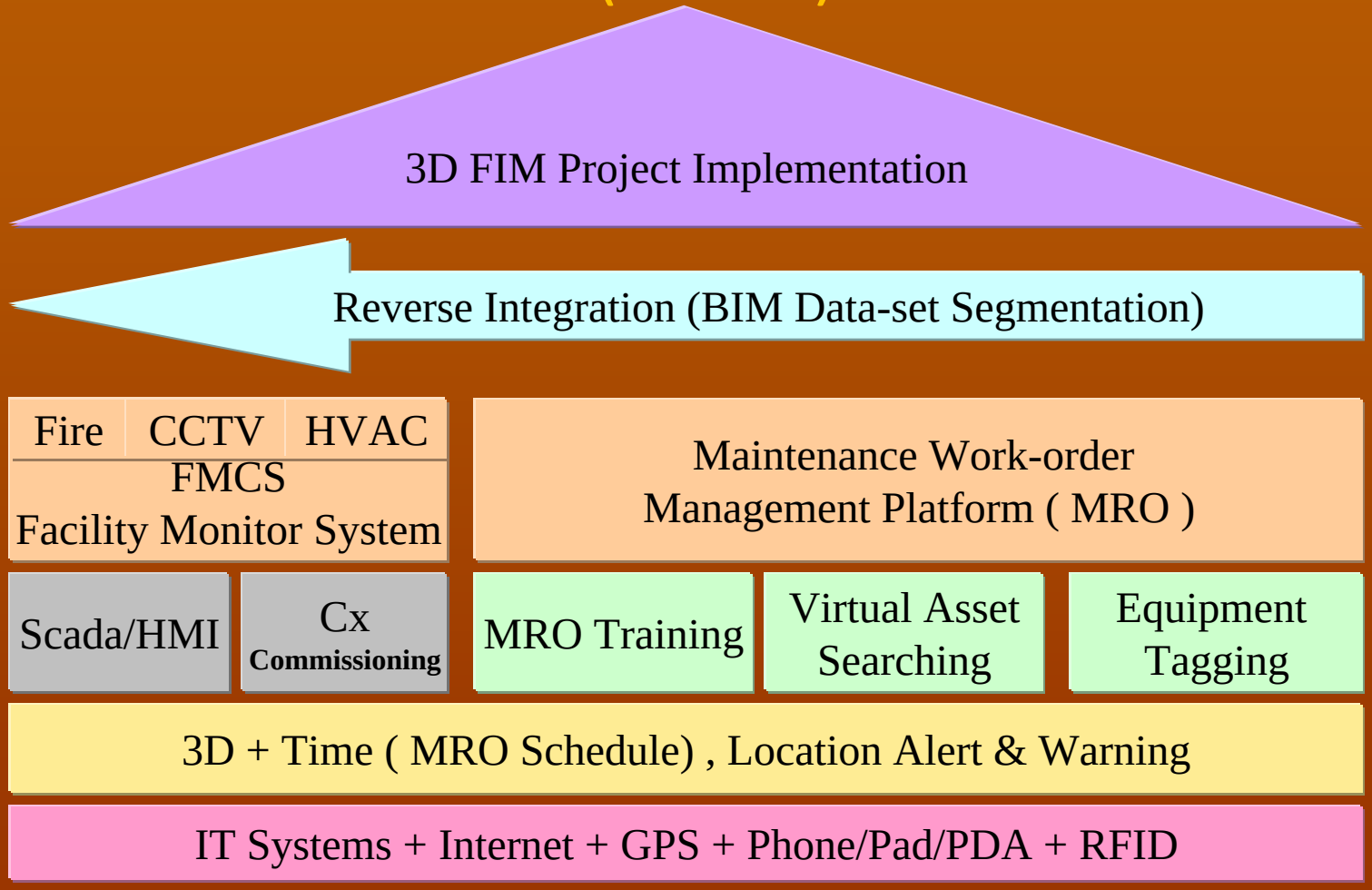
O: Operation Data

Delivery Team

Information Integration

3D FIM Framework

Maintenance , Repair & Operation (MRO)



BIM –LEVEL OF DETAILS

BIM applications in a typical sequence order for implementation in Project

= level 1

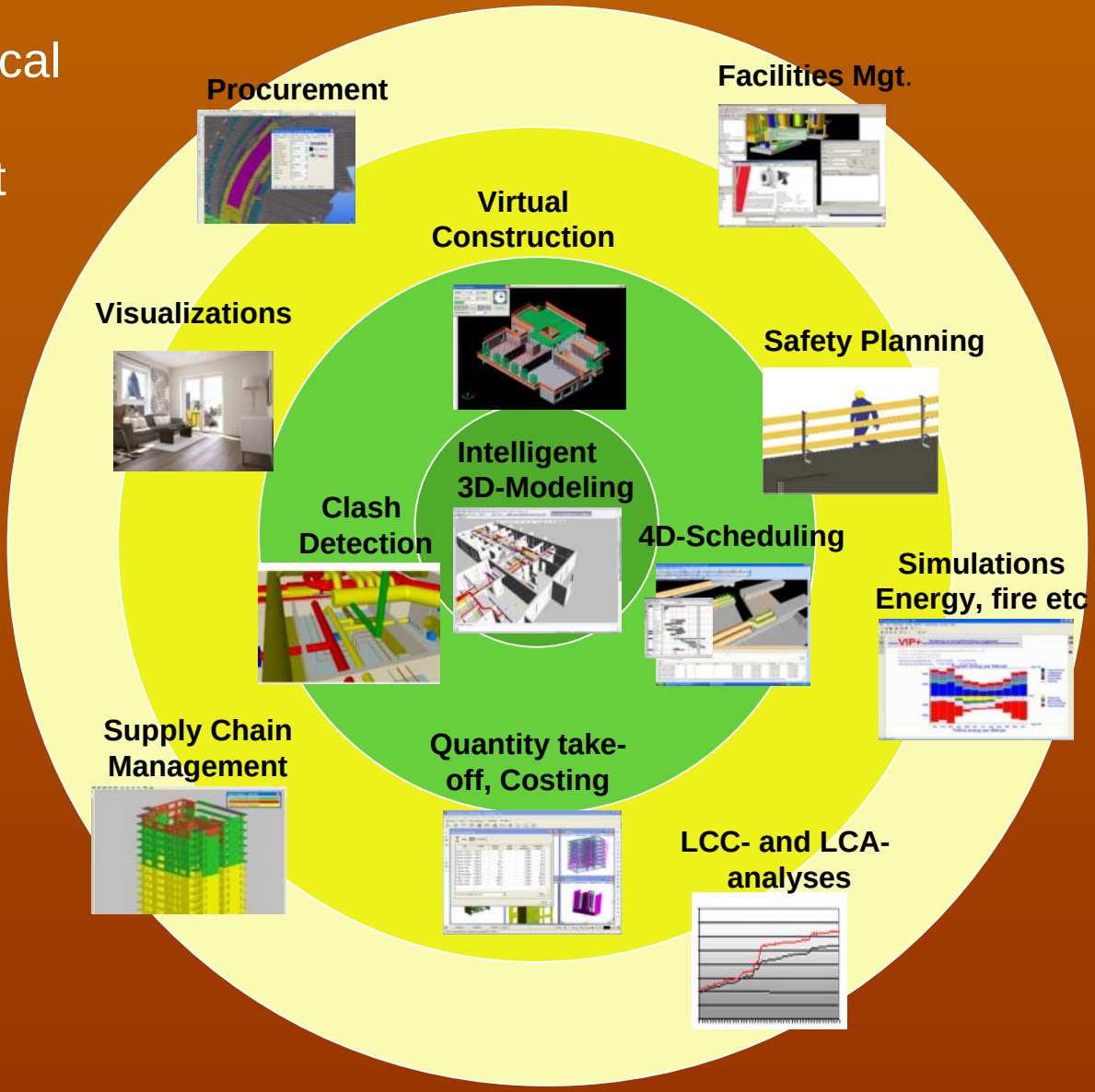
= level 2

= level 3

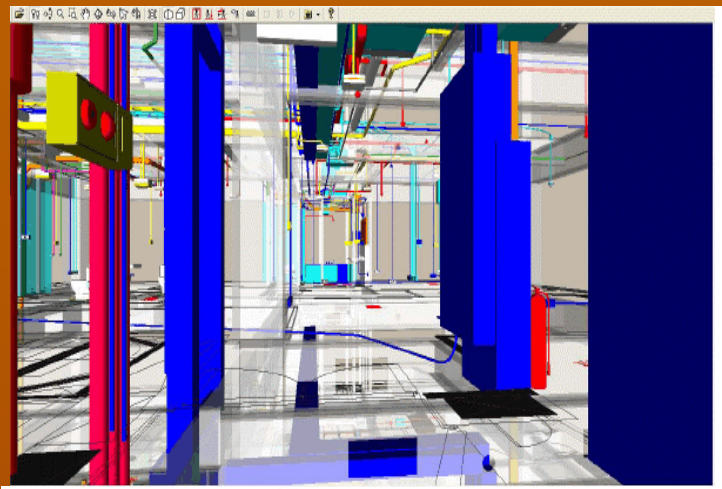
= level 4

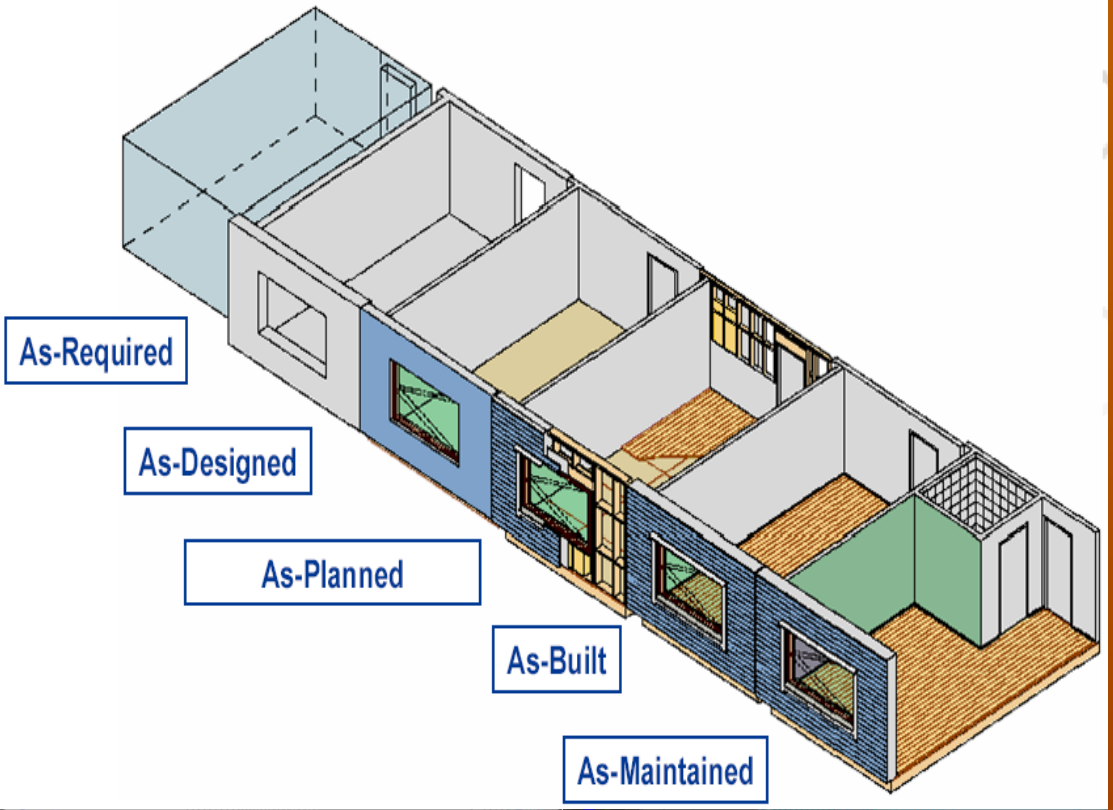
= level 5

BIM LOD Requirements



Model evolution

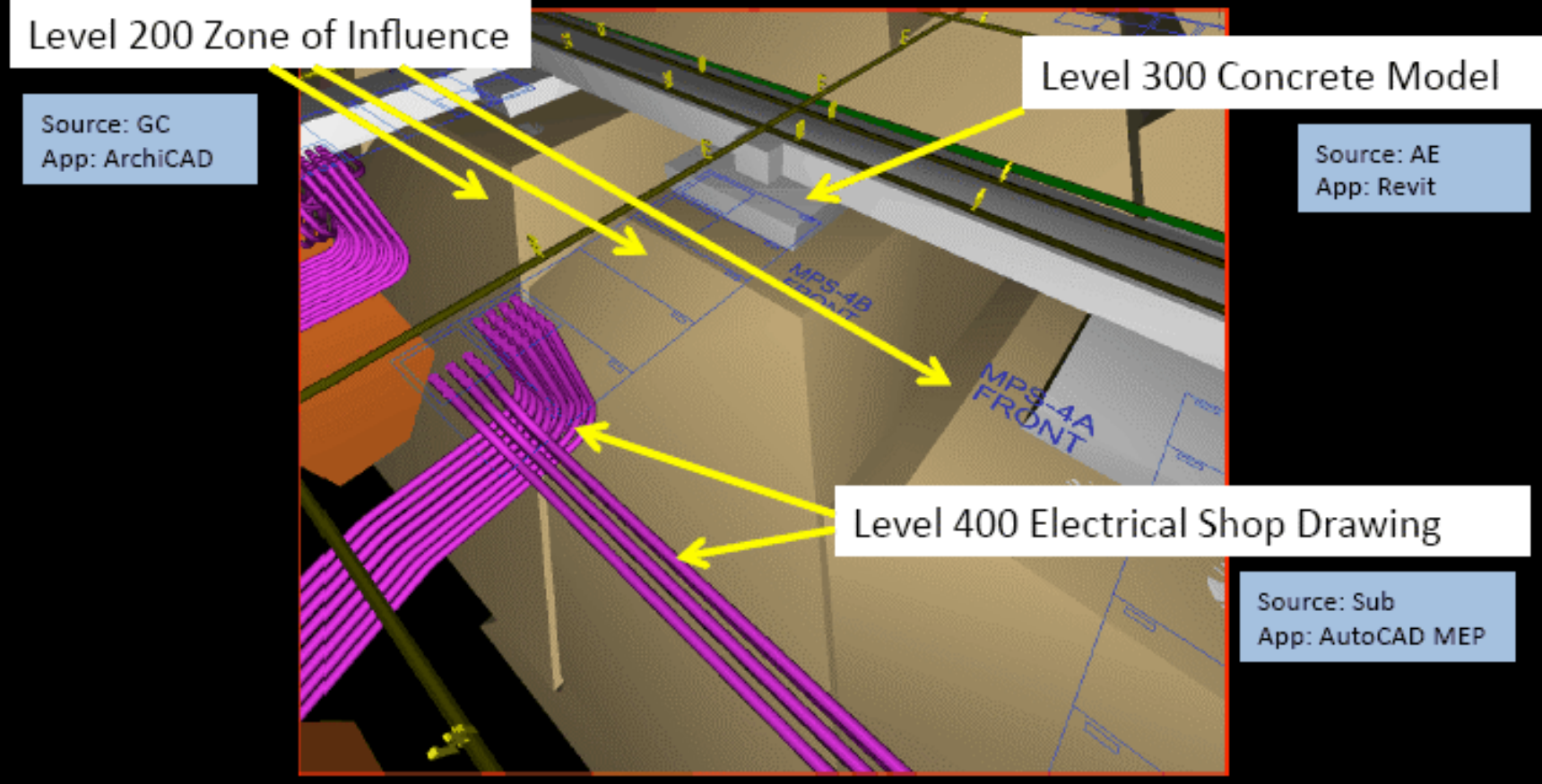




BIM Level Of Detail 100~500

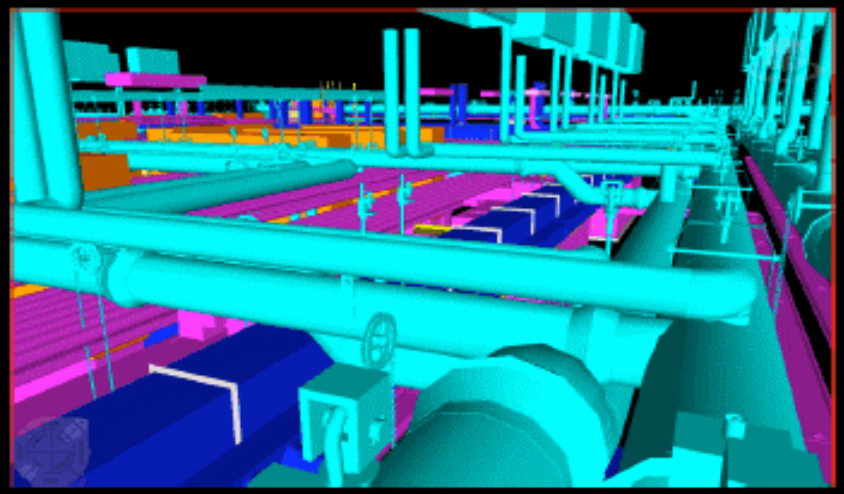
Summary of Levels, Apps, Composite Construction Tools

(Hybrid of Level 200, 300 and 400 Models)

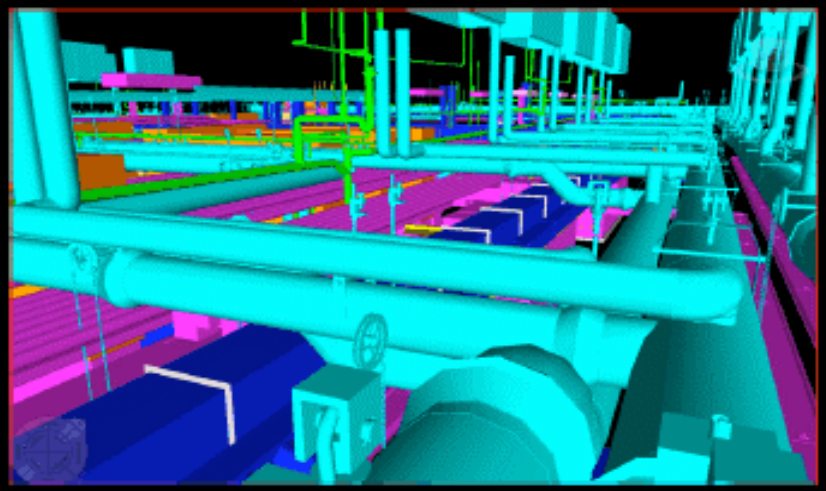


Views: Access Zones, Plumbing, Fire Sprinklers (Level 400)

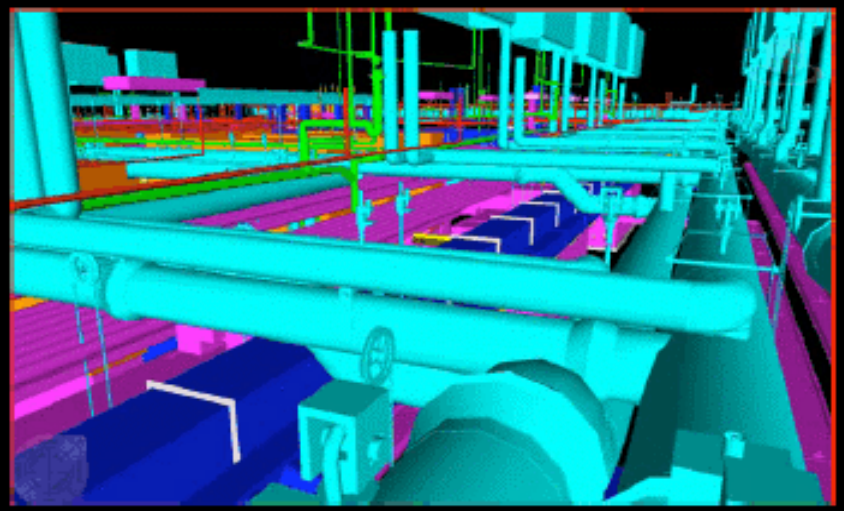
Access Zones



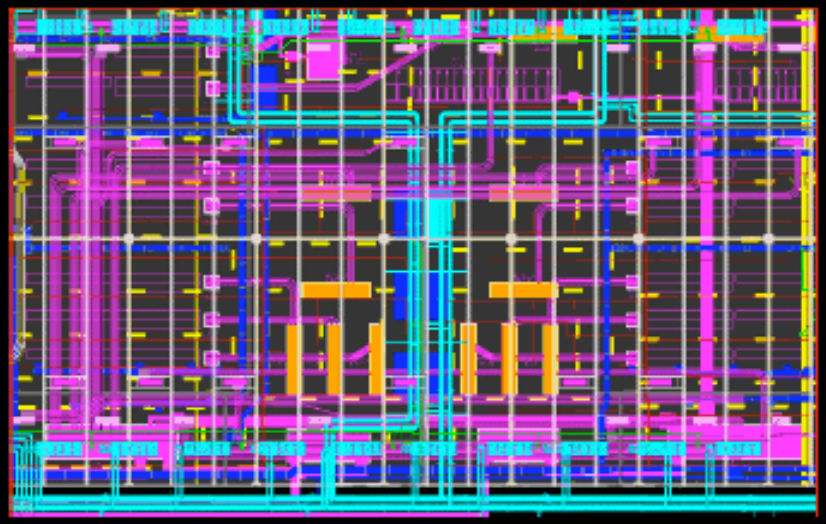
Plumbing



Fire Sprinklers



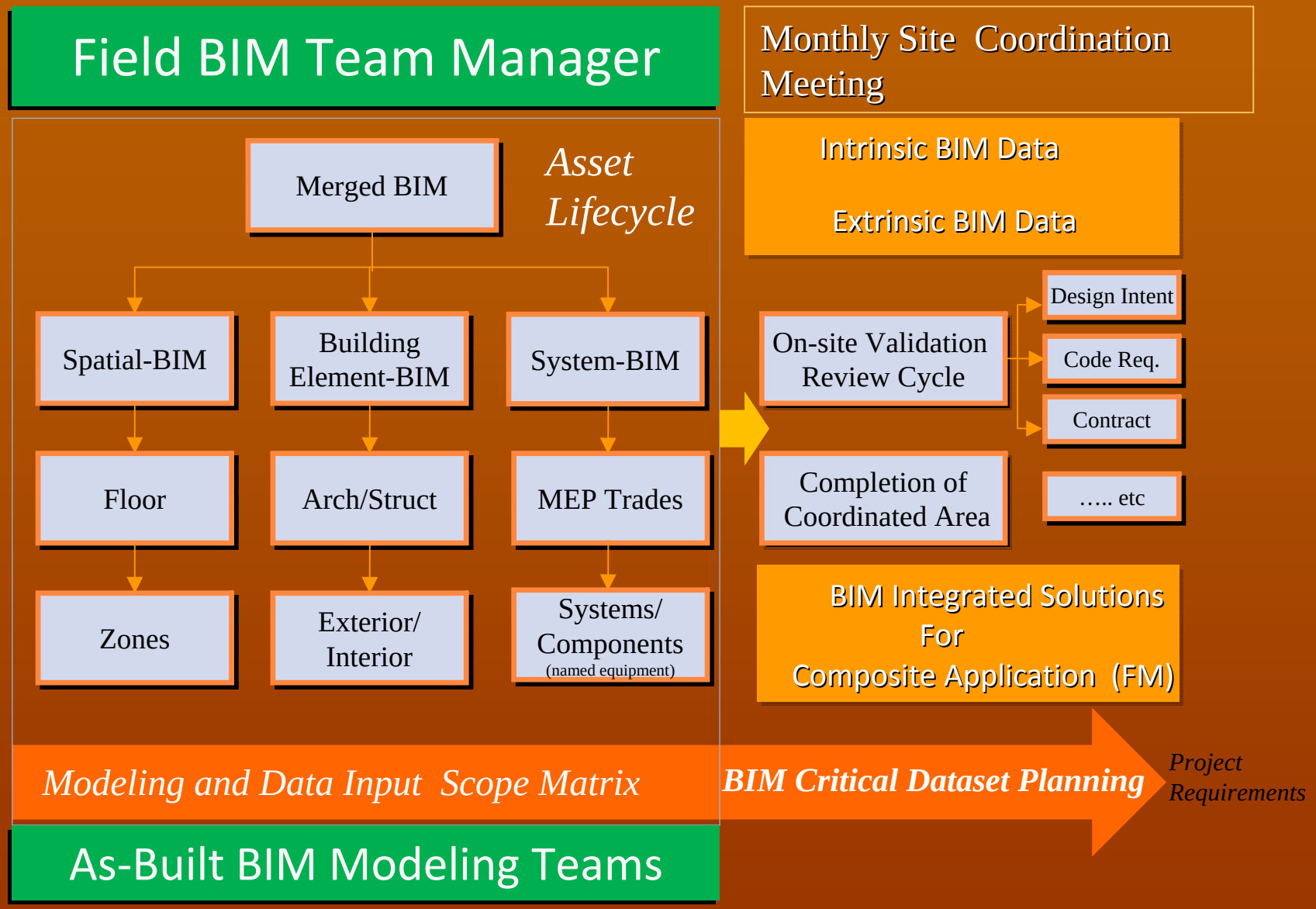
Composite Area 1 Floor Level 1



As-Built BIM Team Organization

- The flowchart shows the team role in adoption of As-built BIM To FM

As-built BIM Delivery Team



As-built BIM Field Checking

BIM and Intrinsic Data

British Standards

- "Library objects for architecture, engineering and construction " **BS8541-2:2011**
  - Part 2: Recommended 2D symbols of building

data

- "Library objects for architecture, engineering and construction " **BS8541-1,3,4:2012**
  - Part 1: identification and grouping
  - Part 3: shape and measurement
  - Part 4: specification and simulation

process

- "Collaborative production of architectural, engineering and construction information. " **BS 1192:2007**
  - How contractual interactions can be documented.
  - Legally complete.
  - Integrates with workflow management
- "Collaborative production of architectural, engineering and construction information. "

process

- **CAPEX BS 1192-Part 2:2012**
  - Design and construction
  - Date pre-requisites for specific information exchanges
  - Data expectations after specific information exchanges

data

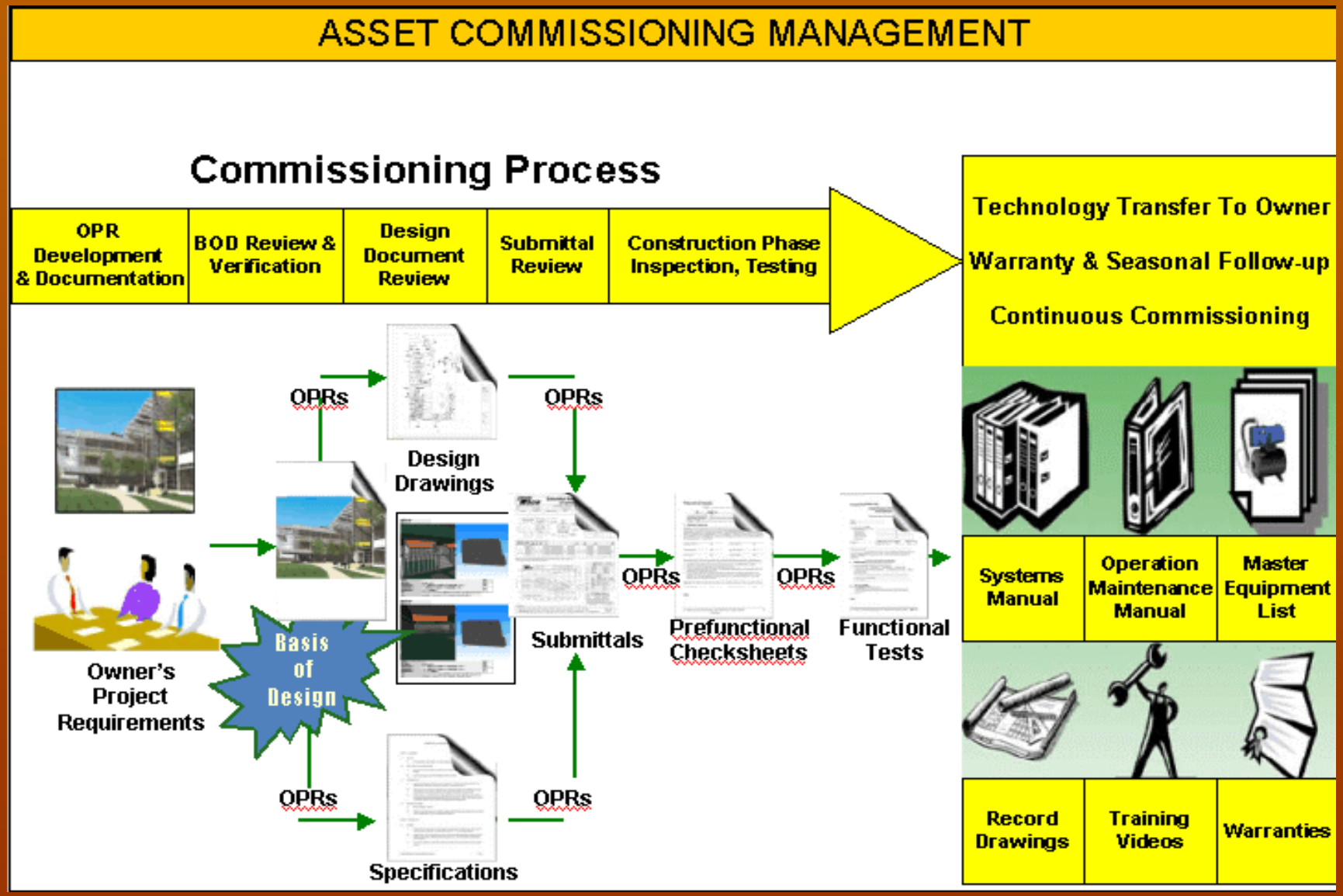
- **OPEX BS 1192-Part 3:2012**
  - Handover and O&M
  - Data expectations.

BIM and Extrinsic Data

TABLE: TYPICAL BUILDING INFORMATION MODELING DATA EXTRINSIC TO 3D MODEL COLLECTED AND DEVELOPED DURING DESIGN AND CONSTRUCTION

	Suitable Software Applications	
Typical Processes, Data, & Documents	*Project Management (e.g., TurnerTalk, CxMS, other)*	*Document Management - a virtual filing cabinet- (e.g., SharePoint)*
Commissioning	Cx data collection system	Cx report
Project Contact Information	X	
Contracts (trade contracts)	contract data change order data	signed documents, modifications
Controls Info and Sequence of Operation		design intent in contract docs
Cost / Budget / Payment progress	budget reports payment progress reports	Certified pay applications
Engineering Guides	manage / track	detailed reference docs
Equipment Schedules	manage / track	detailed reference docs
Fixture Schedules	manage / track	detailed reference docs
Color and Pattern Selections	manage / track	detailed reference docs
Installer Information	manage / track	detailed reference docs
Manufacturer Information	manage / track	detailed reference docs
Operations and Maintenance Manuals	manage / track	detailed reference docs
Preventative Maintenance Procedures	manage / track	detailed reference docs
Product Information	manage / track	detailed reference docs
Shop Drawings	manage / track	detailed reference docs
Spare Parts Information	manage / track	detailed reference docs
Specifications		detailed reference docs
Supplier Information	manage / track	detailed reference docs
Training Documentation and Materials	manage / track	video and other media
Test and Balance Reports	manage / track	detailed reference docs
Warranties	manage / track	detailed reference docs
Warranty Service (post construction)	X	

BIM and Commissioning (Cx)



U:Ubiquitous

Infrastructure Demand

BIM For Operations/Facility Management

Owner's Vision:

Interactive As-Built 3D Building Model linked to Building Management System & Computerized Maintenance Management System

Operation-BIM Demand Cross-Platform Approach

On Site

Remote (Mobile)

Enterprise

Energy Management

Climate Control

Energy+Comfort

Inventory

Space Planning

Assets

Access Control

People

Work Orders

Network Management

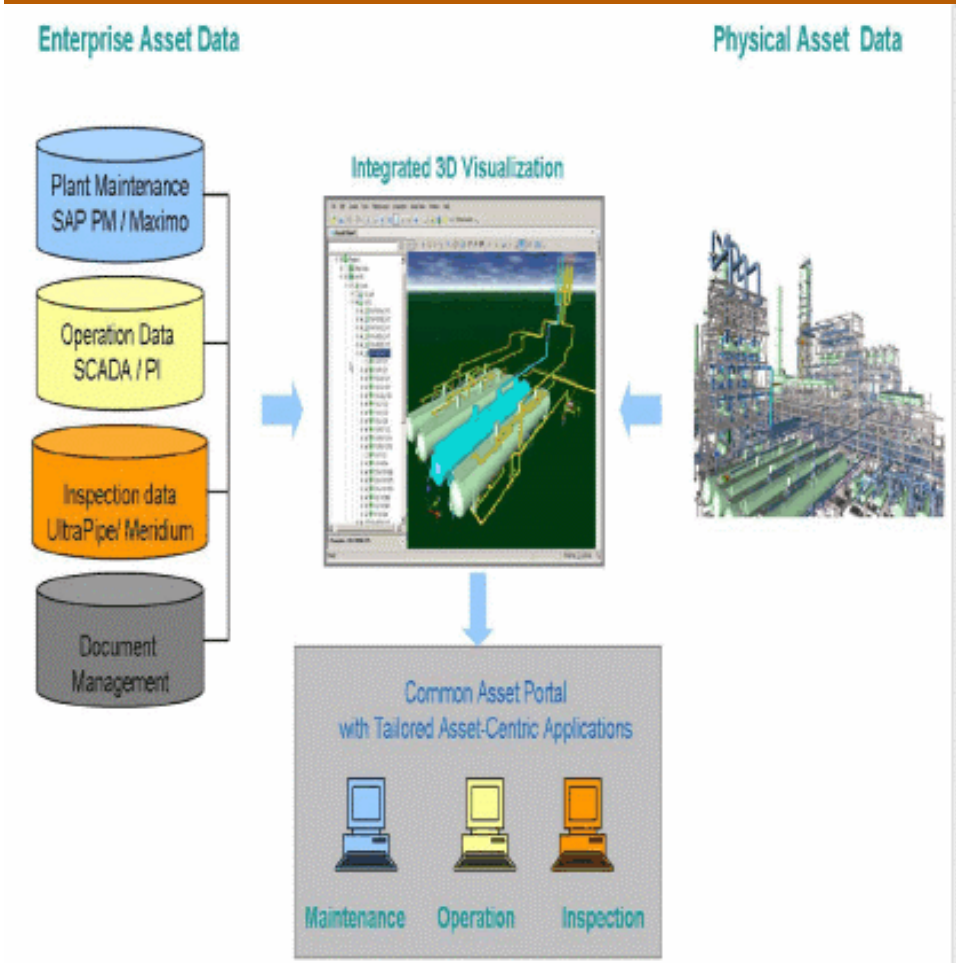
Security

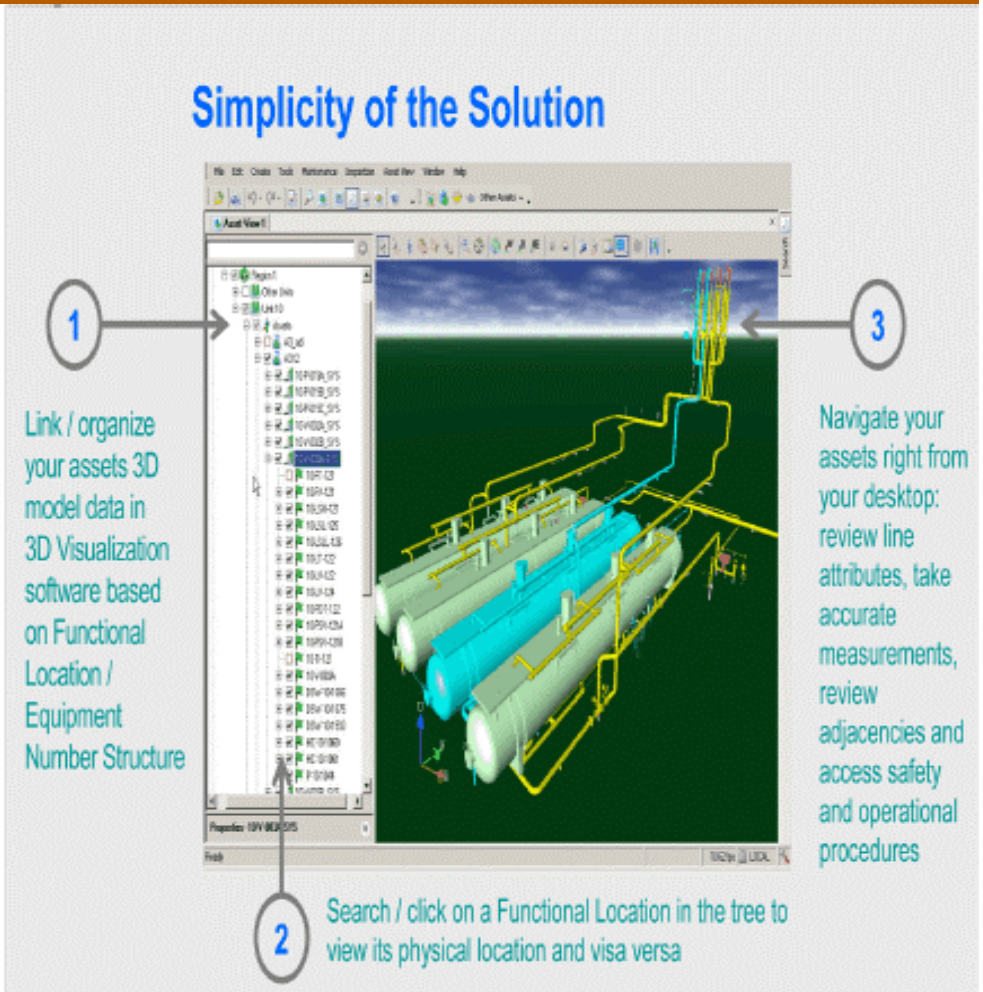
Servers

IT

We Need To Bring Operation-BIM To Site

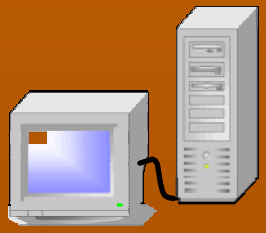
Owner's Vision : Operation-BIM + Scada + CMMS





Typical CMMS Modules

HELP DESK
- phone
- fax
- internet
- e-mail



SITES
BUILDINGS
LOCATIONS
ASSETS
- installations
- telephones
- furniture
- etc, etc

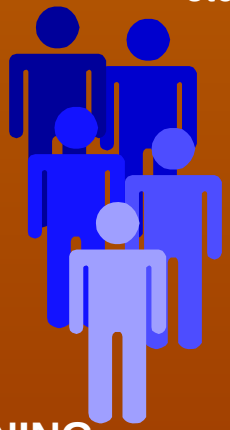
CONTRACT MANAGEMENT
(SLA's, costs, conditions etc)

PPM

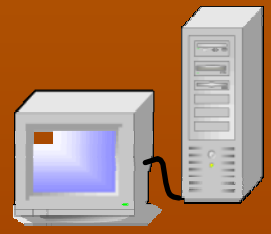
TECHNICAL & INFRASTRUCTURAL

ROOM BOOKING

RESOURCES
- site staff
- mobile staff
- client staff
- sub suppliers

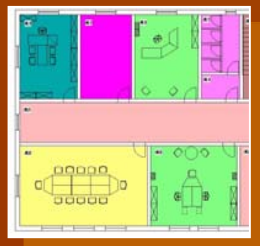


BMS's

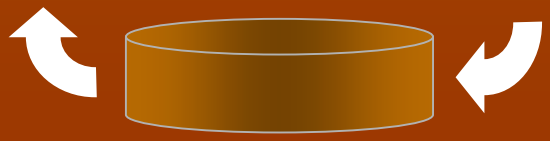


PROJECT MANAGEMENT

SPACE PLANNING



FINANCIAL SYSTEMS



RE-ENGINEERING
through information and knowledge

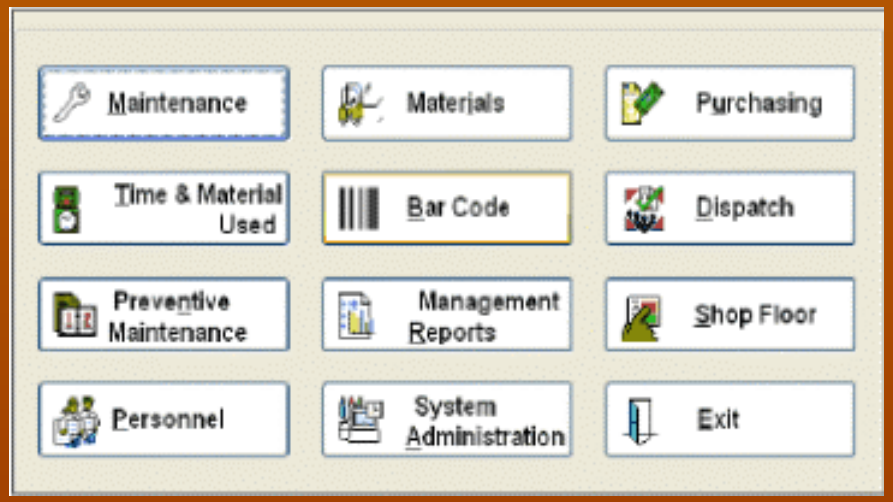
Typical CMMS System Functions

Materials
Spare Parts
Management

Dispatch
Work Order
Queue

Purchasing
Controls
Expenditure

Maintenance
Create Work
Orders, PM'S
Time Cards



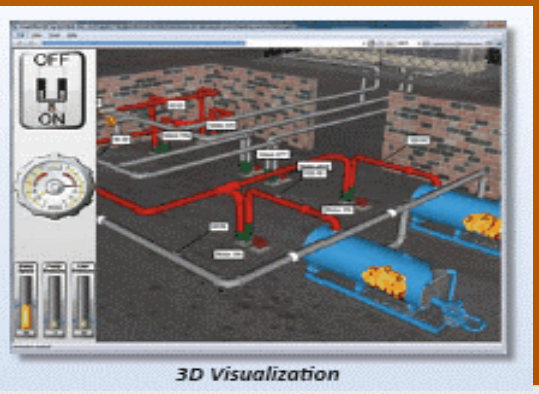
Personnel
Ability to
Record labour
Costs &
Training data

Administration
Customizes
Maintenance
System

Reporting
Fault trends
Cause Analysis
Downtime

WO Priority
Backlog
Management

Owner's Vision : Operation-BIM + Scada + CMMS



OperationBIM	Web3D/Mobile3D
1. Identify Assets (referred to as node "A")	Building Elements
2. Identify Performance Requirements (refer to as node "R")	Building Components
3. Assess Performance (refer to as node "P")	Functional Requirement
4. Plan Maintenance (refer to as node "M")	Functional Requirement Type
5. Manage Maintenance Operations (refer to as node "O")	Condition
	Inspection Order
	Inspection Task
	Inspection Test
	Inspection Result
	MRR task
	MRR Task Type
	Risk Schedule
	Resource Type
	Condition Type

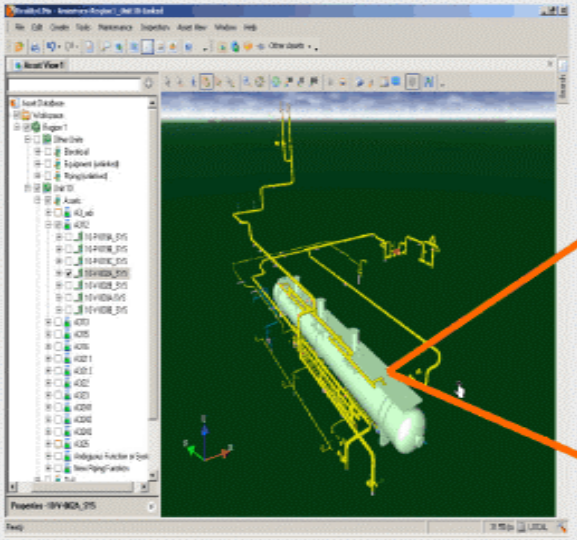
3D LAYERS

Building ID	Complex ID	Building Summary	Search
Environment	Electrical	Exterior Circulation	Exterior Closure
Roofing	Site	Interior Construction	Structural
Fire Suppression	HVAC	Drainage	Plumbing
Component	Air Handling Unit		System Air Side

Section / Equipment / Component Type / Year / Age / Warranty

Dynamic.Form···Dynamic.Indexing

Access All Related Asset Documents & Data

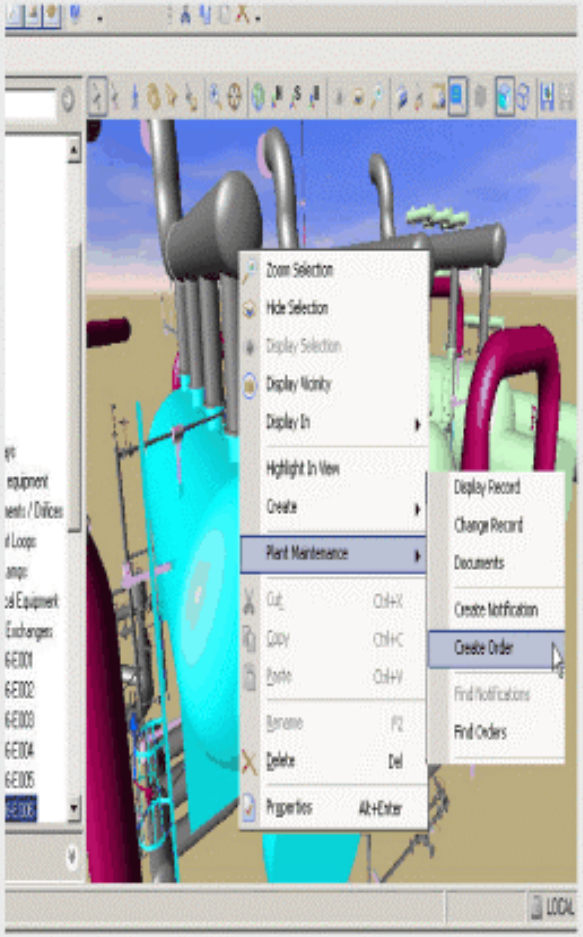


- Improved time efficiency in locating all necessary information to a particular task.

Right click on a piece of equipment and review all available documents, vendor data, BoM's, spare parts, etc.

Owner's Vision : Operation-BIM + Scada + CMMS

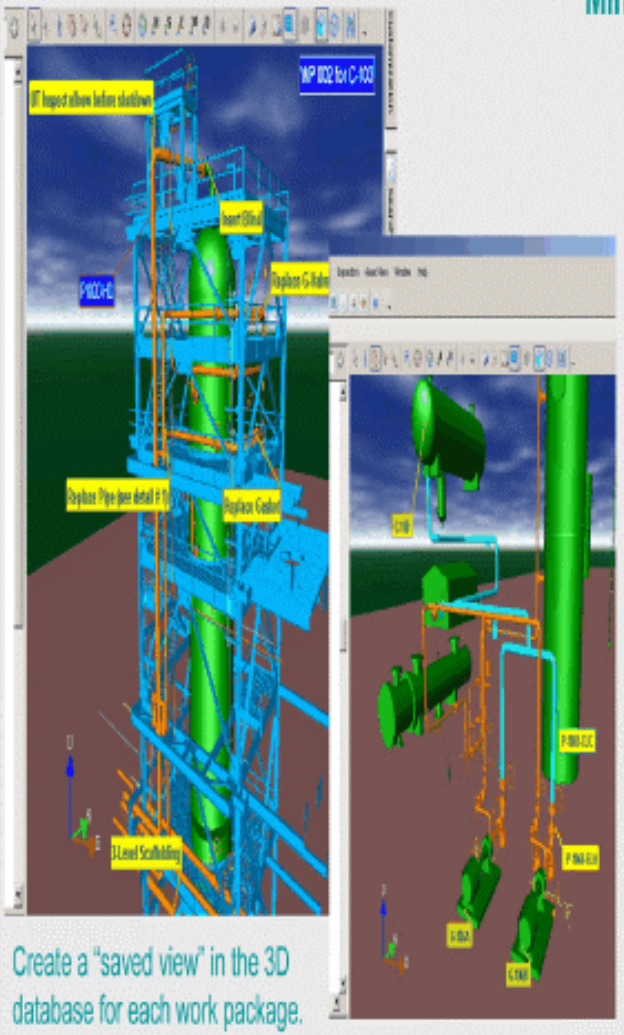
Create / View Work Orders & Notifications



Right Click on the asset in 3D or in the tree to create, or review w/o's and notifications

- Use 3D objects to physically locate assets. Identification of assets from their physical location. Location of objects in the proximity of a known object. Access/modify data within 3D Asset Model for any these objects once they are located.
- Create, modify and view all work orders and notifications by clicking on the asset's 3D object.
- Simplified work order entry will make data less susceptible to errors caused by casual users.
- Encourage non-maintenance personnel (i.e. operation) to create w/o's and notifications more intuitively.

Shutdown / Turn Around Applications

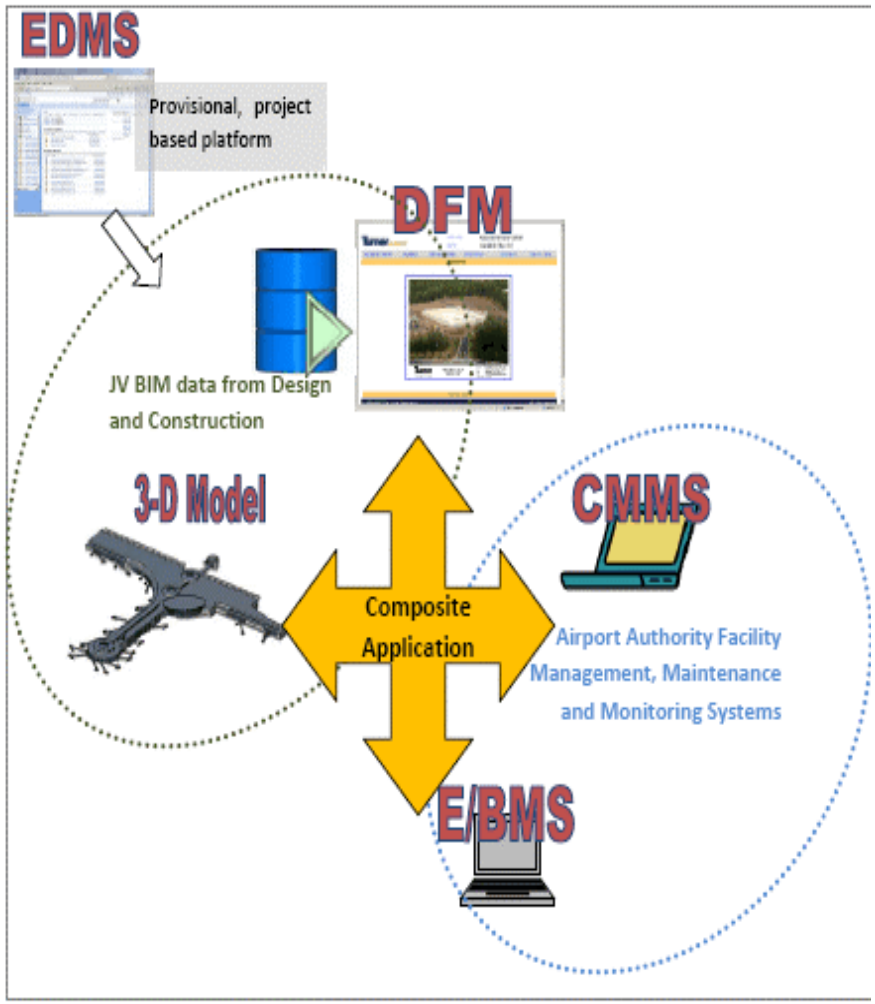


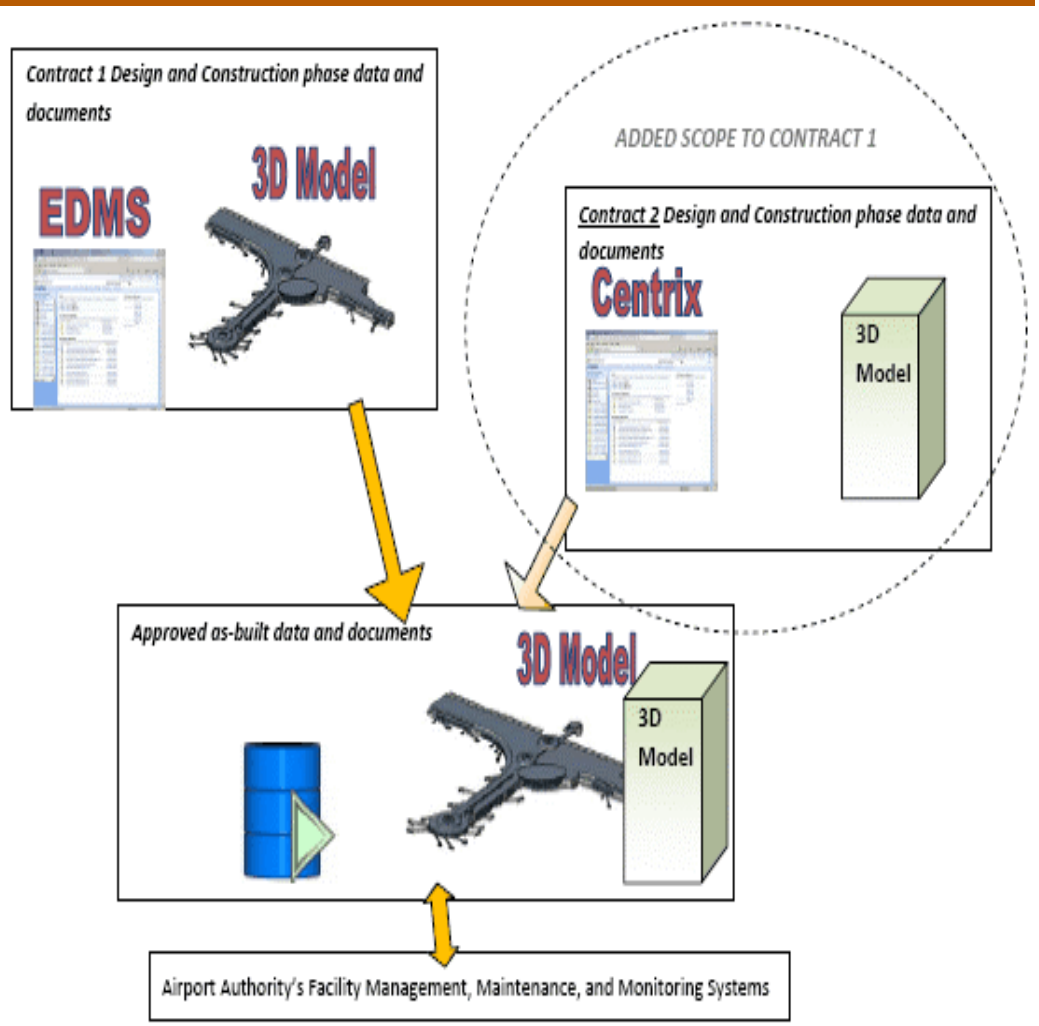
Create a "saved view" in the 3D database for each work package.

Minimize Shut-Down Duration

- Define a clear work scope for each work package with a corresponding w/o's
- Review scope internally - i.e. HAZOP & safety review with operation, maintenance.
- Produce drawings for contractors / work permits.
- Review and familiarize contractors with assets.
- Optimize & review sequence of events by: schedule, contractor, geographical area, requirements, constructability studies
- Shut-down/start-up sequencing.
- Hydrotest packages - boundary definition and blind locations.

- 3D Model , CMMS Plus Digital Facilities Manual integrate as composite application for Facility Management , Maintenance and Monitoring *US SAN DIEGO*





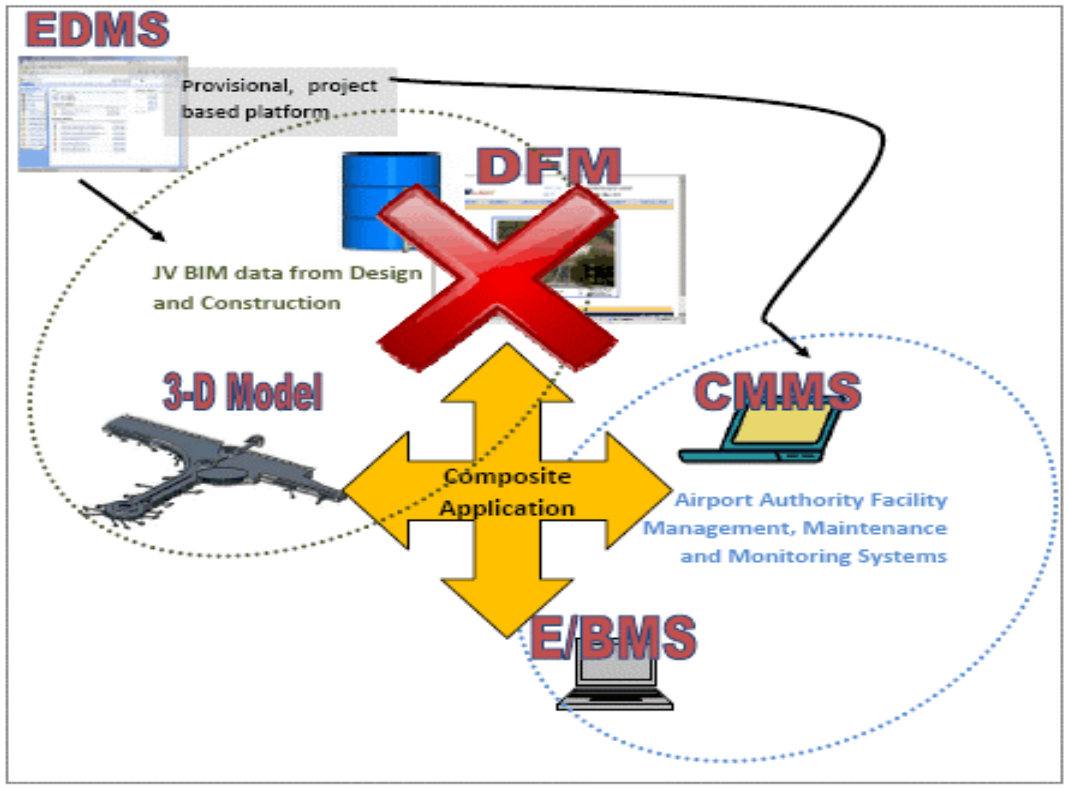
- 3D Model and CMMS act as the source of all current building data and documentation (without Digital Facilities Manual) for Facility Management, Maintenance and Monitoring

US SAN DIEGO

CHAPTER 3 | ALTERNATIVE SCENARIO - DELETE DIGITAL FACILITIES MANUAL

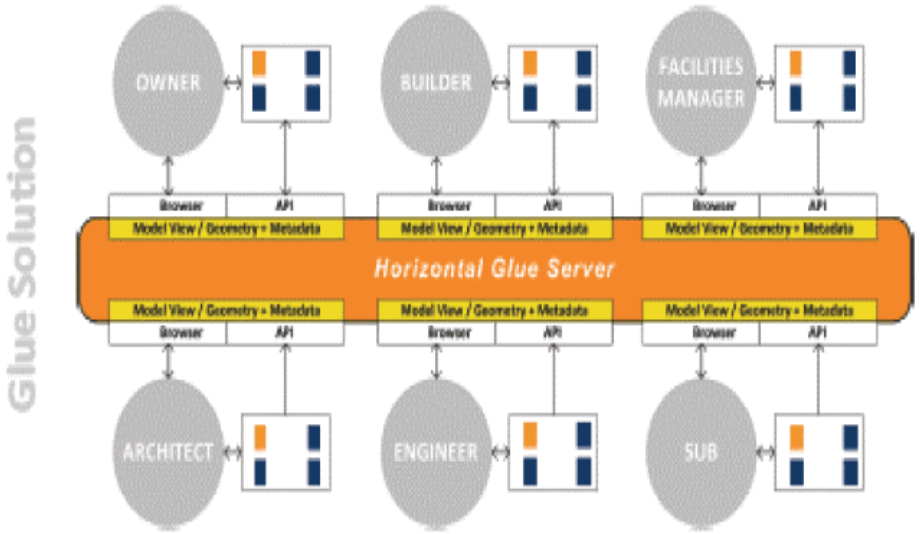
1. BACKGROUND

In a meeting on 21 July 2009 The Airport Authority requested review of an alternative solution that would delete the Digital Facilities Manual SQL Server database as a final deliverable. The CMMS and 3D model would act as the source of all current building data and documentation, with the E/BMS providing a source to live data.



Web Based Digital Facilities Platform

Web based Building Information Management



- Platform for BIM exchange,guaranteed fidelity of geometry and metadata.
- Integration between BIM authoring tools and PM systems.
- Web-based streaming and 3G optimization for field support.
- Customized data delivery and reporting.
- Centralized project, model and user management.

Glue Platform: Web Service API

Browser Based Client | **Desktop Client** | **Tablet / Mobile Client**

HTTP / HTTPS Communications

Glue Web Service API

Security Service	User Service	Project Service	Model Service	Document Service	Record Service
This service is responsible for the security management of Glue user accounts	This service is used for the use and maintenance of Glue user information	This service is used to manage the Projects within the Glue platform	This service is used to manage the 3D models within the Glue platform	This service is used to manage Documents within the Glue platform	This service is used to access / manage Records (history entries) within the Glue platform

Access Control Layer
Determining client access (Auth Token or IP Address)
Signature Validation
Determine the proxy User for this transaction
Perform Rate Limiting if Necessary

API Adaptation Layer
API Version Handler
Mapping of Private Web Services to publicly released Glue Services API

Glue Private Web Services Interface

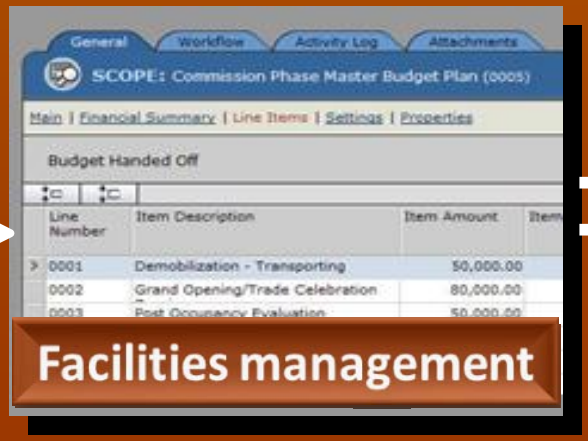
Horizontal Hosting Hardware Infrastructure

Database Server Farm | **Network Attached Storage**

Operation-BIM Demand Cross-Platform Approach

FACILITIES

Manufacturer Model > BIM > Facilities Management



Automate Work Orders

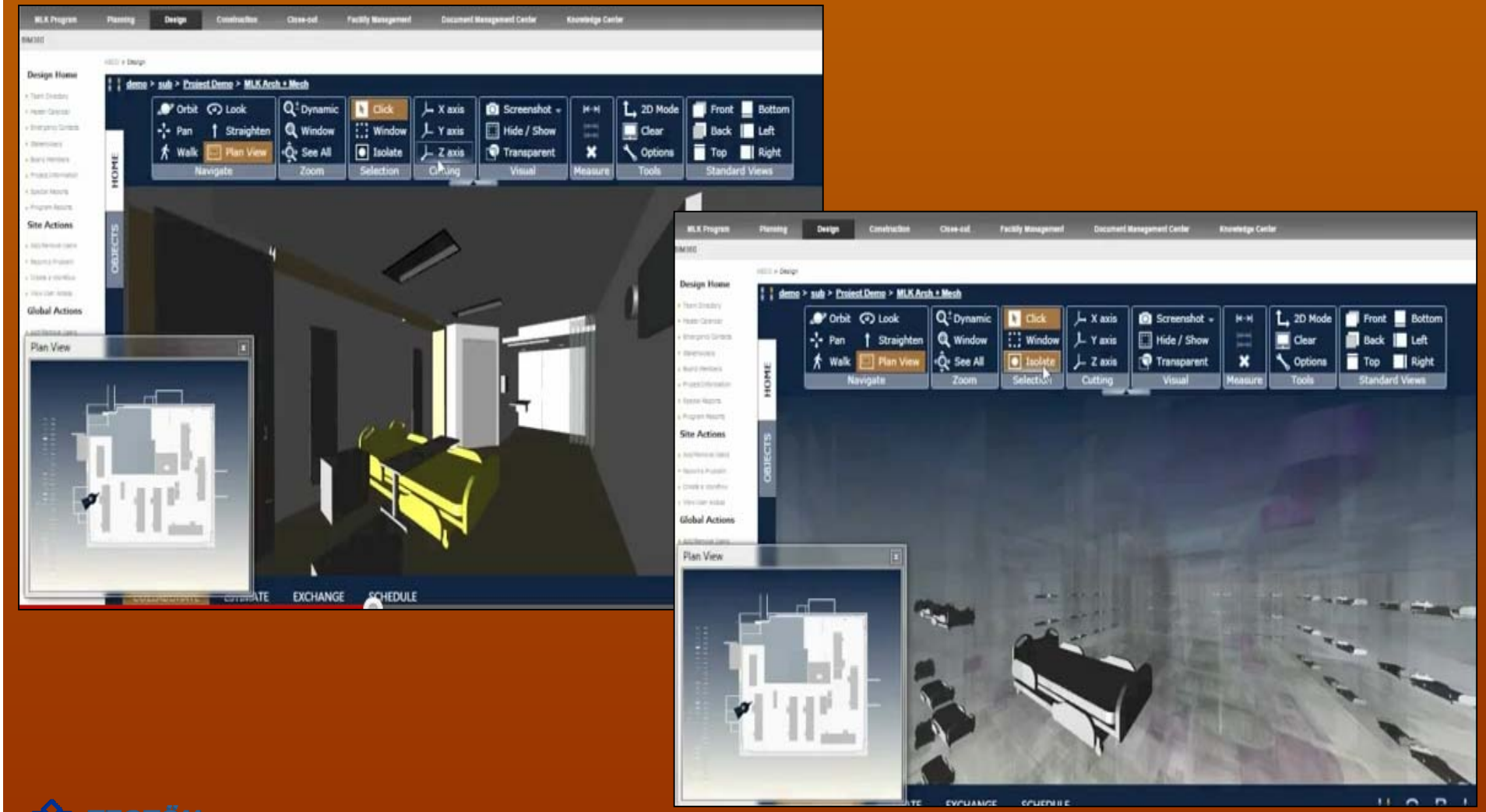
Visual Inspection

Operation-BIM Demand Cross-Platform Approach

BIM > Facilities Management > Identify System

Operation-BIM Demand Cross-Platform Approach

BIM > Facilities Management > Identify Component



Operation-BIM Demand Cross-Platform Approach

BIM Tools	Glue	NavisWorks	Revit
Time to launch app.	0:10	0:30	1:04
Time to load model	0:15	1:03	4:20
Time to open application + model	0:25	1:33	5:24
File Size	14 MB	29 MB	135MB
BIM Authoring	No	No	Yes
File Import/Export	10+	20+	5
Complexity	Low	Medium	High
Hardware Requirements	Minimal	Medium	High
BIM Access	Web	Desktop	Desktop

Operation-BIM Linking Field-Data

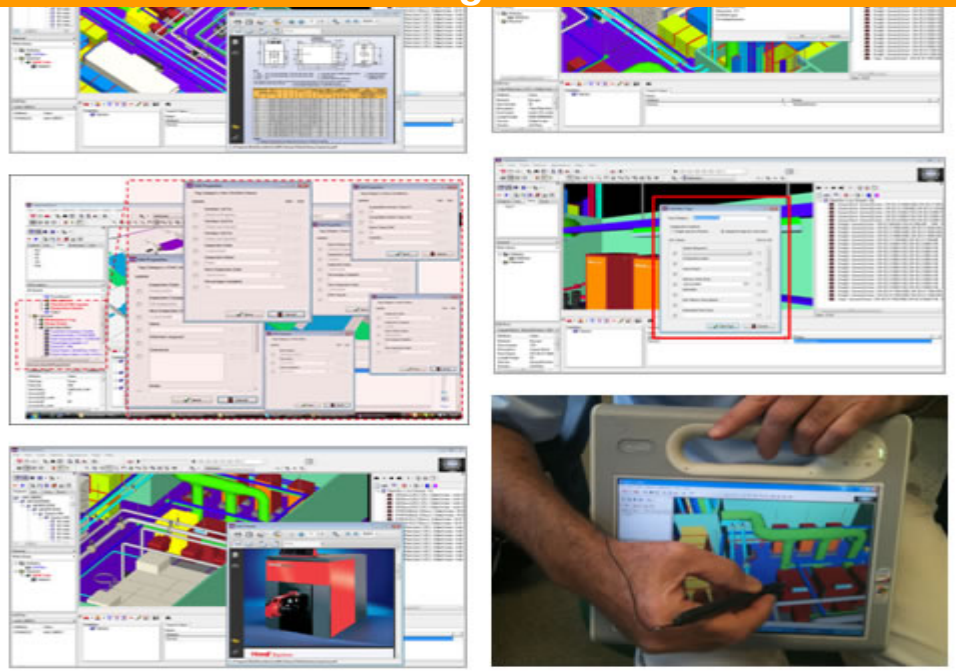
- Field-BIM ensure the mass of information collected during construction to be added to the Digital Model and eventually handed over to the operation team.

Most BIM applications are

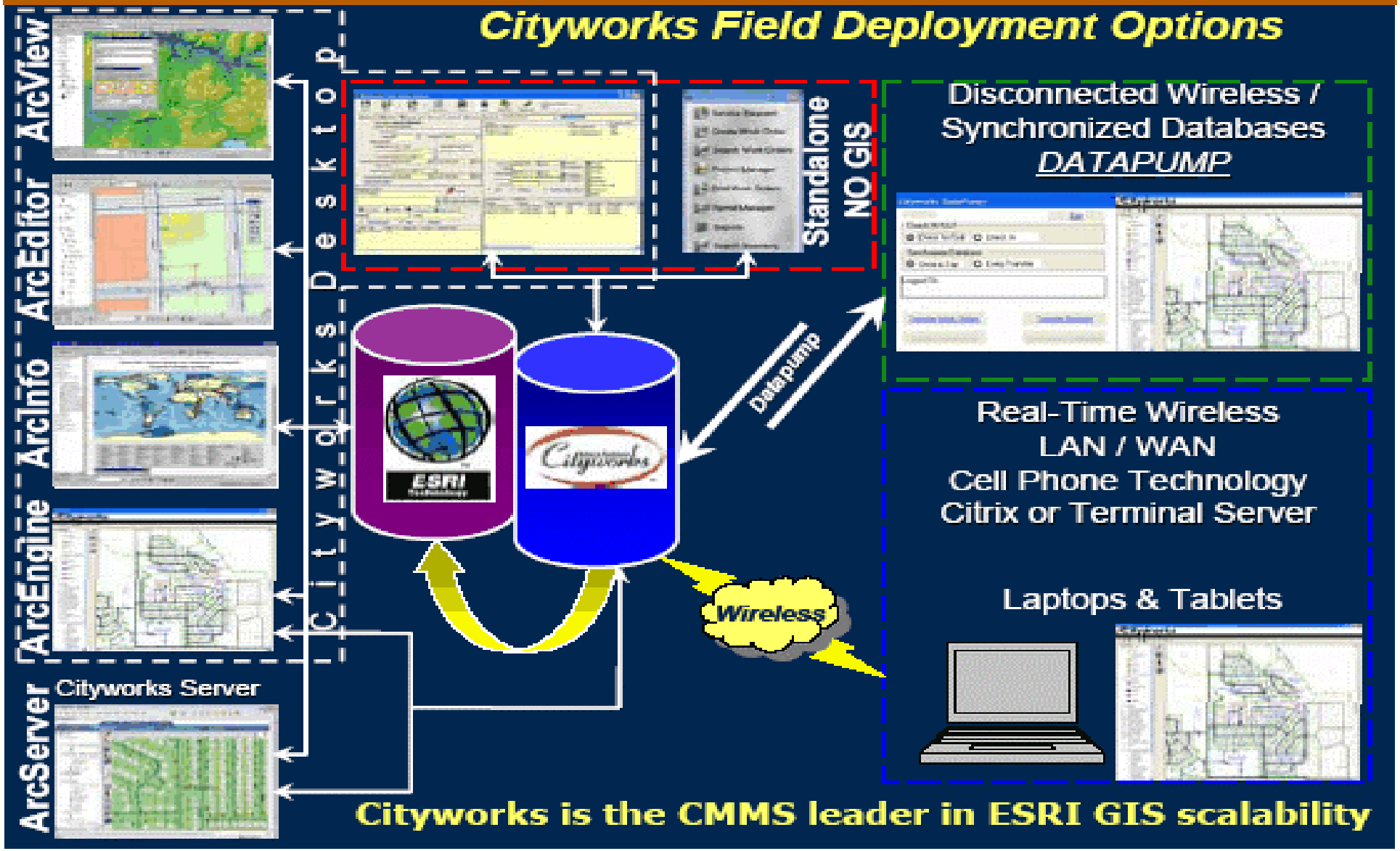
Developed for the Design Phase

Digital Building Portal is developed

For Construction and Asset Lifecycle Management

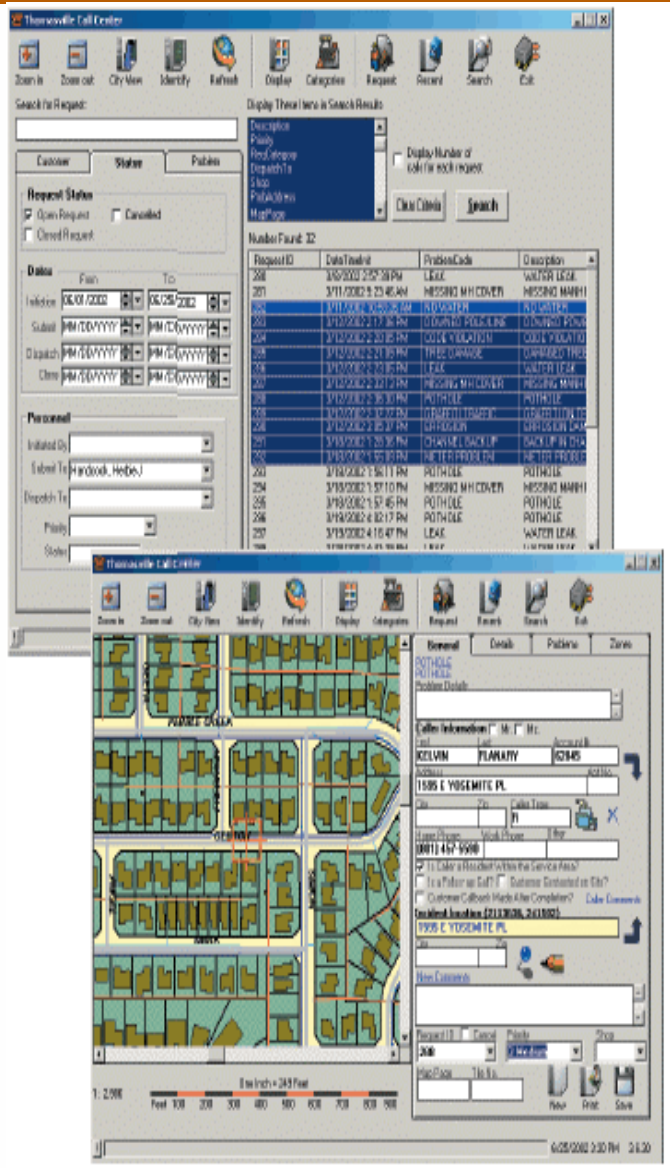


GIS Based CMMS System Design



GIS Based CMMS System Design

Cityworks GIS-Centric Approach



Cityworks Data Models

- Water
- Wastewater
- Storm Water
- Streets and Traffic
- Parks and Trees
- Electric
- Open Asset Engine-User Defined and Custom Models

Extensions

- Call Center
- Cityworks Wireless
- Data Pump
- GASB 34
- Storeroom

I: IMPLEMENT

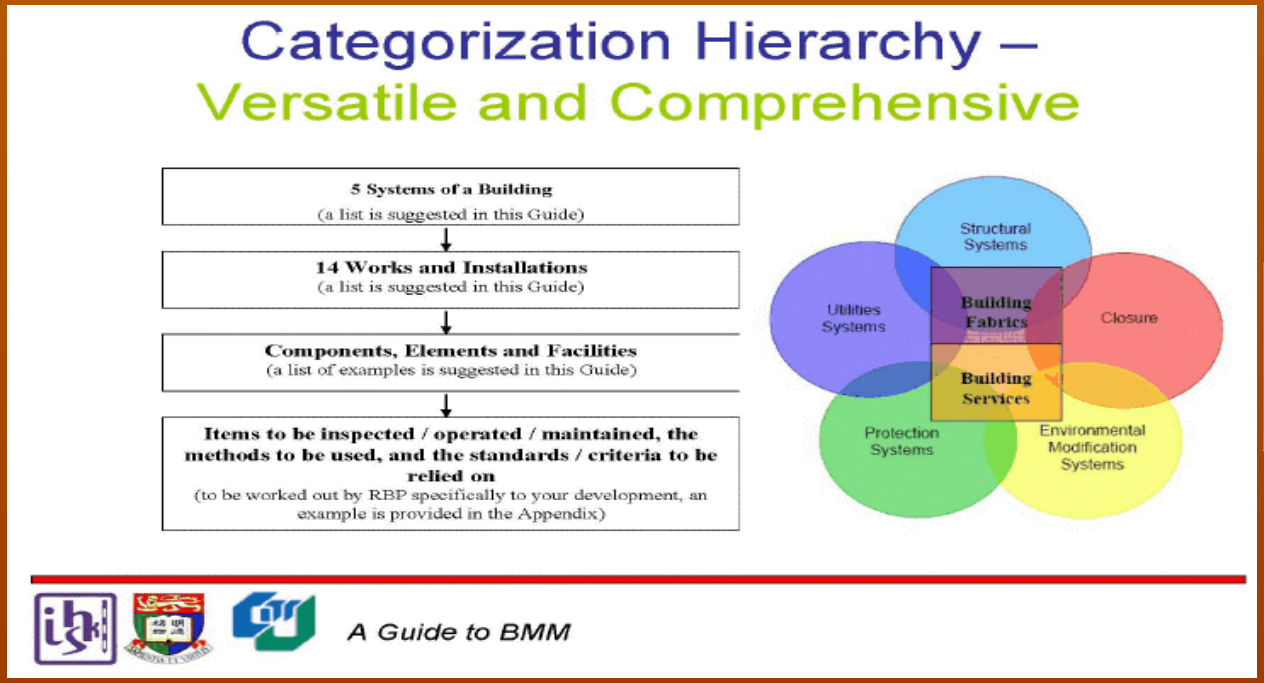
Information Integration

Facility Information Management

1. Operation Maintenance Manuals
2. As installed Drawings & 3D Model
3. Vendor & Manufacturers Data
4. Commissioning Data
5. Statutory Requirements
6. Insurance Requirements
7. Health & Safety considerations
8. Best Practice
9. Experience

BIM TO FIM PROCESSES

BIM to FIM Specification Development → Formed Team from Maintenance Specialist /Eng. → Statutory Req., Best Practices & Previous experience → Facility Commissioning Development



↓

CMMS/FIM Master Data

↓

Asset Structure Planning → FM Strategy Selection → Implementation plan / Composite Application → Review implementation / KPI's

Prepare Building Maintenance Manual

Reference : HKIS Manual / Building Department PNAP

Twelve

12

- Conveying
- Electrical
- Exterior Circulation
- Exterior Closure
- Fire Suppression
- HVAC
- Interior Construction
- Plumbing
- Roofing
- Site
- Specialties
- Structural

Segmentation Of As-built BIM

Assigning Data Fields To BIM Model Floor / Zone

Spatial Data

Project Data

Facility

Contact

Spatial Data

Floor

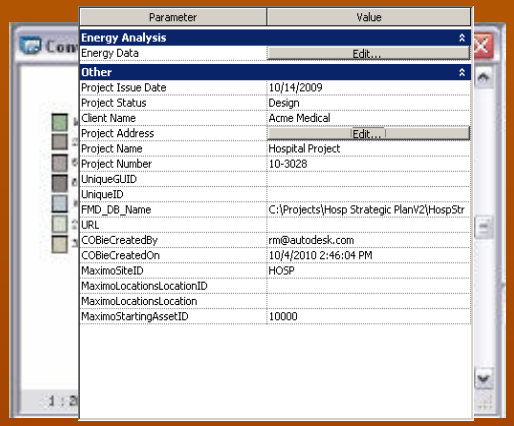
Space

Zone

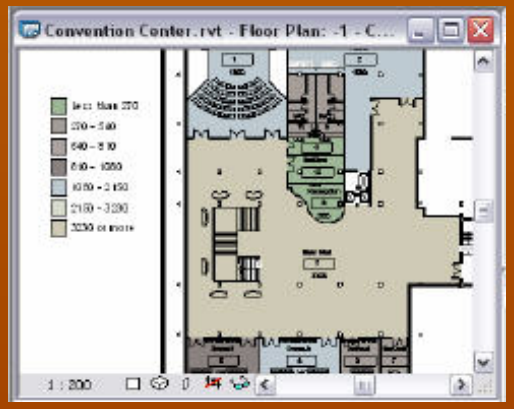
Building Components

Type

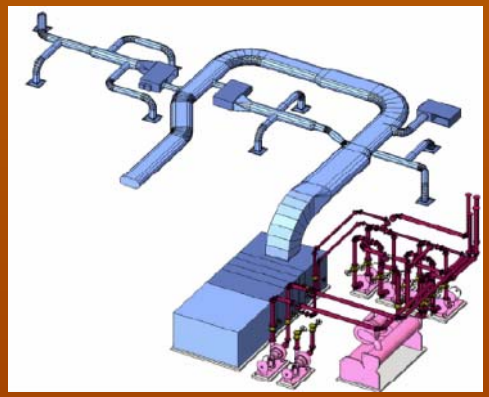
System, Component



Project Level Data- not model Components



Space/Room Components



3D Components

Developing Data + BIM Components

Create Asset Structure

Level 1 - Site	Level 2 - Service	Level 3- System	Level 4- Function	Level 5- Category

As-Built BIM For Quick-Fix

What is the required level of system availability

1. Service quality measure

What is the required level of reliability

Set appropriate response times with stakeholders

1. Critical Response time <10 minutes
2. Normal Response time <30 minutes
3. Temporary Resolution time <120 minutes
4. Actual Resolution time <48 hours

Establish System Criticality

Maintenance Strategy will be influenced by system criticality & the associated level of redundancy.

The system are broken down into 4 primary categories:

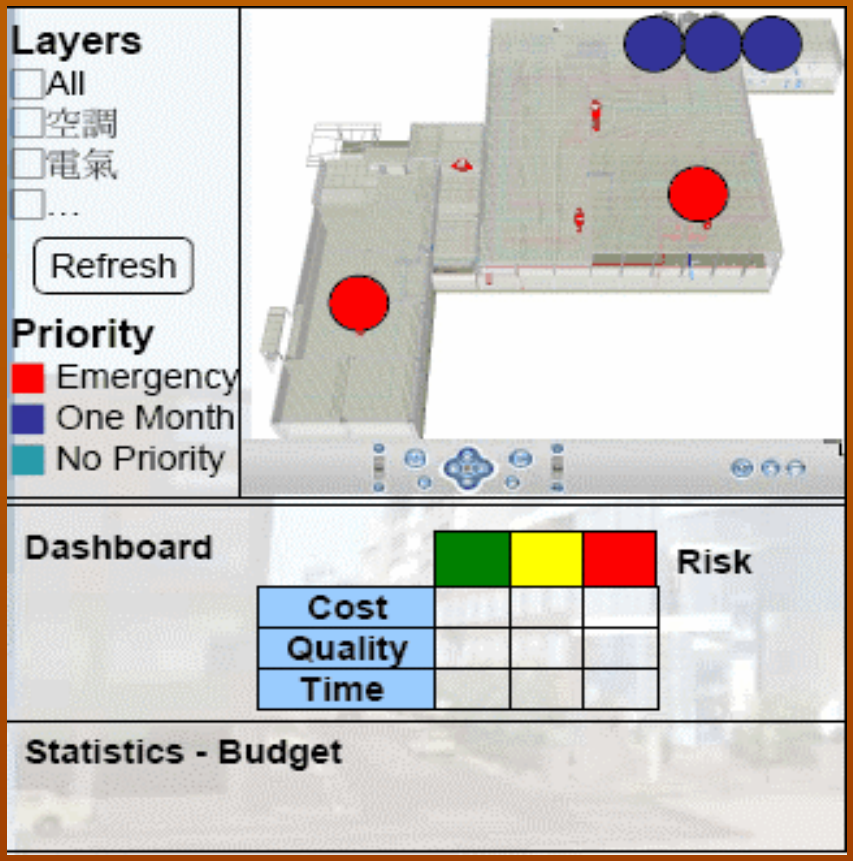
1.Life Safety

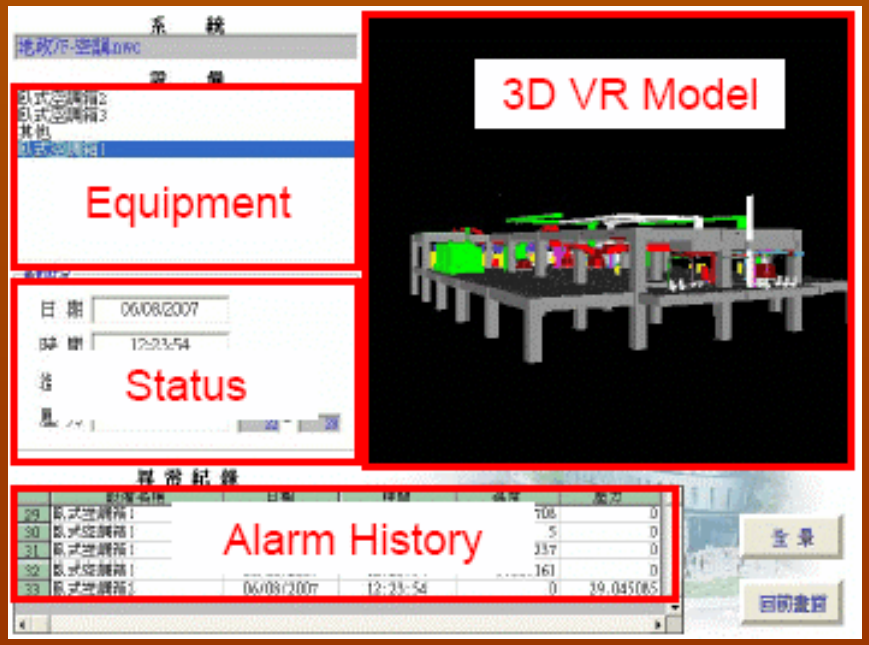
2.Business Critical

3.User / Occupancy Sensitive

4.Building Services

Alert Visualization In 3D FIM System



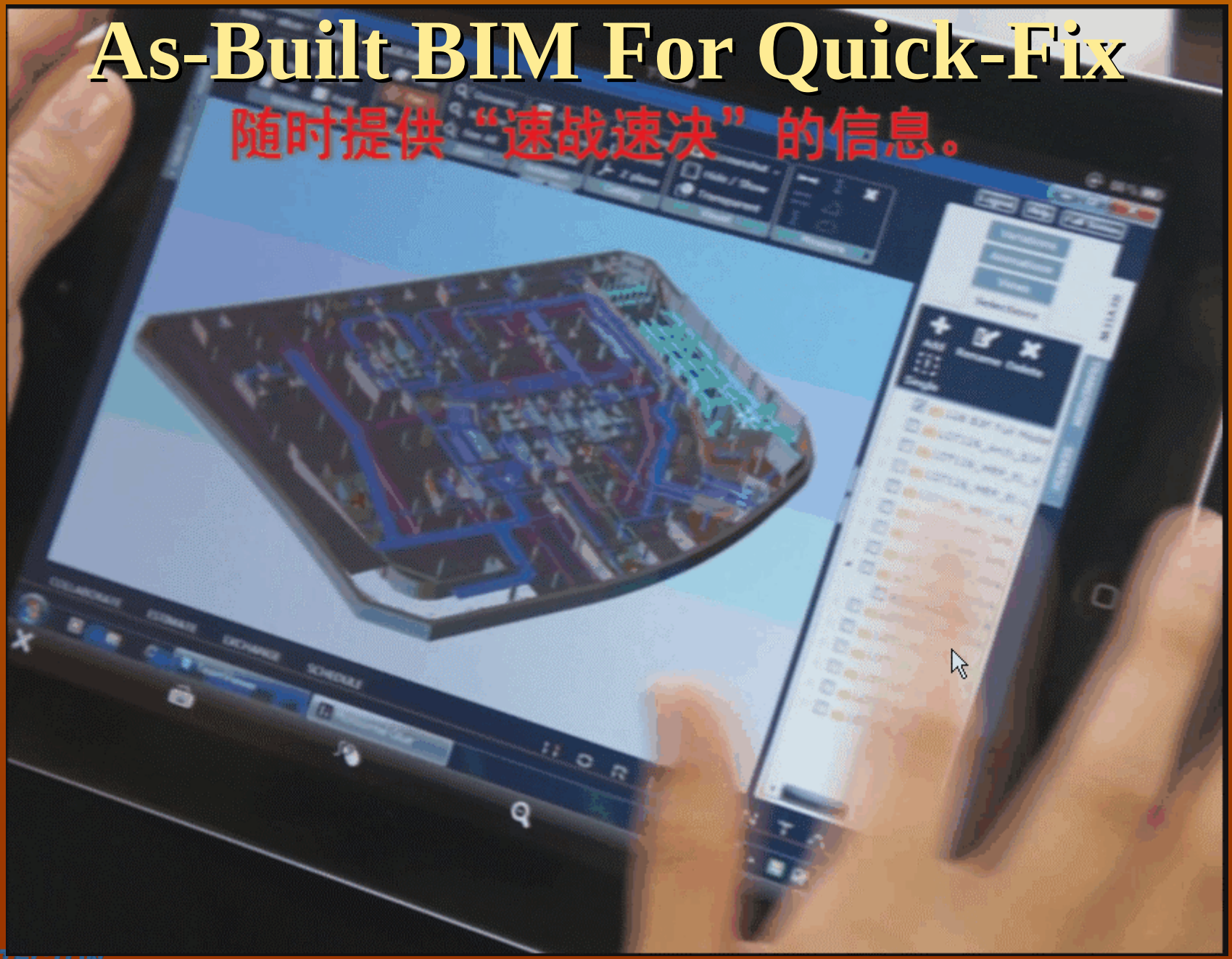


High Priority Work Request

	Code	Status	Priority
☐	06103	Requested	Emergency
☐	06102	Requested	One Month
☐	06101	Requested	One Month

As-Built BIM For Quick-Fix

随时提供“速战速决”的信息。



As-Built BIM For Quick-Fix

即时下载查看电子资料，
省却寻找大量图纸及纸张文件档

As-Built BIM For Quick-Fix

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Select Maintenance Strategy

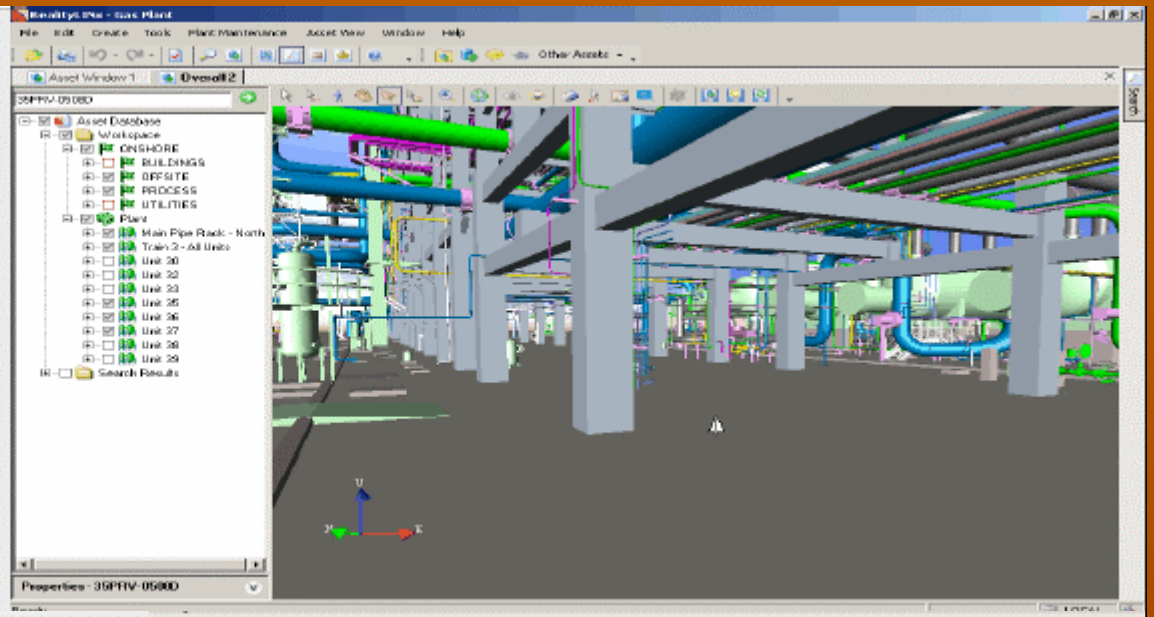
1. Statutory maintenance
2. Time based preventative maintenance
3. Responsive maintenance
4. Predictive maintenance
5. Condition maintenance
6. Run to destruction
7. Continuous improvement

Implement – plan the work

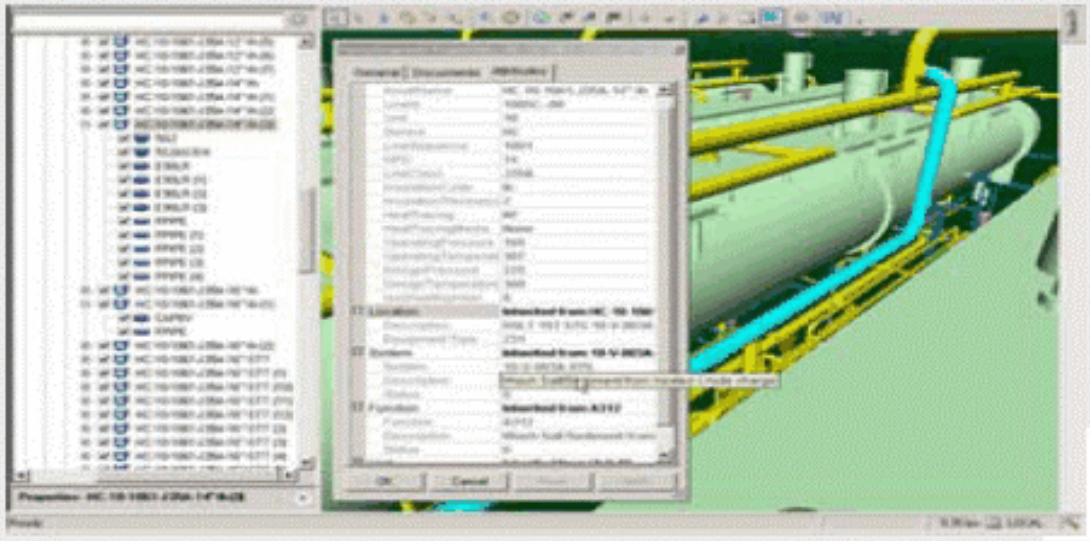
1. Generate work orders
2. Schedule the works
3. External specialist vendors
4. In-house maintenance team
5. Identify required resource levels
6. Create daily system checks
7. Generate route walks
8. Check resource allocation
9. Complete the tasks

Virtualization In Plant CMMS

- A way to walk through your plant while sitting in your office



- Enables you to access everything you know about your assets in just "one-touch"



Virtualization In Plant CMMS

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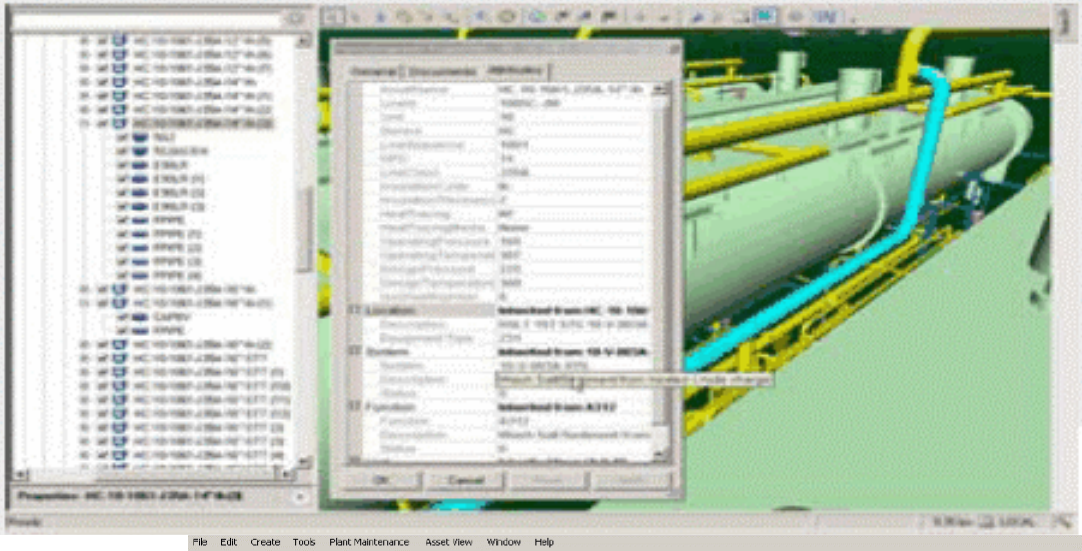
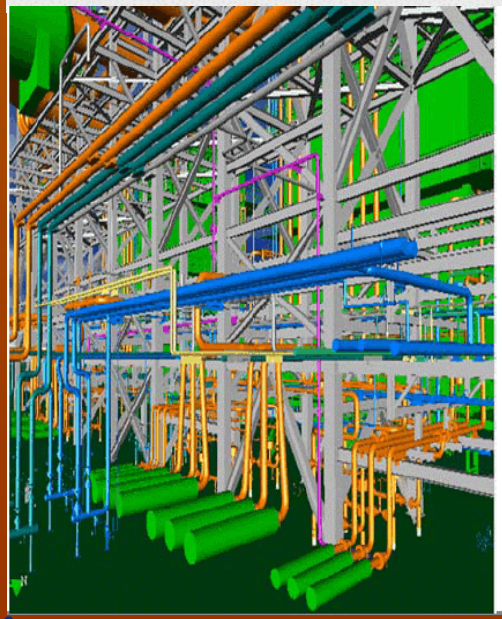
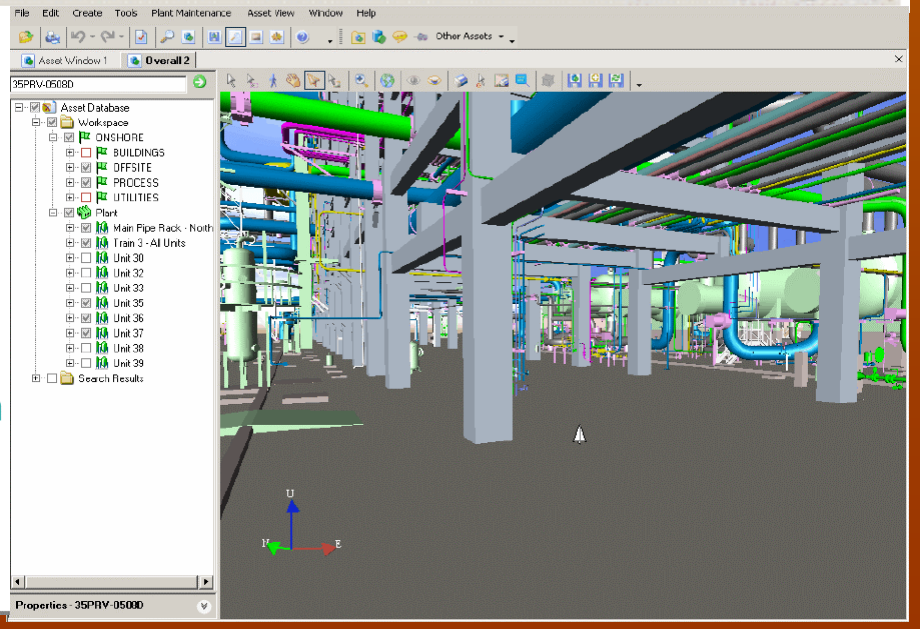




Intelligent 3D Models

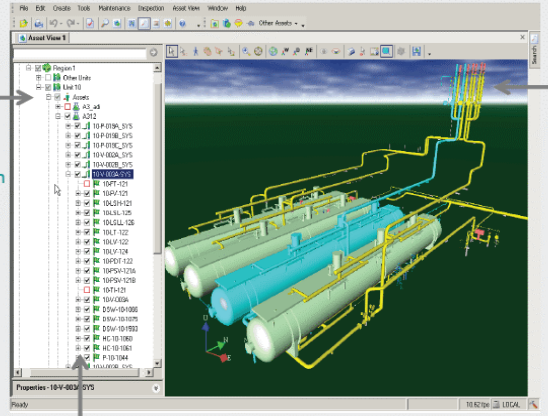
Ready to be integrated with asset data systems



Virtualization In Plant CMMS

Simplicity of the solution

Certified Interface

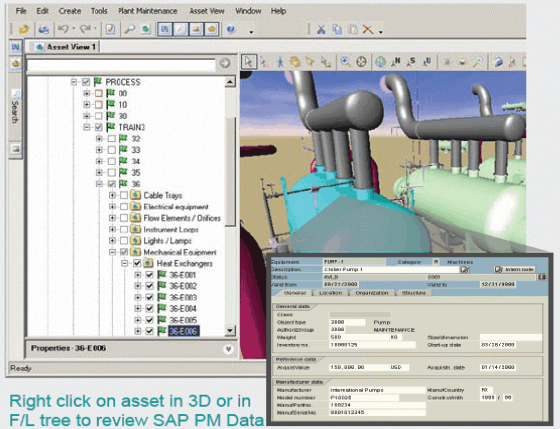


1. Based on SAP's Functional Location / Equipment Number hierarchical structure, link / organize your assets 3D model data in INOVx's RealityLINx 3D Visualization software

2. Search / click on a Functional Location in the tree to view its physical location and visa versa

3. Navigate your assets right from your desktop: review line attributes, take accurate measurements, review adjacencies and access safety and operational procedures

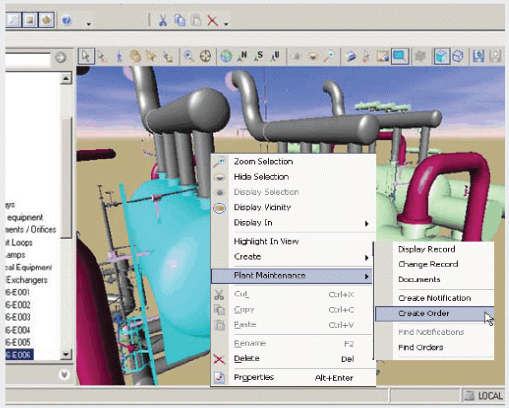
Quick Access to Assets Master Records



Right click on asset in 3D or in F/L tree to review SAP PM Data

- Access SAP PM data and records more intuitively while reviewing the actual plant physical layout in 3D.
- Assists technicians during training who are less-familiar with the facility to identify assets.
- Easier for maintenance and operation staff to access and use SAP, and therefore they would keep SAP more current and useful.
- Encourage full leverage and utilization of all SAP PM functionalities across the entire organization.

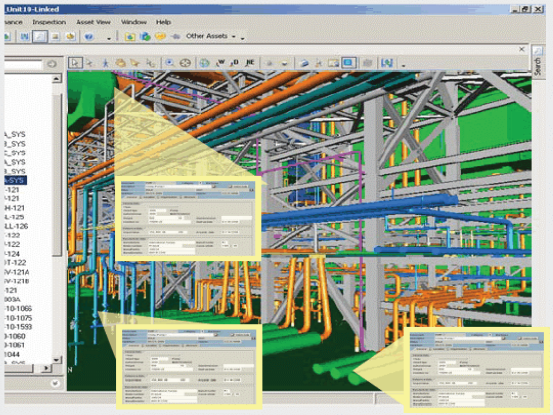
Create / View Work Orders & Notifications



Right Click on the asset in 3D or in the tree to create, or review work orders and notifications

- Use RealityLINx to physically locate assets. Identification of assets from their physical location. Location of objects in the proximity of a known object. Access/modify data within SAP for any of these objects, once they are located.
- Create, modify and view all work orders and notifications by clicking on the asset's 3D object.
- Simplified work order entry will make SAP data less **susceptible** to errors caused by casual users.
- Encourage non-maintenance personnel (i.e. operation) to create work orders and notifications more intuitively.

Color-Code 3D Model by W/O's & Notifications



Execute SAP queries to color-code or highlight all equipment that have outstanding w/o's due within a user-specific period (i.e. 2-week look ahead)

- Color-code & view SAP w/o's by schedule, by criticality, by type or by field requirements such as scaffolding & special equipment.
- Color-code / review geographical locations of w/o's and determine best PM route.
- Improve the efficiency of scheduling daily activities and logistics.
- Review confined space requirements.
- Clearer, faster planning and communication between operation, maintenance and field staff.

-End-
Thank You

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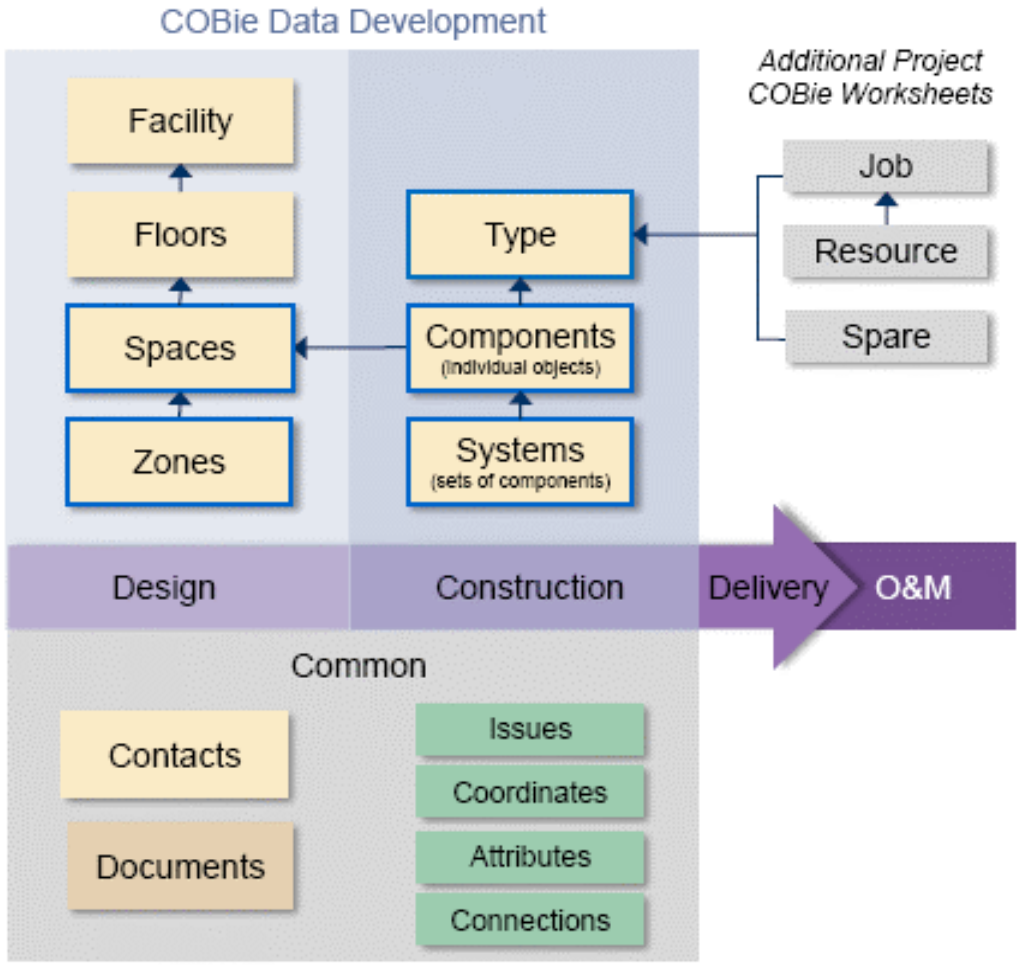
Backup-COBIE

COBie

Construction Operations Building Information Exchange

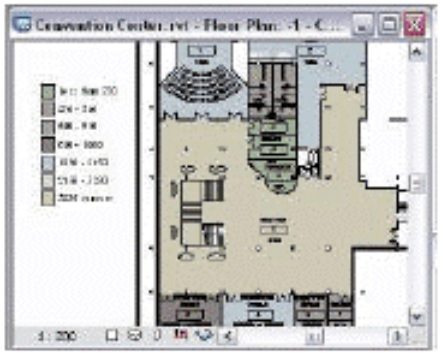
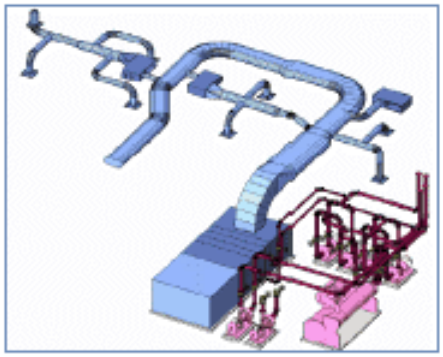
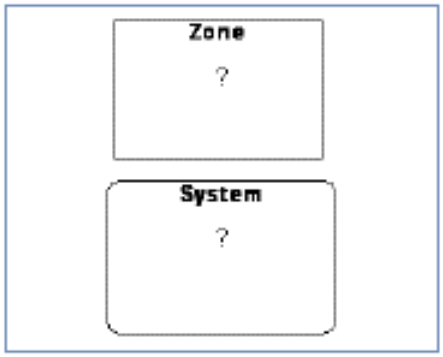
- COBie - a framework for organizing project data for delivery to FM
- Data development in Revit with parameters
- Data export from BIM to multiple COBie worksheets



Backup-COBIE

Developing Data + Revit Components

Assigning COBie Data Fields To Model Components

COBie Worksheet	Spatial Data	Building Components	System and Zone Data
	04-Space	06-Type 07-Component	05-Zone 08-System
Revit Component			
	Space/Room Components	3D Revit components	Project level data – not model components
	• COBie data elements are populated from Revit space/room objects • Caveat – Space measurement is highly variable between organizations/owners. What attributes are required by the project's client/owner?	• Project team to determine the components to be tracked for COBie (Probably not all! e.g. no mullions) • Doors and Window components are scheduled for COBie in Revit separately	• COBie data that by default is not organized within Revit • Add 2 "non-model" components to a site plan view

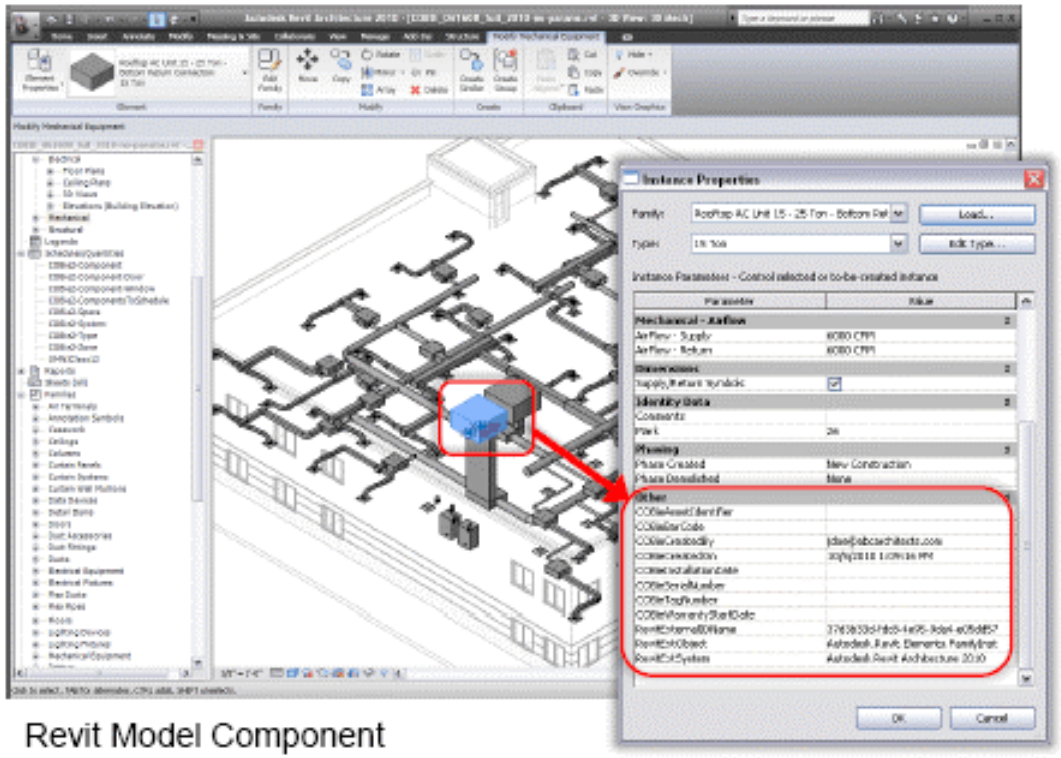
Backup-COBIE

Autodesk Revit to COBie Toolkit

File	File name	Description
Revit template	COBie2_30.rte	Provides: COBie formatted Revit schedules and schedule keys, Revit library files(below) and a default site plan view
Revit blank project	COBie2_30BlankProject.rvt	Provides formatted Revit schedule views formatted for COBie that can be copied into an existing Revit project
Revit library files for schedule views	COBie2_30System.rfa COBie2_30Zone.rfa	Revit Family files. These provide a "container" to schedule COBie-specific data not typically associated with Revit model objects
COBie formatted spreadsheet template	COBie2_30_Candidate1_Template.xls	MS Excel file that contains blank COBie worksheets in the required format
COBie formatted spreadsheet template	COBieDoorWindowReformatterPopulated.xls	Excel file to intake Revit door and window component data and reformat it to paste into the project COBie Excel spreadsheet
Macro utility to update Revit objects	UpdateRevitExternalIDName2011.dll	Revit macro, updates components in a model to have a unique ID data field that is required by COBie

Backup-COBIE

Developing Data in Revit

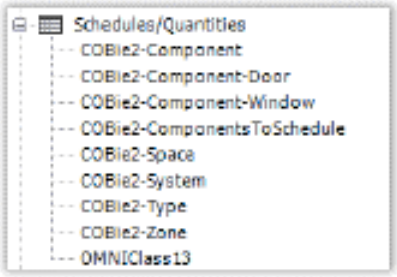


Revit Model Component
(3D View)

Component Properties

with Revit parameters to hold COBie data fields

Revit Schedule
Views for COBie



Data can be viewed and manipulated, then exported from schedule views

Model is Developed + Data Attached to Components