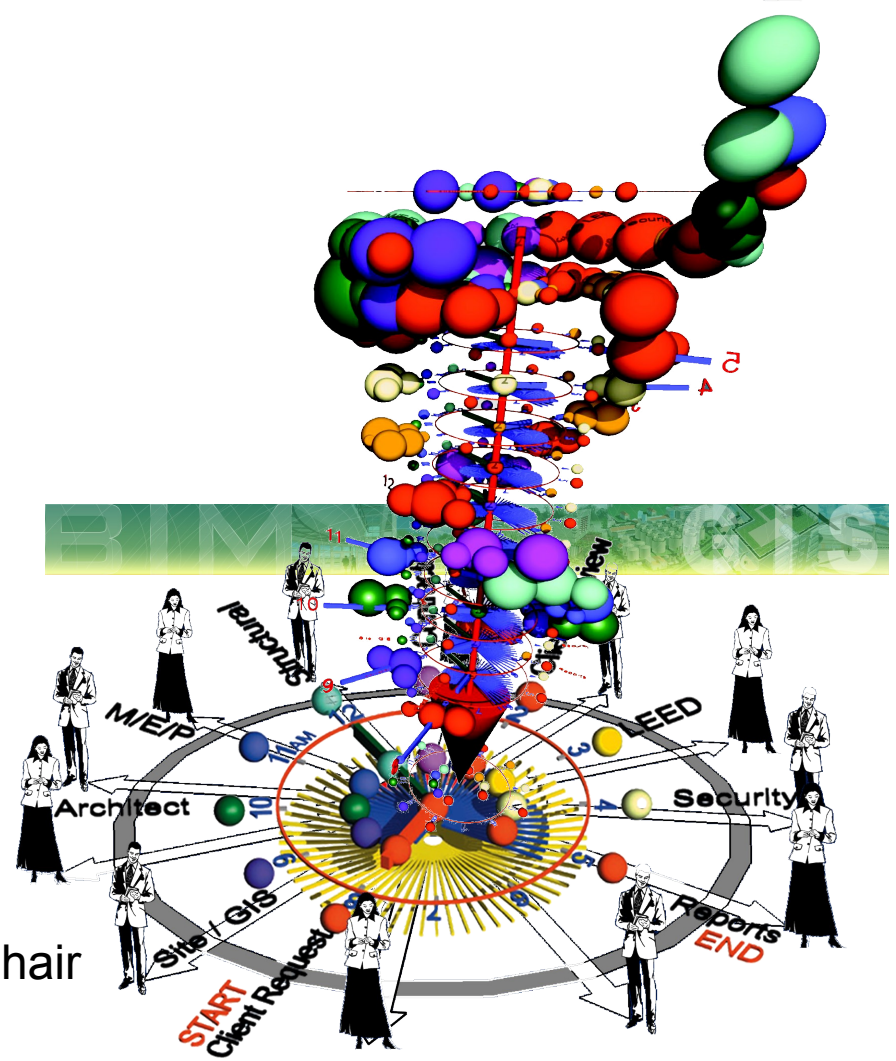
National Building Information Model Standard NBIMS

- BIM GIS Integration
- Why NBIMS
- What is NBIMS
- Issues of Interoperability



National Institute of Building Sciences
Facilities Information Council
National BIM Standard

Dianne Davis
Chair-National BIM Standards Scoping Chair

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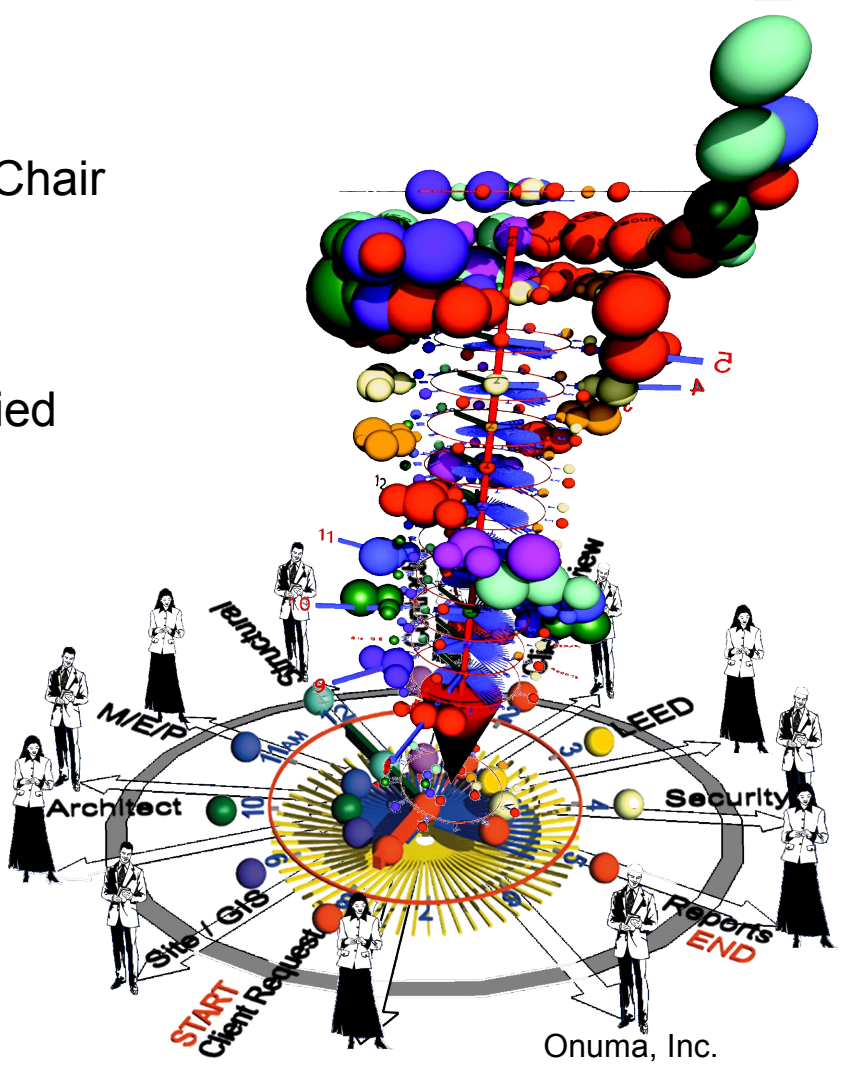
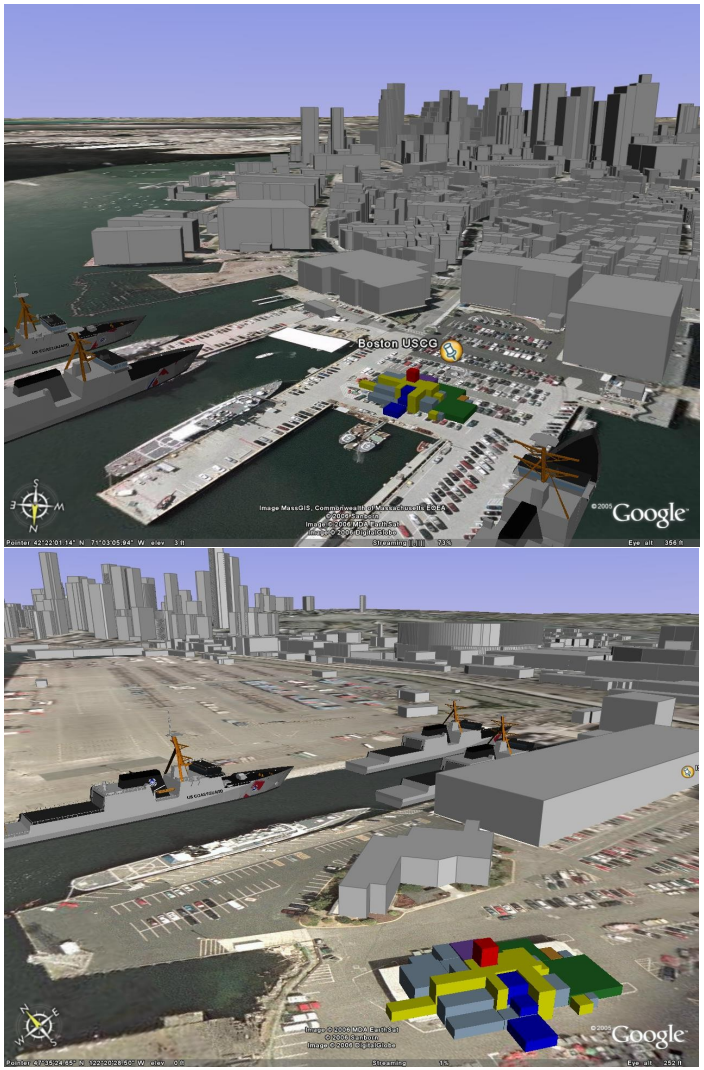
National Institute of Building Sciences
Facilities Information Council
National BIM Standard



Onuma, Inc.

BIM/GIS Integration USCG 2001



buildingSMART
International Alliance for Interoperability

Business Intelligence

Outsourcing

Globalization

Value-Chain & Supply Chains

Simulation

Clinger-Cohen Act of 1996

BIM

OMB-Capital Programming Guide/A-11:
GAO –Practices in Capital Decision-Making

Lean Construction

Models of Anything & Everything

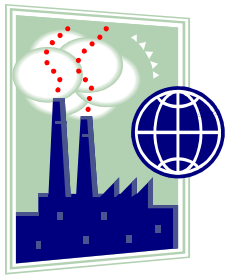
Data standards

Interoperability

Internet

LoB

Metrics



AHP Scores

Sustainable Design, Green & LEED

Delivery Methods

Information Leveraging

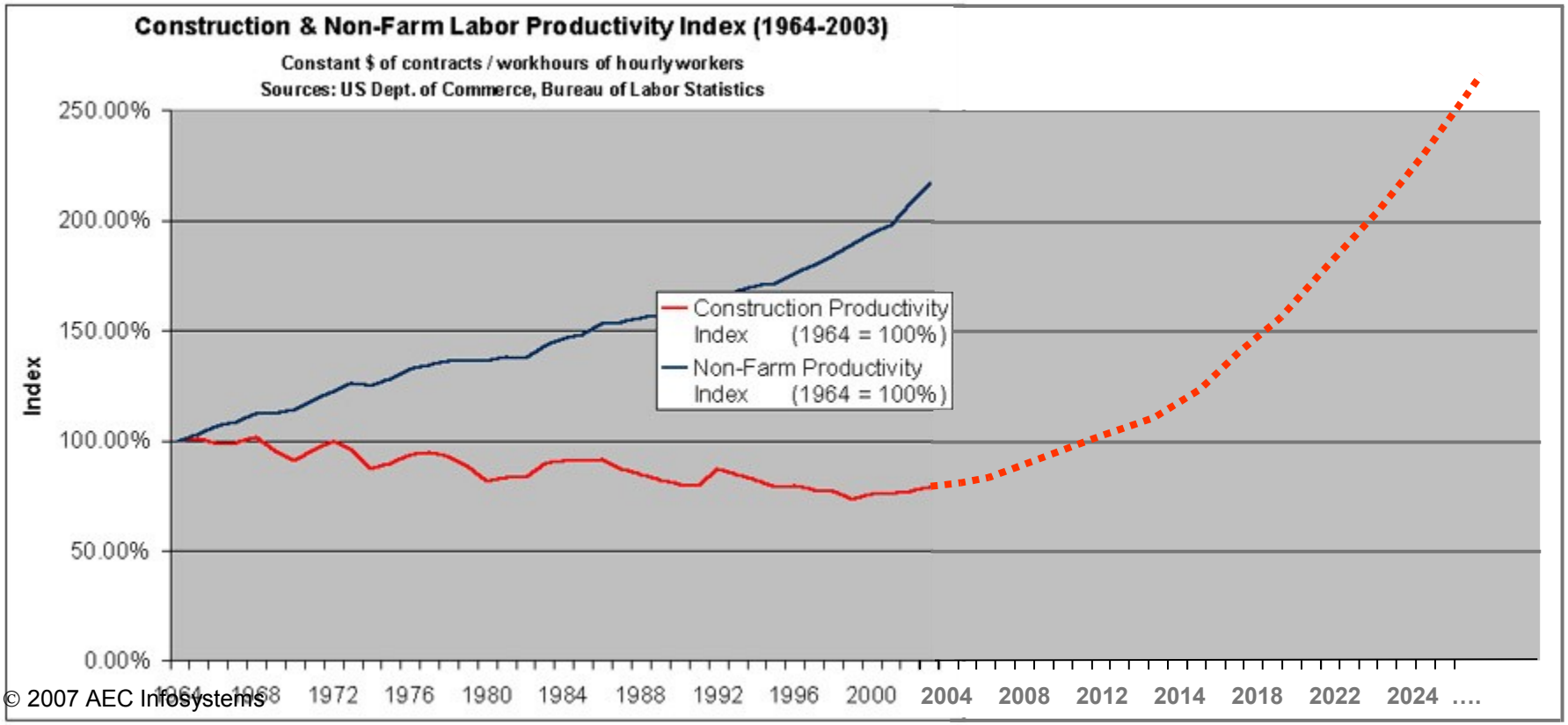
Databases & Data mining

“Productizing” Construction

Real Property Executive Order # 13327

SUSTAINABILITY, SECURITY, COMPETITIVENESS

- NIST report on lack of information Interoperability
- $15.8 Billion Loss Yearly



Who Benefits From BIM Implementation?

Facility Information Views

- Owners
- Planners
- Realtors
- Appraisers
- Mortgage Bankers
- Designers
- Engineers
- Cost & Quantity Estimators
- Specifiers
- Contracts & Lawyers
- Construction Contractors
- Sub-Contractors
- Fabricators
- Code Officials
- Facility Managers
- Maintenance & Sustainment
- Renovation & Restoration
- Disposal & Recycling
- Scoping, Testing, Simulation
- Safety & Occupational Health
- Environmental & NEPA
- Plant Operations
- Energy, LEED
- Space & Security
- Network Managers
- CIO's
- Risk Management
- Occupant Support
- First Responders

Environmental impact of buildings

- 40% of global raw materials is consumed by buildings
- 65.2% of total U.S. electricity consumption
- 136 million tons of construction waste in the U.S.

We must make the rescue of the environment the central organizing principle for civilization.

U.S. Department of the Interior

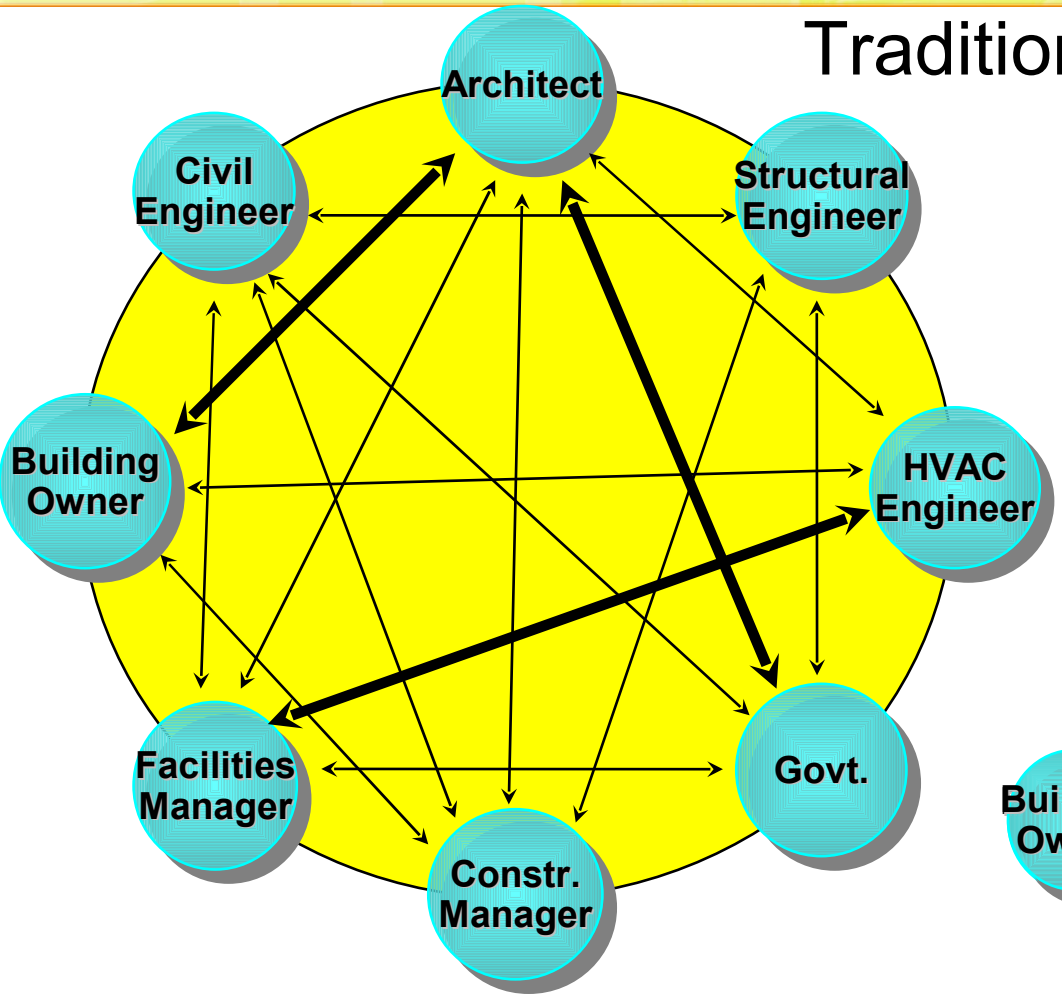
Building Information Model Definition

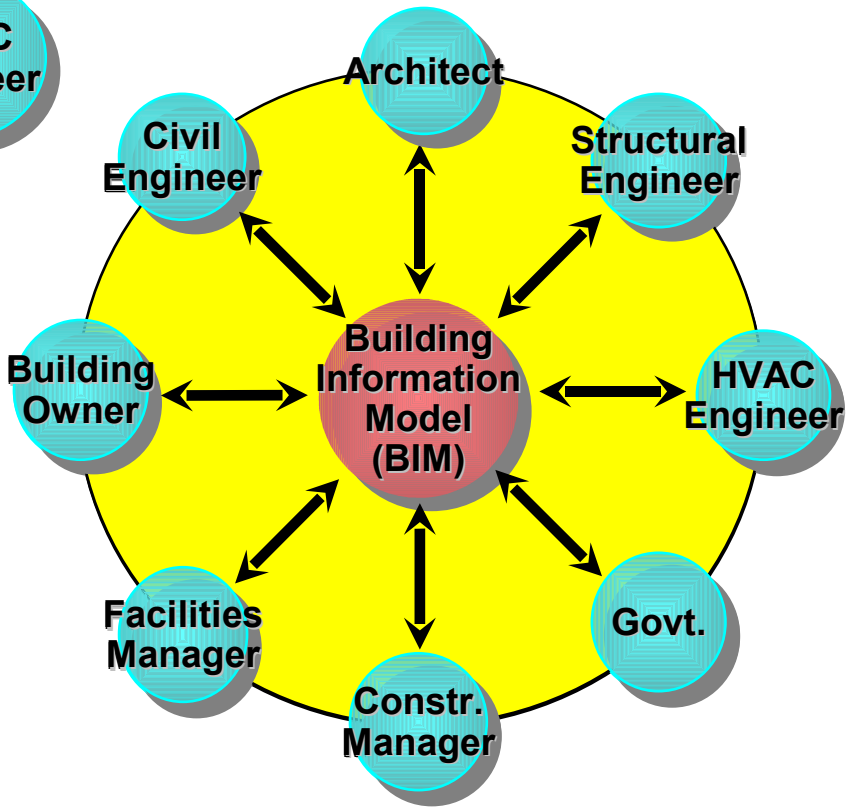
- ***A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle from inception onward.***
- ***A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder. The BIM is a shared digital representation founded on open standards for interoperability.***
- ***The US National BIM Standard promotes the business requirement that this model be interoperable based on open standards.***

Approved March 1, 2006 – NBIMS Exec Comm.

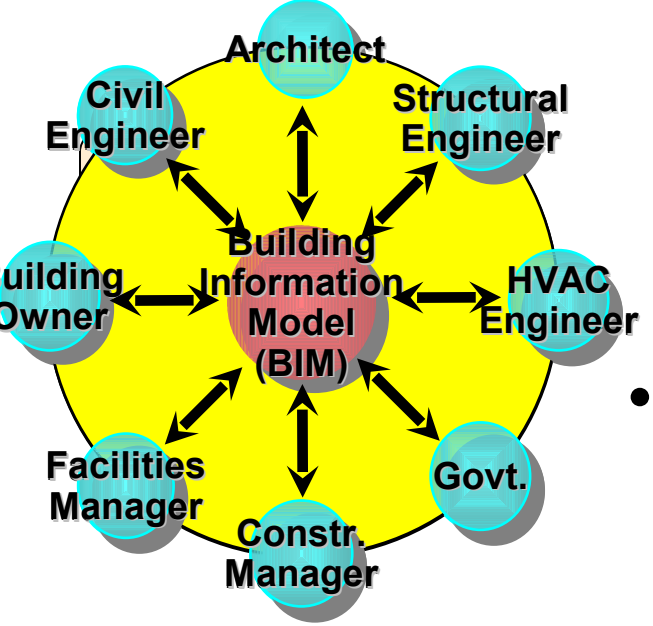
National Institute of Building Sciences
Facilities Information Council
National BIM Standard

Traditional Information Exchange





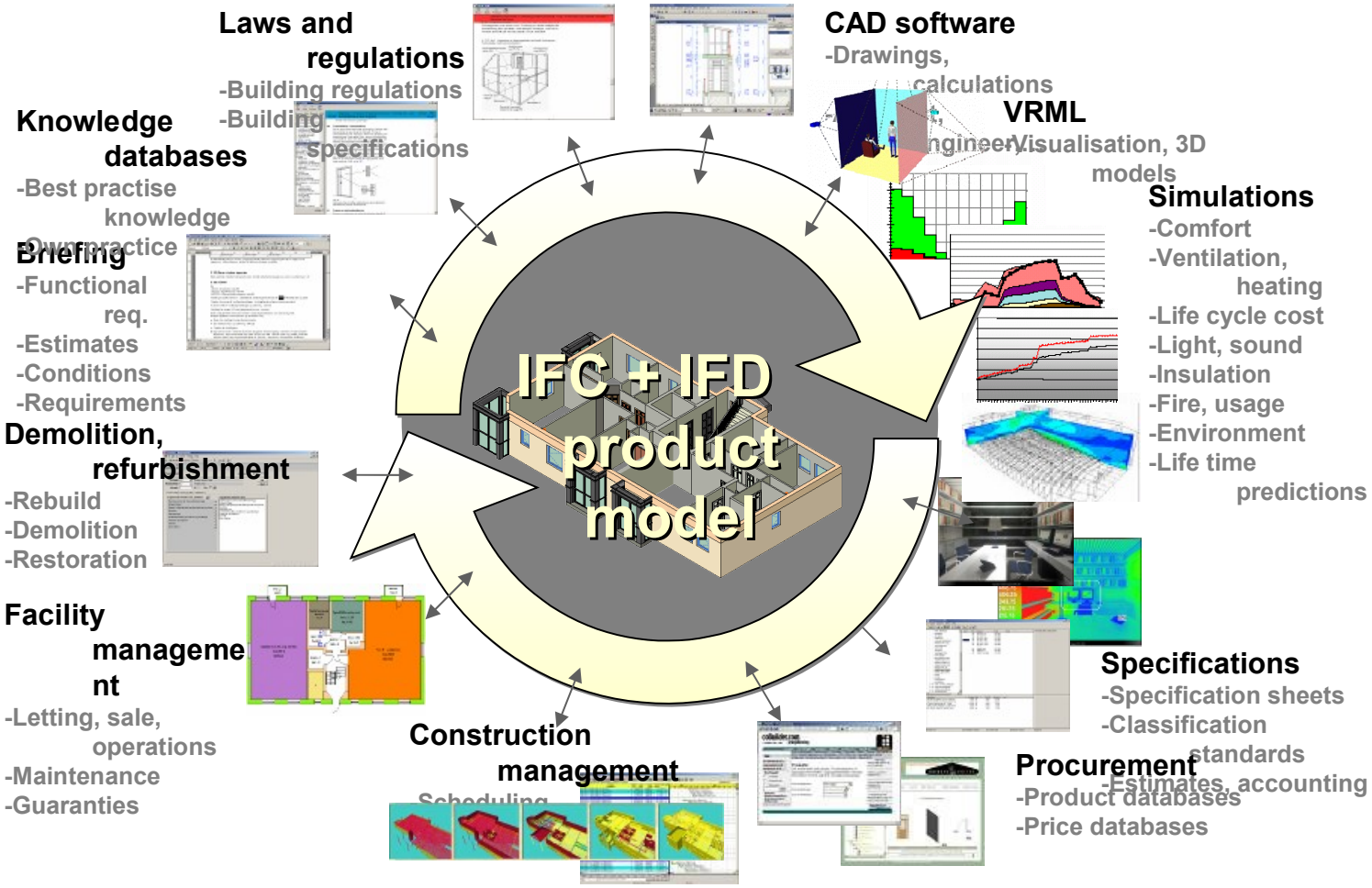
Slide courtesy of IAI International



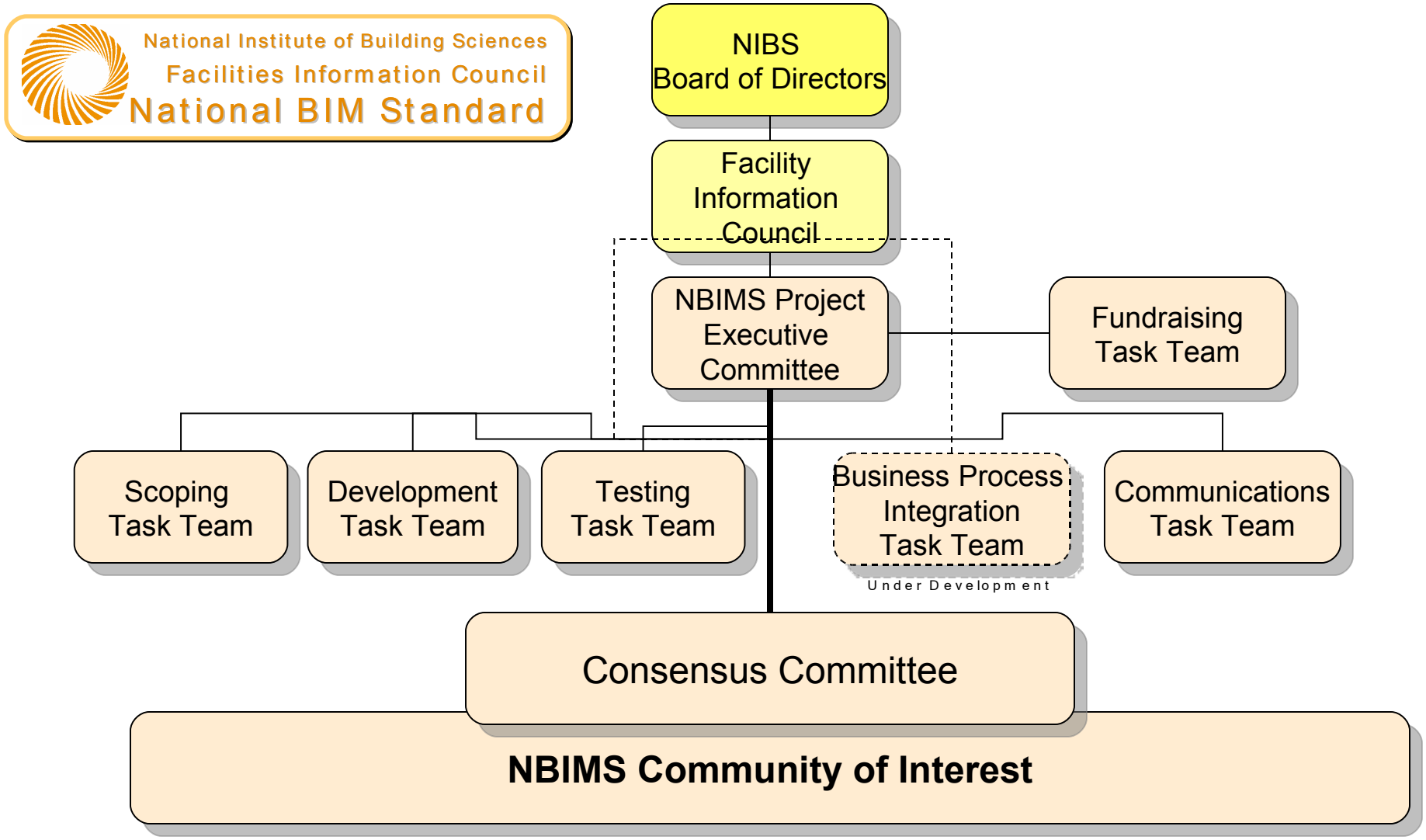
NA Process Identification

- Building Information Model
  - represents product and digital deliverable of data
  - Information aggregated to support simulation and analysis
- Building Information Modeling
  - Process by which we utilize BIM based upon business use cases
- Integrated Practice
  - The collaborative environment possible with the use of a BIM process

Building Lifecycle



NBIMS Organization Chart



NBIMS Levels of involvement

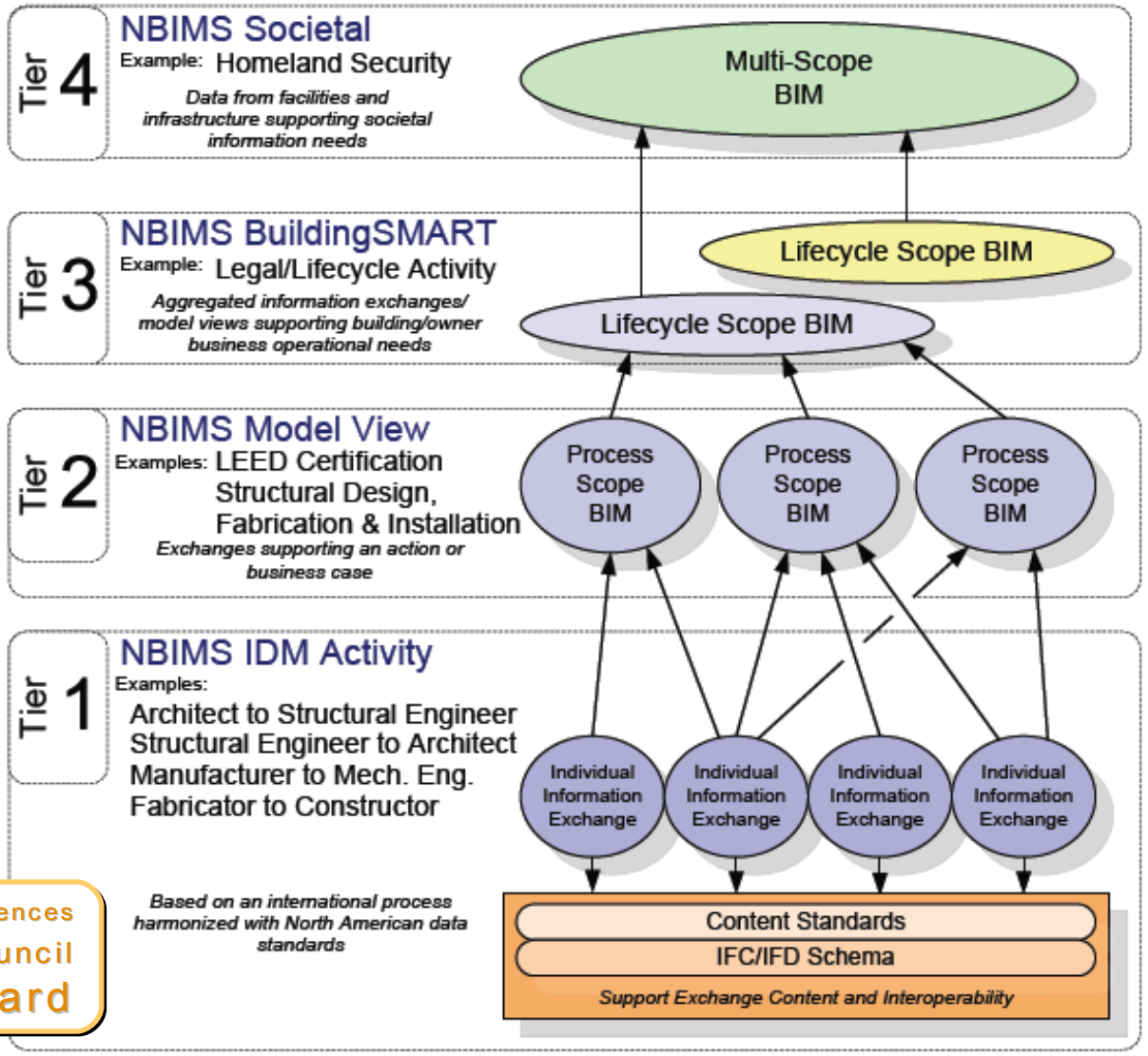
- **Community of interest/Knowledge Experts**
  - Membership on the listserv and participation in BIM related discussions
- **Consensus Committee**
  - A cross-sectional subset of the Community of Interest that will actually participate in the voting on the standard.
- **Task Teams**
  - Open membership for those who want to be involved in the drafting of the standard which will go to the Consensus Committee
- **NBIMS Executive Committee**
  - Management and oversight of the entire project committee effort with cross sectional representation
- **Facility Information Council**
  - The NIBS Council under which the NBIMS and NCS efforts operate. They determine what other projects may be necessary in the future

These Are Only a Few of the Organizations Currently Participating in the NBIMS Effort

Signatories of Charter
March 1, 2006

- FIATECH
- CYON Research
- ARCOM
- Total Resource Management
- Graphic Systems Inc
- AEC Infosystems
- SMACNA
- HDR
- CH2M Hill
- FM Global
- Nemetschek North America
- Onuma
- ERDC
- NAVISWORKS
- Maryland National Capital Park & Planning Comm.
- Parsons Brinckerhoff
- OSCRE America, Inc.
- USCG
- Jordani Consulting
- Open Geospatial Consortium, Inc
- American Institute of Architects
- State of Massachusetts Capital Asset Management
- K. Hovnanian Homes
- Woolpert, Inc.
- Little Diversified Architectural Consulting
- MACTEC E&C
- International Centre for Facilities
- Open Design Alliance
- CID Engineering, Inc.
- GHAFARI Associates, LLC
- Bentley Systems, Inc.

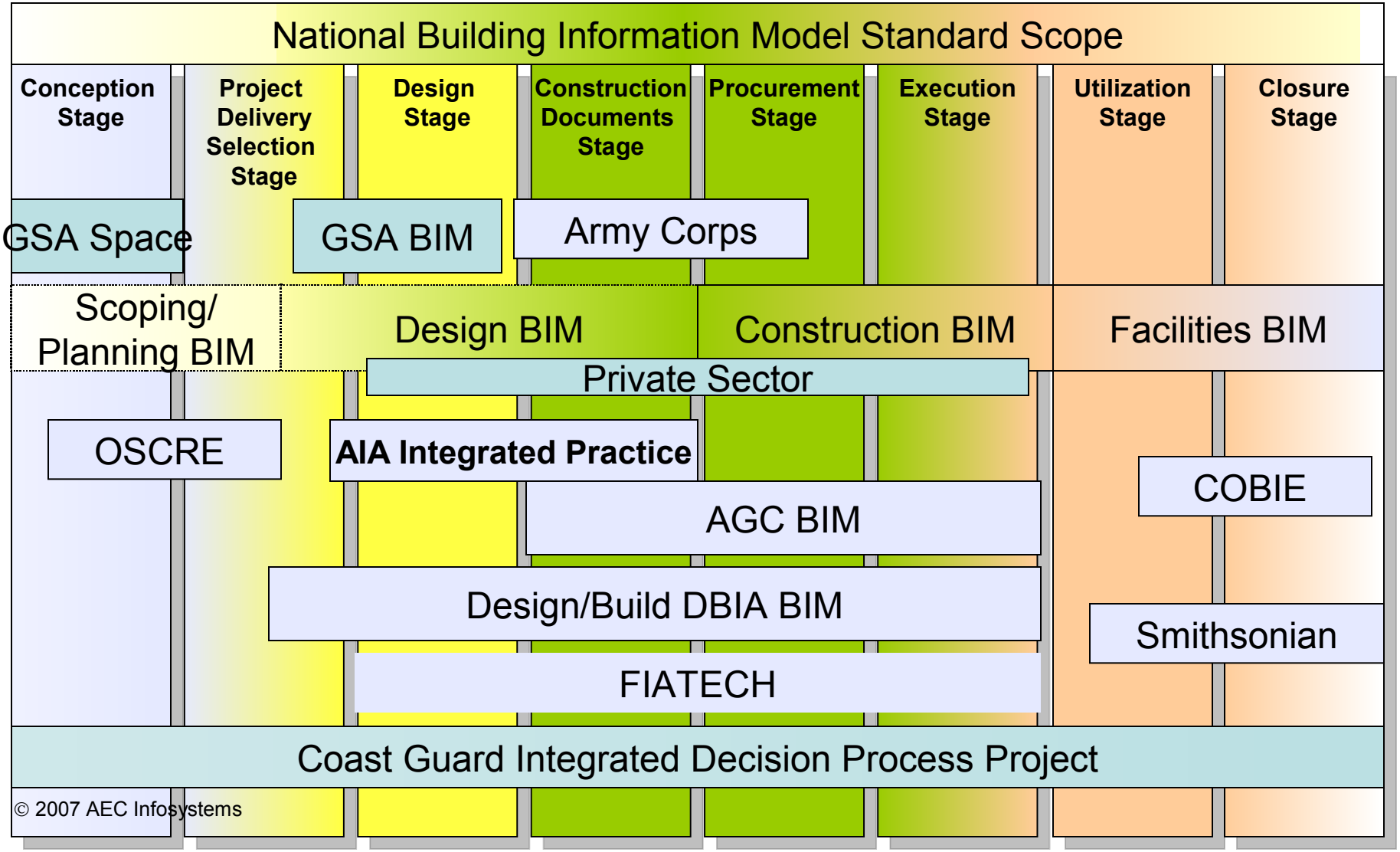
NBIM



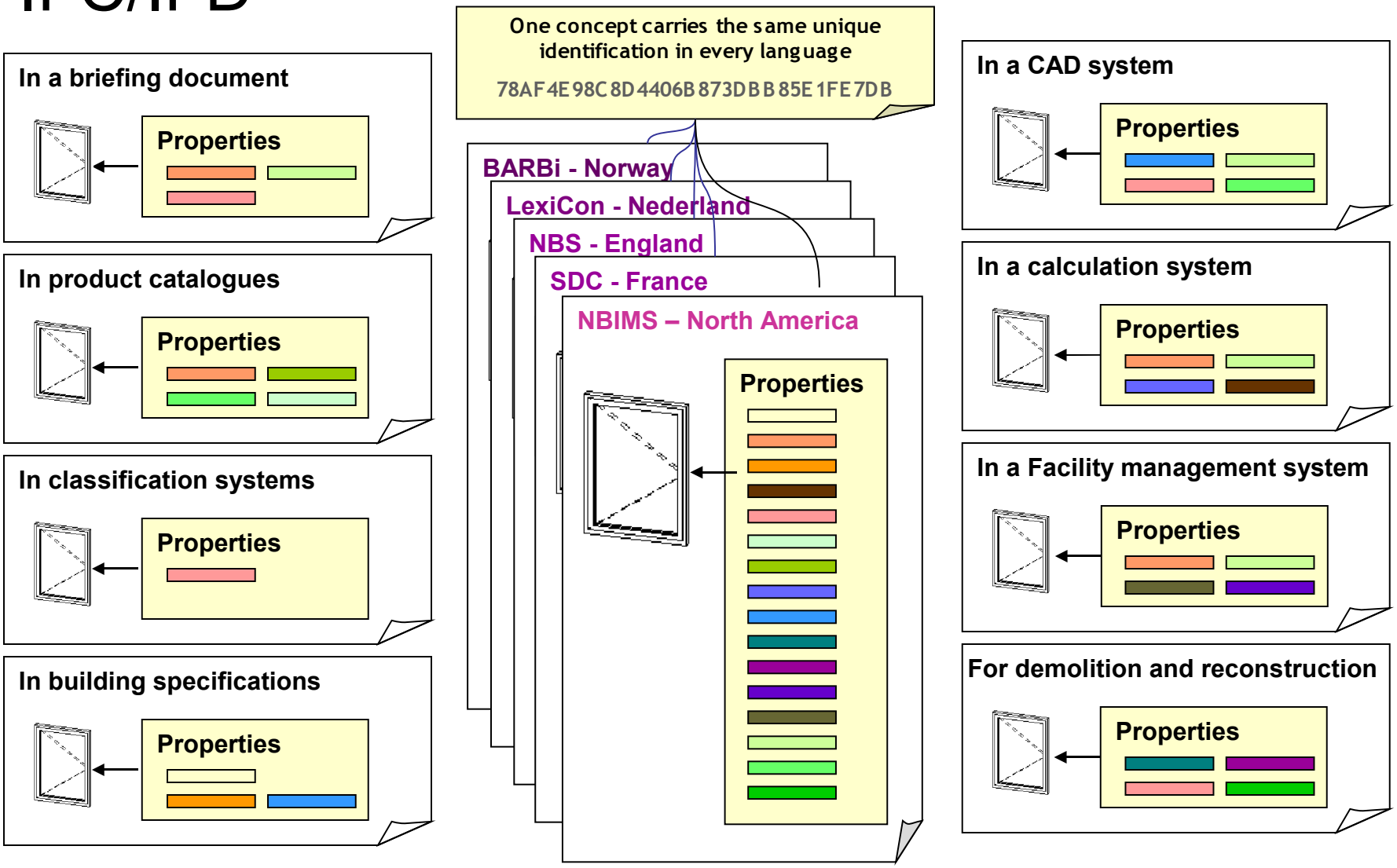
NBIMS Exchange Tier Architecture

National Institute of Building Sciences
Facilities Information Council
National BIM Standard

Coverage of various BIM Projects



IFC/IFD



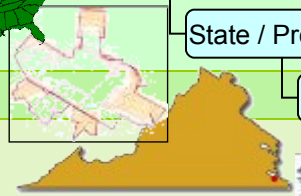
Courtesy of Lars Bjørkhaug, Norwegian Building Research Institute

Hierarchical Information Relationships

Theatre / World

Country

Installation / Region

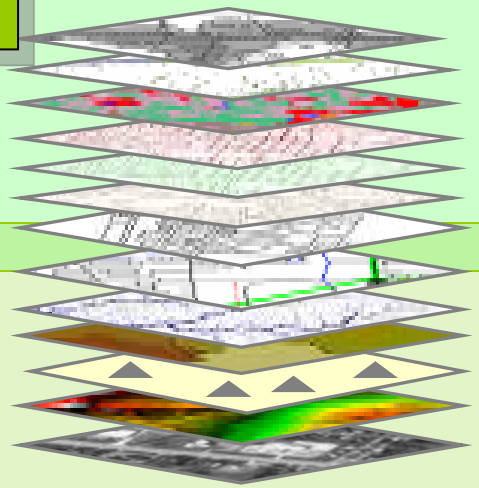


State / Province

City / County

Site

Geospatial Information (GIS)



Natural Asset

Air / Space

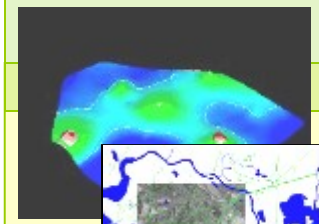
Underground

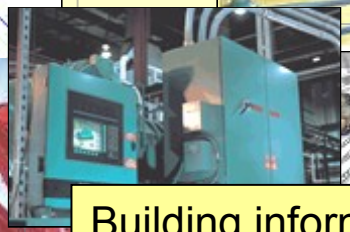
Water / Sea

Real Property Asset

Land / Parcel

Facility / Built





Building information (Building Information Models)

Building

System

Sub-Systems

Components

Space

Level

Room

Overlay

Structure

System

Sub-Systems

Components

Space

Level

Room

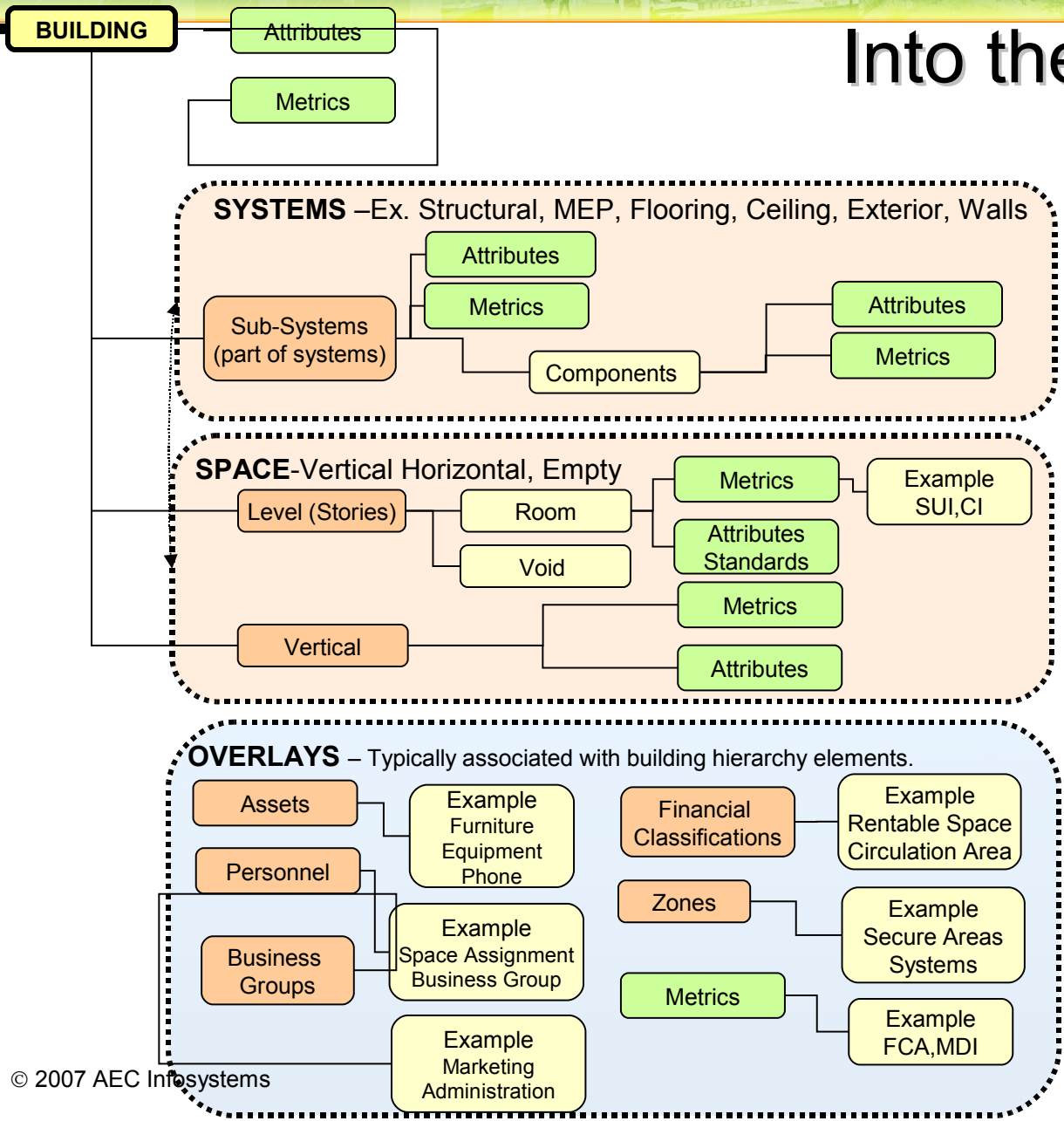
Overlay

Linear Structure

Node

Segment

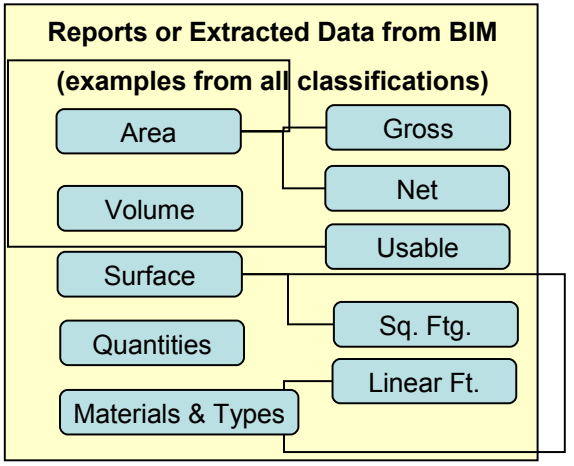
Into the BIM Taxonomy



Systems represent the physical entities of the building. Systems use NA classifications such as Omni-Class and Uniformat and are transported/exchanged via IFCs

Space is physical in nature, but can be unbounded (have no or cross physical boundaries) but it will always be tied to the physical structure or systems in some way

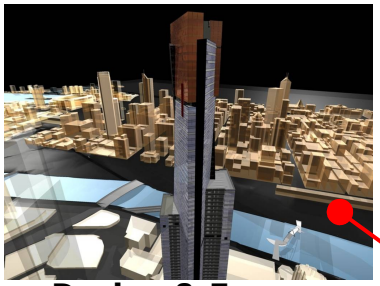
Overlays are more abstract data - organizational, operational, functional, financial, non-fixed assets, resources, personnel, etc. that is data tied to the Systems and Space



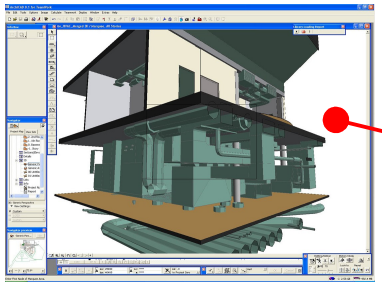
Open Asset Architecture

Required by More Owners
Maximum Flexibility for Our Users

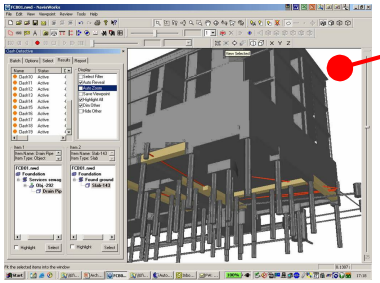
The Digital Asset Manager



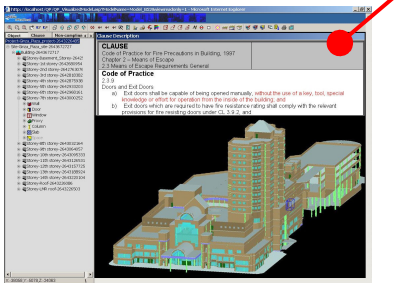
Design & Energy (Green & LEED)



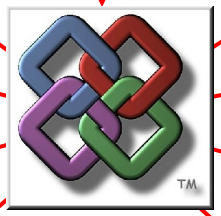
HVAC & Structural



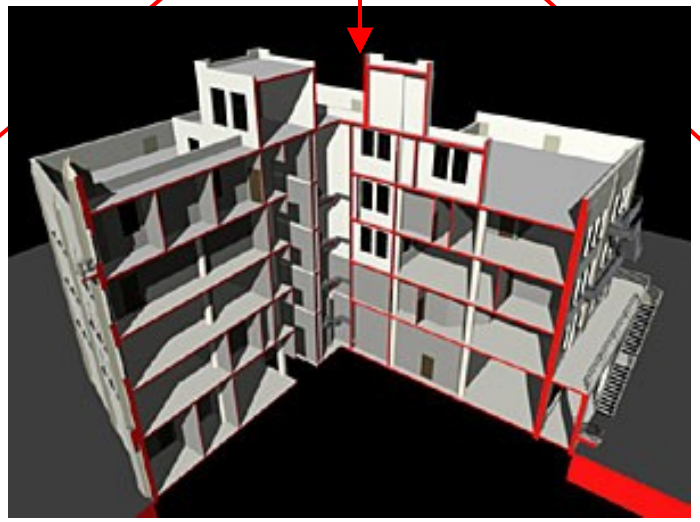
Collision – NavisWorks



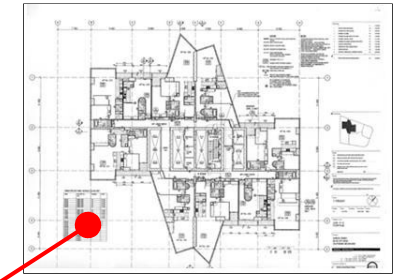
Code Checking – CSI National CODE Council



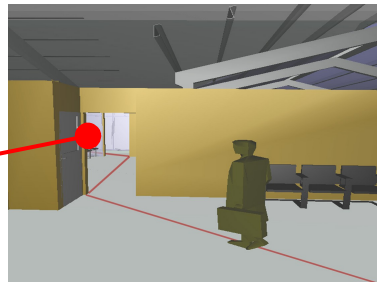
IFC



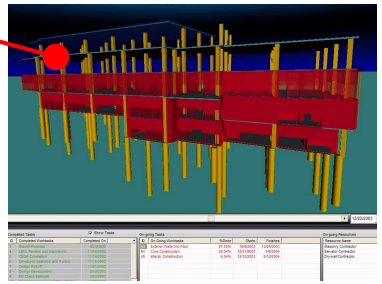
B u i l d i n g M o d e l



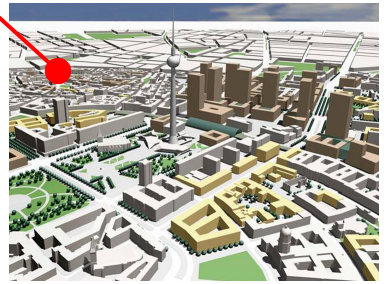
Drawings & Specs



Security - Solibri

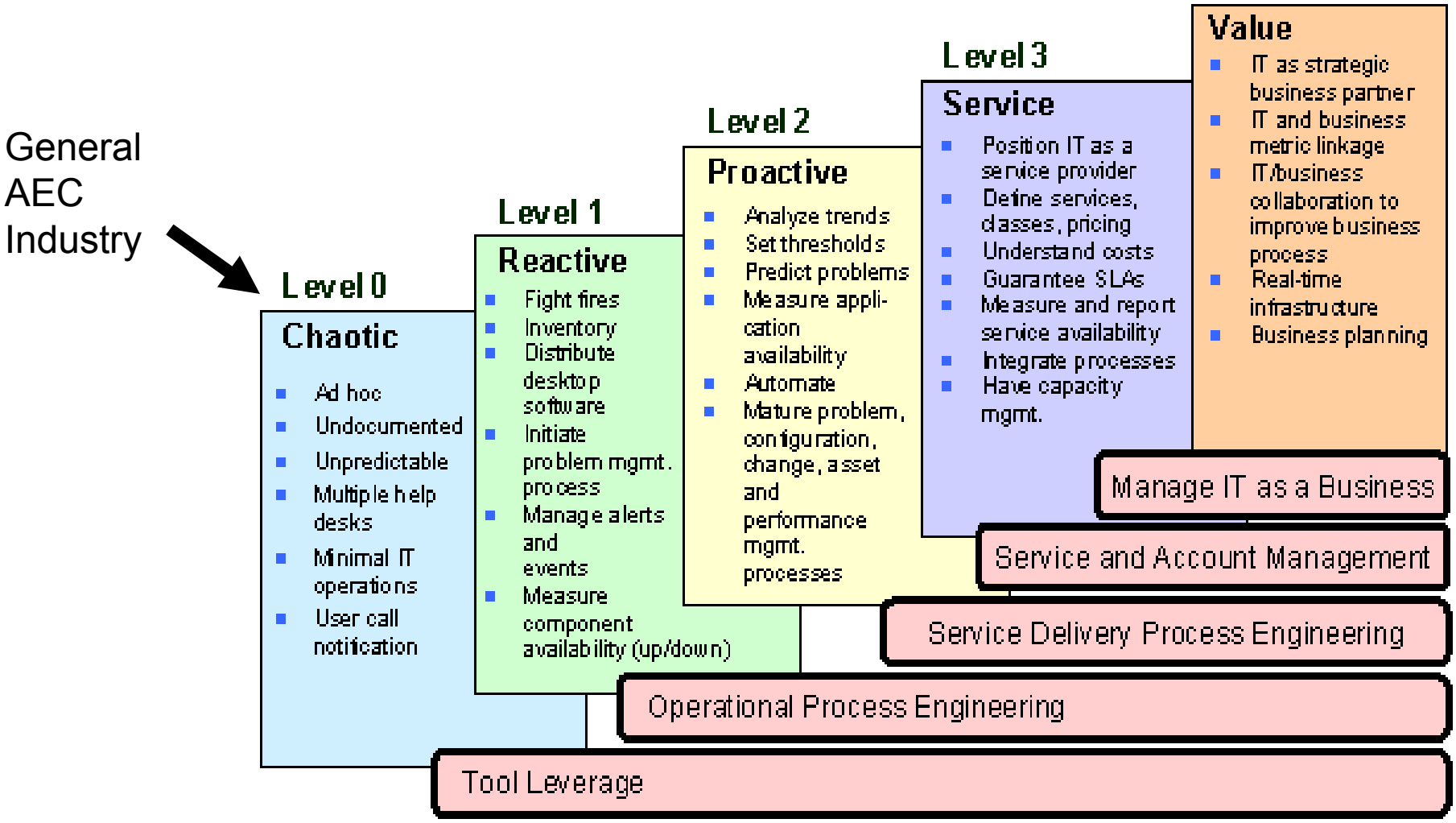


4D & 5D Estimating



City Modeling – ESRI Google Earth, CityGML

The Gartner IT Infrastructure Maturity Model

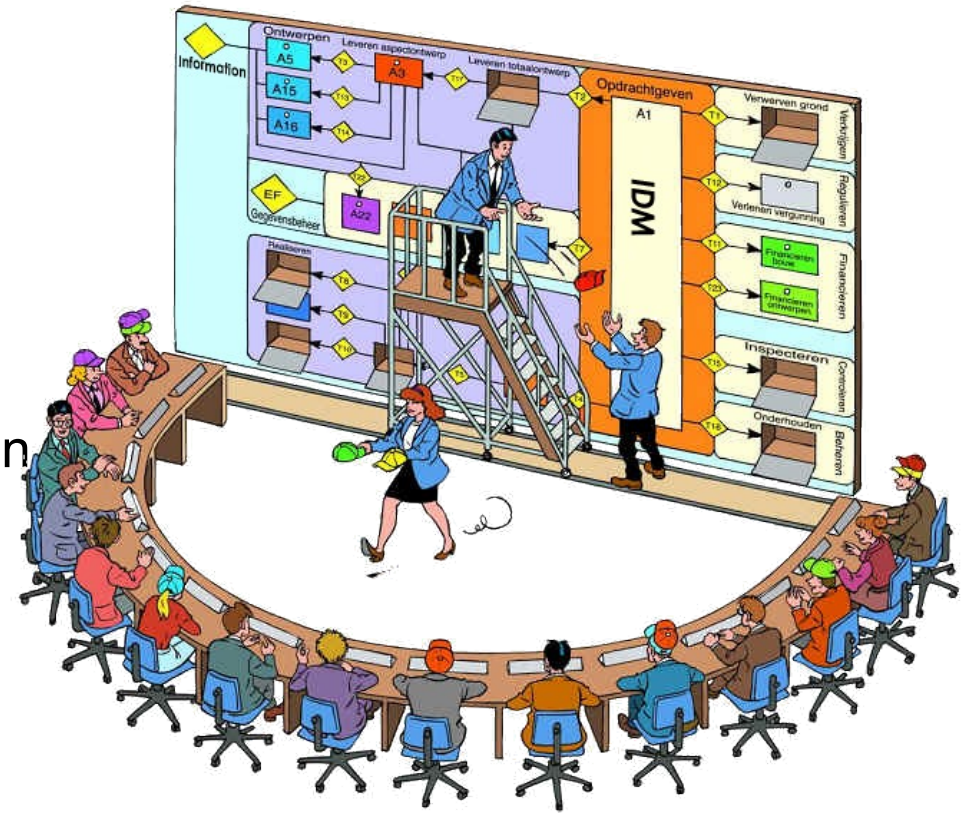


NBIMS Scoping Task Team

- You can't automate what you don't understand
  - Each day information is exchanged by teams, but in different ways and with different content for the same purpose. Not STANDARD Methodology
  - Based upon a paper-centric process, email, phone, RFI's
- This isn't a process which can take advantage of BIM and automation.

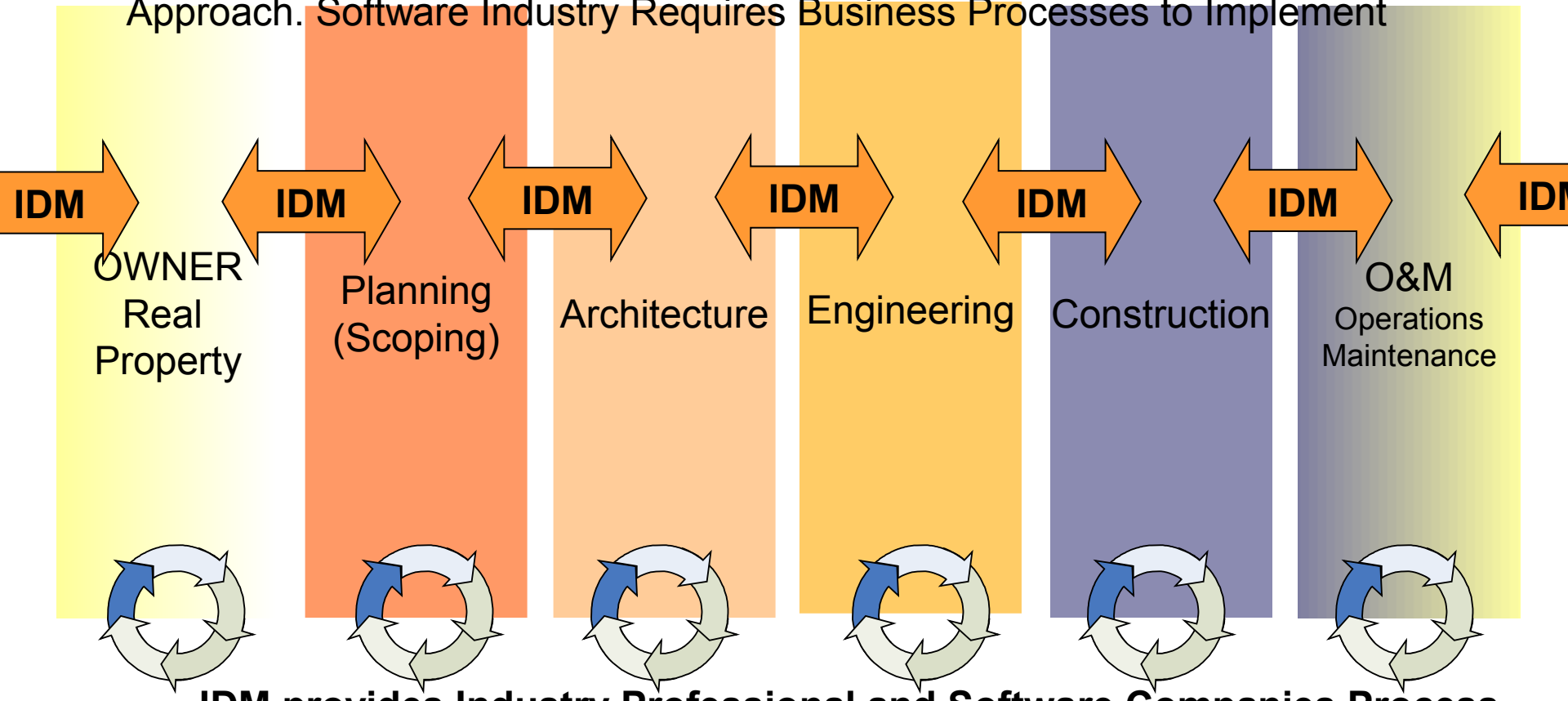
IDM Supports AECO BIM Process Scoping Task Team

- Requirement & Goal
  - Standardize on information needed for specific tasks within the building lifecycle
  - Development based upon open data standards used by all
  - Provides requirements to software companies
- In NA uses data standards

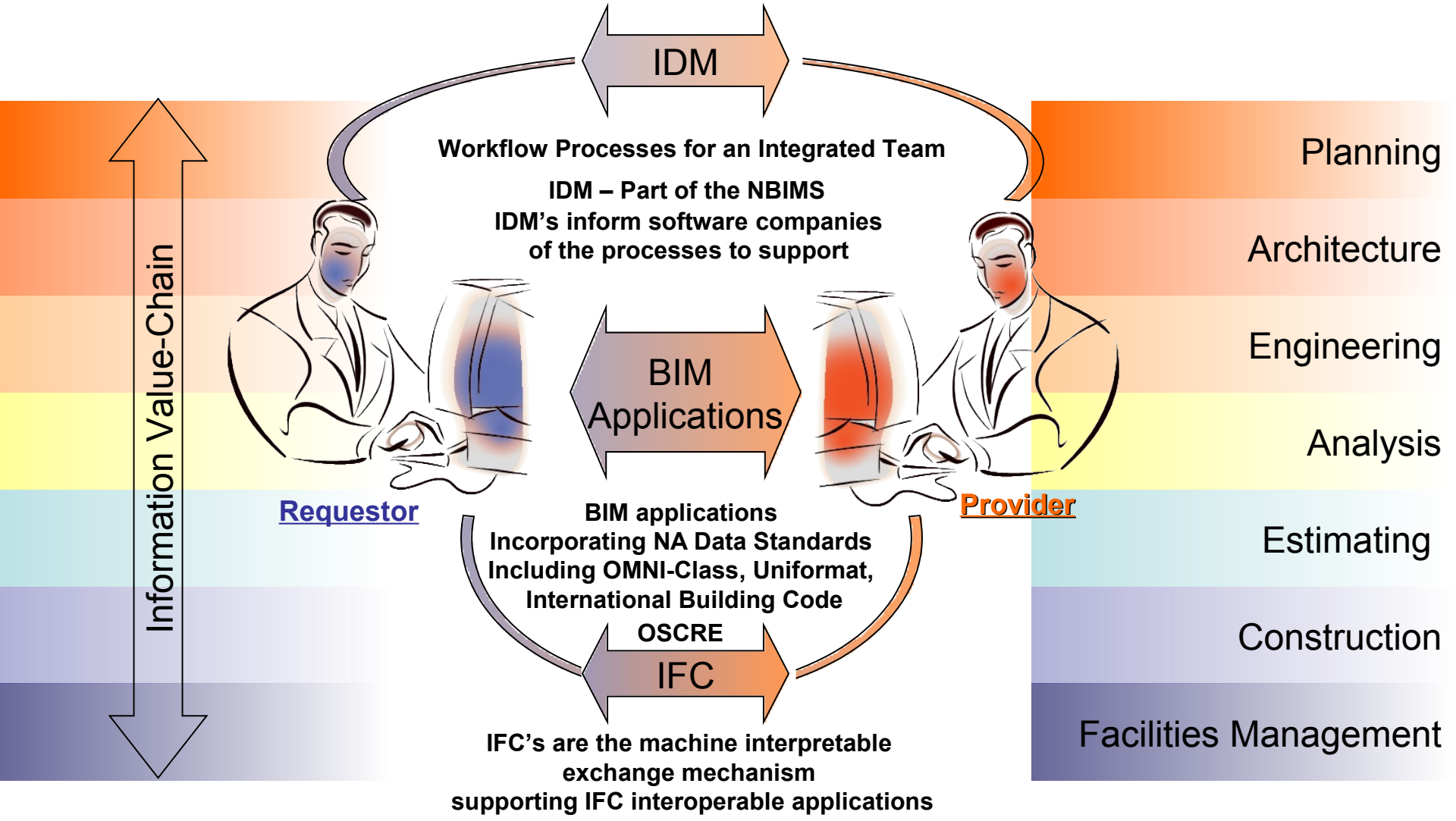


Software Applications Tend to Sub-Optimize

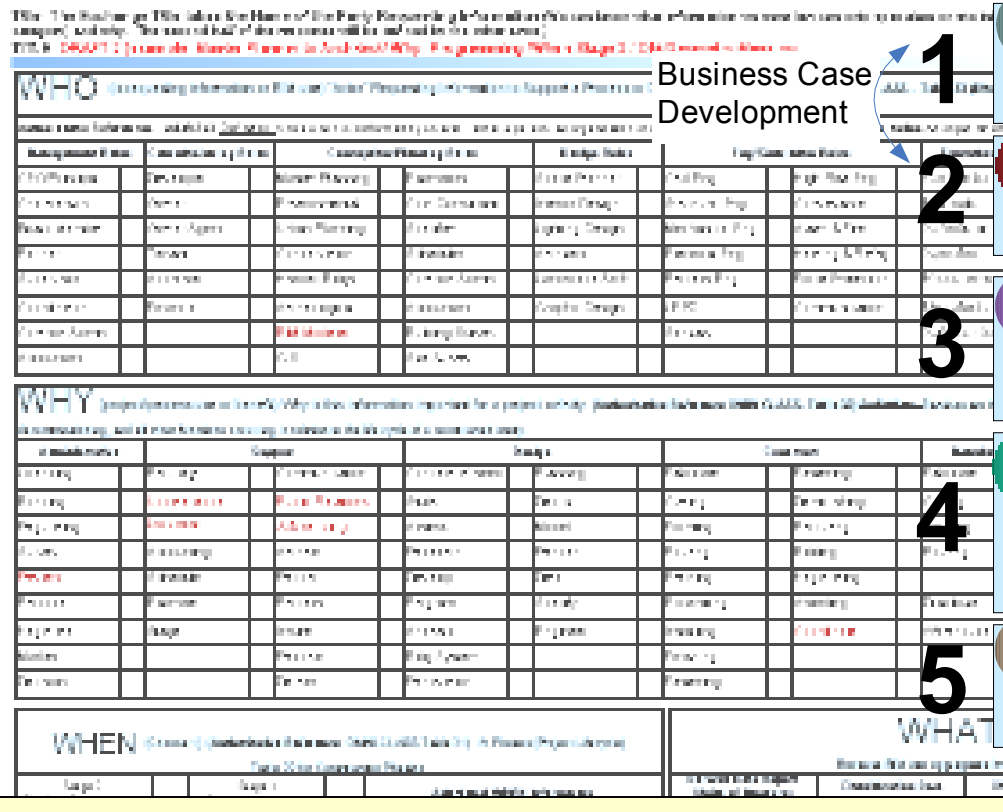
Current Software Products Sub-Optimize with a Fragmented or Proprietary Approach. Software Industry Requires Business Processes to Implement



IDM provides Industry Professional and Software Companies Process Information to Support Building Lifecycle



Information Exchange Requirement



Business Case Development

1 WHO (is requesting)

Actor Requesting Information to Support a Process or Decision
(Authoritative Reference OMNI CLASS – Table 33 & 34)

2 WHY (project/process use or benefit)

Why is this information important for a project activity
(Authoritative Reference OMNI CLASS- Table 32)

3 WHEN (stage in project)

(Authoritative Reference OMNI-CLASS-Table 31) Table 31 is tied to Ifc Phases (Project Lifecycle) Table 22 for Construction Phasing

4 WHAT

Dataset in BIM that supports the request and benefit
Because BIM use aggregates Information Several Tables Support this activity.

Authoritative Reference OMNI-CLASS Tables 14, 21, 23, 41, 49.

5 To WHOM

Group/Actor that provides/fullfills the information need OMNI-Class 33. 34

The information exchange requirements are part of the Information Delivery Manual (IDM)

NA Information Exchange Requirement

OmniClass™

Process

- **Who?** Table 14 - Spaces by Form (Room, courtyard, city block)
- **When?** Table 31 – Phases (Conception, design, occupancy)
- **Why?** Table 32 – Services (Designing, constructing, inspecting)
- **To Whom?** Table 33, 34 – Disciplines, Organizational roles (General Construction, cost estimator)

Content (What)

- Table 14 - Spaces by Form
- Table 21 – Elements (walls, HVAC distr., furniture
- Table 23 – Products (conc., paint, partitions.
- Table 41 – Materials (rock, plastic, glass)
- Table 49 - Properties (color, width, fire resistance)

Interoperability

- IFC/IFD Mapping – for machine to machine exchanges

BENTLEY GRAPHISOFT Autodesk SOLIBRI NavisWorks NEMETSCHEK TIMBERLINE +300 more

Some of the Information Delivery Manuals

IDM (Information Delivery Manuals) are defined data points that support specific process needs in the building lifecycle. In a portal environment they act as object filters.

- Costing
- Geometry
- Early Planning
- Space
- Energy
- LEED
- Site
- Occupancy
- Electrical Engineering
- HVAC
- Piping
- Functional Parts
- COBIE-Owner Turnover
- Maintenance
- Scheduling
- Performance & Code

buildingSMART Initiative

NBIMS Capability Model

BIM Capability Maturity Model

Maturity Level	A Data Richness	B Life-cycle Views	C Roles Or Disciplines	D Business process	E Delivery Method	F Timeliness/ Response	G ITIL Maturity Assessment	H Graphical Information	I Spatial Capability	J Information Accuracy	K Interoperability/ IFC Support
1	Basic Core Data	No Complete Project Phase	No Single Role Fully Supported	Separate Processes Not Integrated	Single Point Access No IA	Most Response Info manually re-collected - Slow	No ITIL Implementation	Primarily Text - No Technical Graphics	Not Spatially Located	No Ground Truth	No Interoperability
2	Expanded Data Set	Planning & Design	Only One Role Supported	Few Bus Processes Collect Info	Single Point Access w/ Limited IA	Most Response Info manually re-collected	Initiation	2D Non-Intelligent As Designed	Basic Spatial Location	Initial Ground Truth	Forced Interoperability
3	Enhanced Data Set	Add Construction/ Supply	Two Roles Partially Supported	Some Bus Process Collect Info	Network Access w/ Basic IA	Data Calls Not In BIM But Most Other Data Is	Limited Awareness	NCS 2D Non-Intelligent As Designed	Spatially Located	Limited Ground Truth - Int Spaces	Limited Interoperability
4	Data Plus Some Information	Includes Construction/ Supply	Two Roles Fully Supported	Most Bus Processes Collect Info	Network Access w/ Full IA	Limited Response Info Available In BIM	Full Awareness	NCS 2D Intelligent As Designed	Located w/ Limited Info Sharing	Full Ground Truth - Int Spaces	Limited Info Transfers Between COTS
5	Data Plus Expanded Information	Includes Constr/Supply & Fabrication	Partial Plan, Design&Constr Supported	All Business Process(BP) Collect Info	Limited Web Enabled Services	Most Response Info Available In BIM	Limited Control	NCS 2D Intelligent As-Builts	Spatially located w/Metadata	Limited Ground Truth - Int & Ext	Most Info Transfers Between COTS
6	Data w/Limited Authoritative Information	Add Limited Operations & Warranty	Plan, Design & Construction Supported	Few BP Collect & Maintain Info	Full Web Enabled Services	All Respoinse Info Available In BIM	Full Control	NCS 2D Intelligent And Current	Spatially located w/Full Info Share	Full Ground Truth - Int And Ext	Full Info Transfers Between COTS
7	Data w/ Mostly Authoritative Information	Includes Operations & Warranty	Partial Ops & Sustainment Supported	Some BP Collect & Maintain Info	Full Web Enabled Services w/IA	All Response Info From BIM & Timely	Limited Integration	3D - Intelligent Graphics	Part of a limited GIS	Limited Comp Areas & Ground Truth	Limited Info Uses IFC's For Interoperability
8	Completely Authoritative Information	Add Financial	Operations & Sustainment Supported	All BP Collect & Maintain Info	Web Enabled Services - Secure	Limited Real Time Access From BIM	Full Integration	3D - Current And Intelligent	Part of a more complete GIS	Full Computed Areas & Ground Truth	Expanded Info Uses IFC's For Interoperability
9	Limited Knowledge Management	Full Facility Life-cycle Collection	All Facility Life-Cycle Roles Supported	Some BP Collect&Maint InReal Time	Netcentric SOA Based CAC Access	Full Real Time Access From BIM	Limited Optimization	4D - Add Time	Integrated into a complete GIS	Comp GT w/Limited Metrics	Most Info Uses IFC's For Interoperability
10	Full Knowledge Management	Supports External Efforts	Internal and External Roles Supported	All BP Collect&Maint In Real Time	Netcentric SOA Role Based CAC	Real Time Access w/ Live Feeds	Full Optimization	nD - Time & Cost	Integrated into GIS w/ Full Info Flow	Computed Ground Truth w/Full Metrics	All Info Uses IFC's For Interoperability

Facility Information Council Partner Effort International Codes Council Code

C:\Documents and Settings\All Users\Documents\Shared Projects\icc 2\failure\example2b.htm - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address C:\Documents and Settings\All Users\Documents\Shared Projects\icc 2\failure\example2b.htm

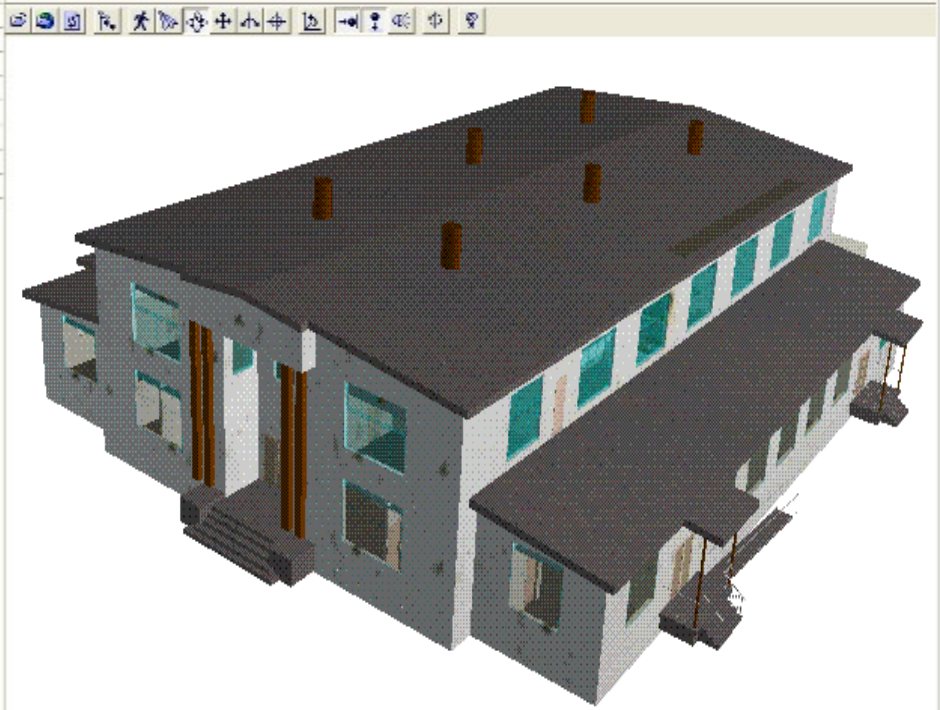
Instance Failure

Project	*prj001*
Description	
Location	*Ulverton*
Identifier	*p23456789012345678901 2*
Wall	*wall-1*
Description	*South west gable wall*
Location	*level 1*
Identifer	*o23456789012345678901 2*

Clause iecc2006.502.5 applies.

- *filter A1 applies - 'framed' .eq. true*
- *filter A2a applies - 'wall' .eq. true*
- *exception E1 fails - 'ventilated' .eq. true*
- *exception E2a fails - 'zone' .eq. 1*
- *exception E2b fails - 'zone' .eq. 2*
- *exception E2c fails - 'zone' .eq. 3*
- *exception E3a fails - 'moistureproof' .eq. true*
- *exception E3b fails - 'frostproof' .eq. true*
- *exception E3b fails - 'condensationproof'> .eq. true*
- *requirement R1 applies 'vapor retarder' 'existance' .eq. true*
- *requirement R2 fails 'vapor retarder' 'permeance' 'le.' '1'*

requirement R2 evaluated to false!



Clause iecc2006.502.5 (hyperlink) on 'vapor retarders' is FAILED.

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Facility Information Council Partner Effort Open Geospatial Consortium Web Services 4

- Standards-based Web Service architecture and technologies tested against GSA and DOD business cases:
  - Provide feedback to IAI International IFC work
  - Compliment National BIM Standard development activity

- December 2006 Demonstration – Location of Field Hospital as part of regional emergency event
  - BIM, Geospatial, and real time (sensor) integration / fusion
  - Newark Airport
  - Port Authority of NY / NJ hosting

Linking CAD-GIS-BIM

- Business Drivers
- Interoperability
- Common Operational Picture
- Universal Concepts and Information Exchanges
- NIBS.org/NBIMS website