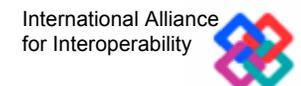


building**SMART**alliance™

***AECOO Testbed  
2007-2008***



## *Industry Transformation for Efficiency and Competitiveness*

---

- The capital facility industry is a key player in fostering energy conservation
  - facilities consume 40% of the energy and 65.2% of total U.S. electricity consumption
- The industry is a key player in environmental management
  - facilities contribute 40% of the emissions and 20% of volume to landfills
  - 40% of global raw materials are consumed by buildings
- Construction spending in the United States is estimated to be \$1.288 trillion for 2008
- Construction Industry Institute estimates up to 57% non-value added effort or waste is present in the current business model
- Stakeholders in the construction industry need to address competitive business advantage and the urgent need and responsibility for maximizing their portion of services that add value in facilities
- To make these transformations a lifecycle view is required.
  - When sustainability is not incorporated, the waste associated with current design, engineering, and construction processes and business practices grows exponentially throughout the rest of the life of a facility

- “buildingSmart” – Optimizing building life cycle value using IFC-BIM
- Optimizing the facility life cycle value chain
- Building smart teams, contracts
- Building smart processes; supply chains
- Building smart buildings
- Optimizing value (profits) for individual participants

[www.buildingsmartalliance.org](http://www.buildingsmartalliance.org)

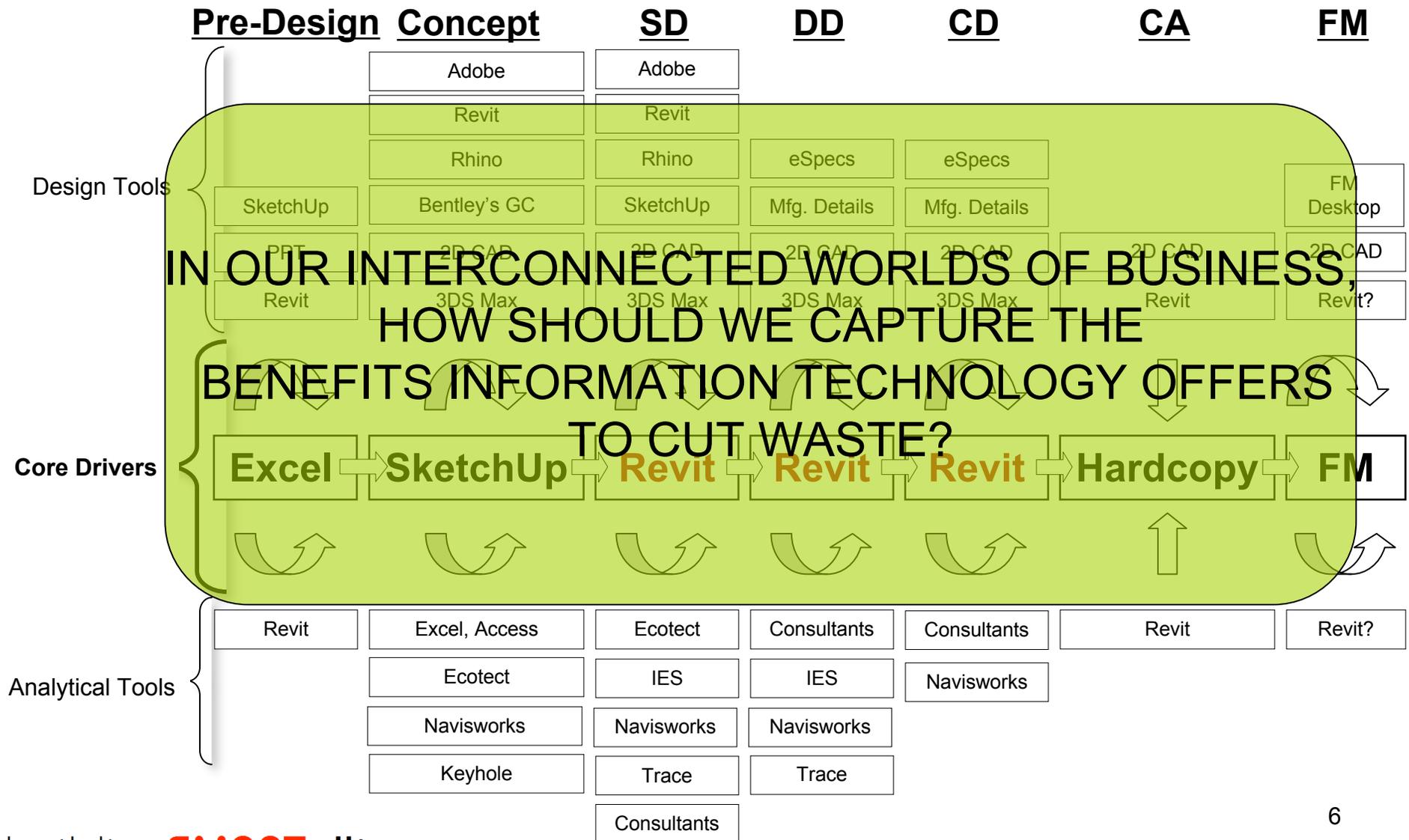
- How do we develop our standards?
- How do we make our standards Standards?
- What can buildingSMART learn from OGC? How can we cooperate to benefit members of both organizations?

## *Our Observations About AECOO Data Processing and Communication*

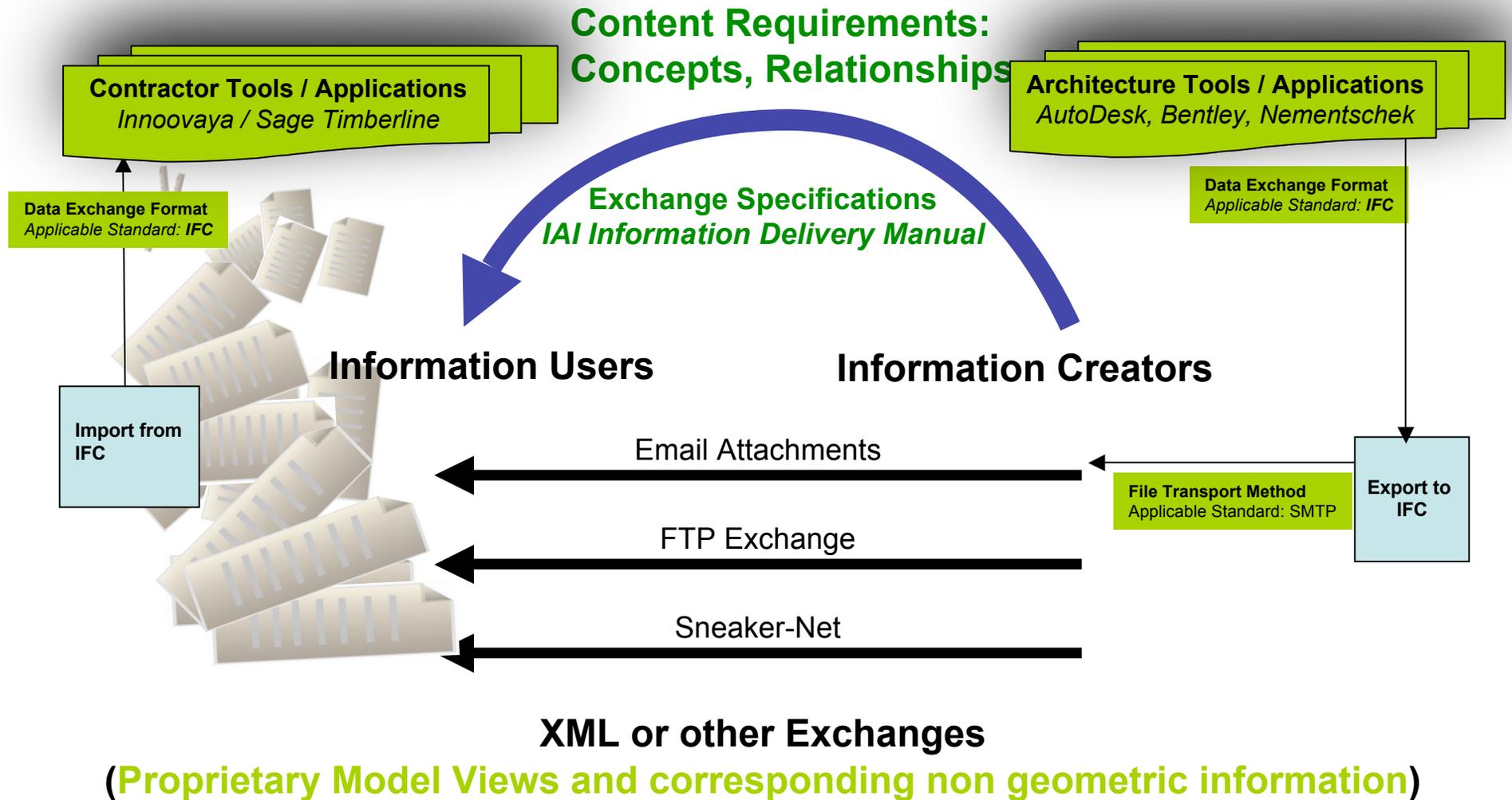
---

- The capital facilities industry has grown increasingly more technically sophisticated
- Community remains fragmented both in terms of processes and data processing automation - lots of standards actors in a vibrant business environment
- As we move into more interconnected business relations we need to begin to pay attention to risk, time savings, lower integration cost, facilitated team approaches with software.
  - Passing information from one domain to another typically involves manual processes including re-creation of data, imperfect translators, or proprietary and specific software integrations.
  - NBIMS, IAI are positive reactions to market dysfunctions.

# The Situational Environment for NON-Interoperability in the AECOO Industry



# Primitive File Based Information Exchange



## *SOME REALLY GOOD STARTING POINTS*

---

- Global IFC - COMMON DATA MODEL FOR BUILDING OBJECTS
- Global IDM APPROACHES AND.....
- CONNECTION TO Global IFD
- All of the above can be localized
  
- MVD
- IFC compliant software, tools and systems for a variety of technical operations
- AIA - Integrated Project Delivery Process
  
- NBIMS Outputs

- Object-oriented technology
  - Objects encapsulates identity, behavior and data
  - Allows inheritance from parent classes
  - Class defines a family of objects
  - Instance defines a specific individual object
  - Instances (can) have attributes (to store data for the instance)
  - *behavior left to vendors*

## *Some Areas Where Work is Necessary*

---

- What still needs to be addressed are
  - Consensus methods and mechanisms for passing semantic and behavior information from one party to another in a loss-less manner and from one domain to another in ways the receiver understands
  - This additional requirement makes possible using, re-using, and re-purposing data across lifecycle phases and those who operate businesses in any part
- Get Software to behave well with workflow offers powerful benefits to the building industry
  - Unambiguous exchanges of building object information between project stakeholders is as essential to project well-being as is managing the information within a stakeholder organization.

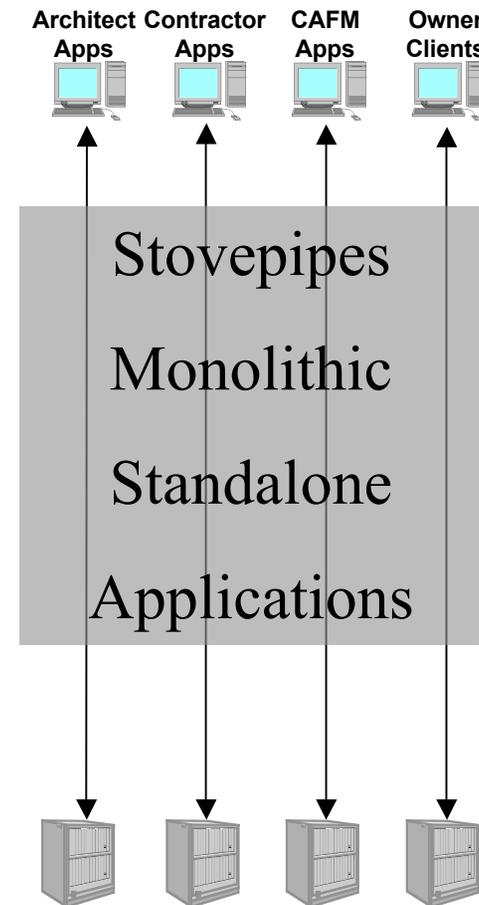
## Workflows for Business Communications

---

- Each phase of a building requires all stakeholders to start over with information creation
- **Right Now Within and Across any phase there are no fluid exchanges**
  - What is passed are files - not Information
- Information needs to flow like the way stakeholders conduct their business - with communications and conversations & No two business may use the same software
  - Questions come up
  - Issues need to be tracked
  - Contracts and related information needs to be developed
  - These conversations involve data that are housed in a BIM
  - Business processes need to utilize BIM object data within other software
- So long as different applications and different vendors understand information semantics and adopt consensus based service communications interfaces seamless data exchange and sharing can begin to happen.
- Otherwise, file sharing and its attendant issues persist

## Purpose of the AECOO Testbed

- Success - is solving a limited set of interoperability problems
- **Establish a joint initiative to unite the AECOO community to address industry wide waste and inordinate life cycle costs caused by stovepipe information**
- **Promote a cooperative model that reduces information bottlenecks and promotes sustainability across all building life cycle phases**
  - Address ROI - Illustrate value of sharing BIM information across the building lifecycle
  - Work to engage relevant standards organizations in a collaborative environment – leveraging their standards, best practices and processes to resolve business issues
  - Align the international technology provider industry to participate in standards development, testing and validation



## *AECOO Testbed Status*

---

- Conducted jointly with IAI / buildingSMART – participation open to IAI, OGC members and leverage OGC testbed process, policies and procedures
  - Executing Concept Development Phase
- Sponsorship (requirements and financial support) confirmed from:
  - Associations and SDO's
    - LFRT (Large Firm Round Table)      - AIA                              - buildingSMART alliance
  - Individual Firms and Organizations
    - HOK                              - Burt Hill                              - Gilbane
    - Webcor                              - Ellerbe Becket                      - GSA
- Other Sponsors actively being sought to complete necessary funding to proceed

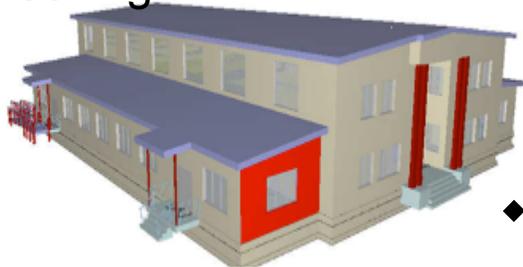
# Sponsor Defined AECOO Testbed Planning Evaluation for Scoping

---

- Building Phase focus in Testbed
  - AIA Integrated Project Delivery - Design elements
- Questions Under Evaluation
  - Question 1: During design, what **information exchanges** need to happen between BIM software and energy modeling software?
  - Question 2: During design, what **information exchanges** need to happen between BIM software and cost estimating software?
  - Question 3: There are numerous types of legal, contractual, and financial communications that take place between architects, owners and construction companies during the planning, design and construction phases. Many of these communications track decisions, submittal progress, cost and budget issues, and follow the trail of questions and answers, and many of these communications may refer, or otherwise relate, to a building information model. What **information flow capabilities** should be in place to handle these information exchanges among and between construction management software?

# AECOO Testbed

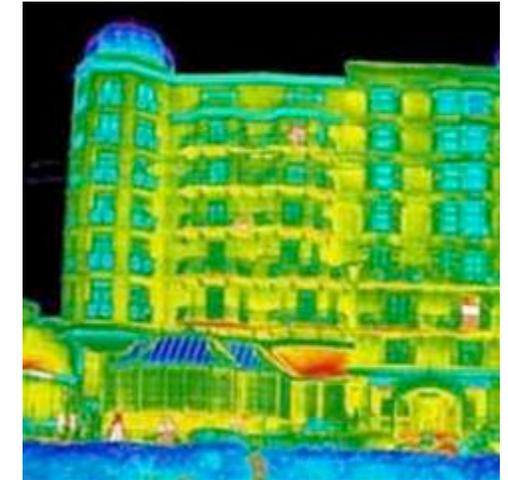
Energy Code Compliance Checking



SMARTcodes<sup>®</sup> INTERNATIONAL CODE COUNCIL

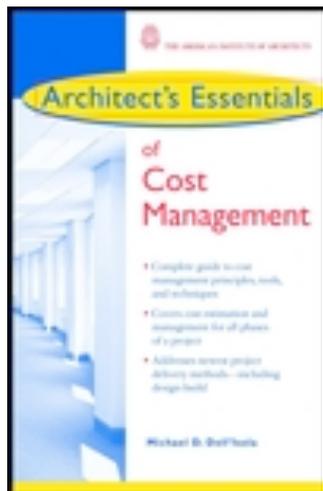


International Alliance for Interoperability  
**OGC**<sup>®</sup>  
Open Geospatial Consortium, Inc.



Energy Analysis Practices

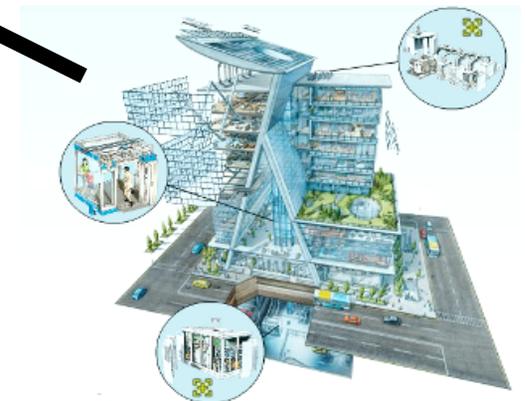
Costing Practices



AECOO Testbed

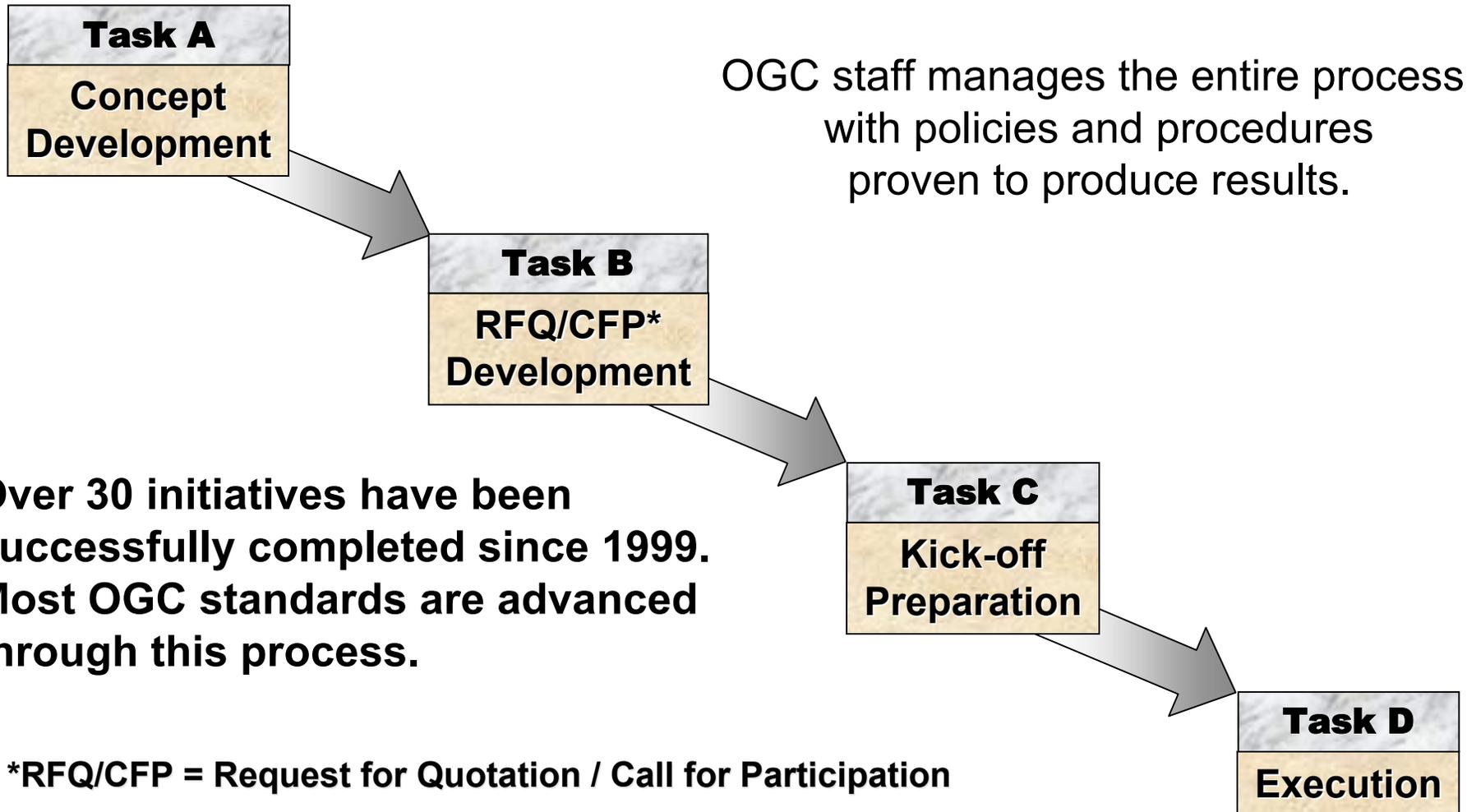


LEAN & LEED Buildings



## OGC Testbed Approach

---

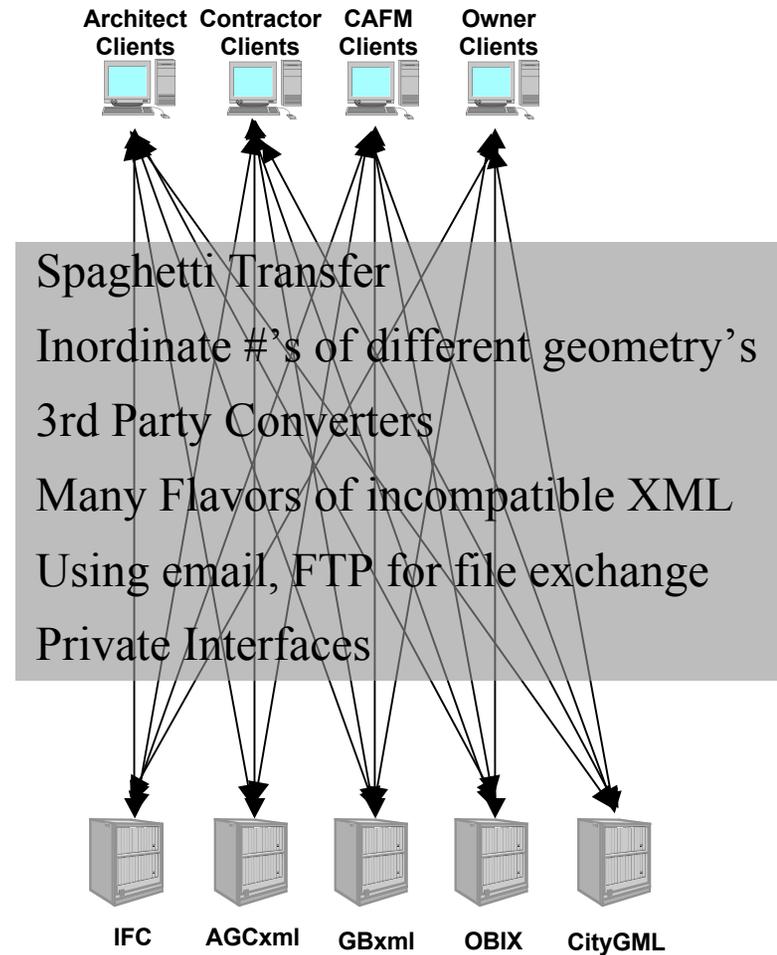


# Roles in AECOO Test Bed



- **Initiative Sponsors**, contribute resources – funding, personnel, facilities. Sponsors specify interoperability requirements to advance testbed objectives including the development of use cases, technology objectives, and schedule.
- **Collaborating Partners**, Alliance organizations that contribute resources and relevant documents towards advancement of testbed goals and have reciprocal standards roles across the community - IAI International, AIA, AGC, CSI, CURT...
- **Initiative Participants**, mainly technology provider companies, formally propose solutions in response to a Request / Call For Participation and are evaluated to determine their ability to address one or more initiative requirements. If selected, these organizations will address initiative requirements for standards development, update their technologies to use these standards, and participate in tests and demonstrations.
- **Interoperability Program Team**, OGC staff and consultants facilitates the overall process. OGC staff work with the Sponsors to: develop, publish and evaluate Requests for Technology (RFTs), Requests for Qualification (RFQs), and Calls for Participation (CFPs); manage initiatives; and provide liaison with other industry consortia and *de jure* standards organizations.

- Develop service infrastructure for stakeholder communication with software independent standards
- Share information across different intelligent 3D building models
  - Visualize facility appearance, function and context
- Demonstrate workflows between building model and construction management software to expedite design decisions and communications between all stakeholders
- Harmonize a number of xmls so that dissimilar software can communicate
  - Reusable service interfaces - enable information orchestration with existing flavors of industry XMLs
  - Avoid an incomprehensible babble of service interfaces



# *Addressing Top Industry-at-Large Issues About Information Exchange*

---

- Workflow to capture exchanges for project communications, energy analysis and cost estimating
  - Collaborative tools for “Specified Data Exchange” - transparency, accessibility and usability of electronic information for seamless exchange using access controls and data security provisions
    - “Use the best data” - shared resources using accepted business processes with access controls and data security provisions and reusable project schemas by the custodians of building, architecture and construction related data in project settings
  - Specifications for BIM query, display and model views
    - “Selective Access” to support disparate and heterogeneous client applications working with focused subsets of data.
  - Data re-usability and machine interpretability
  - Model repository/model management
- Standard terminology for software messaging
- Standard terminology for content messaging
- Quality assurance methods and procedures

## *Realize the Full Capabilities of IFC's - Considering Building Information Characteristics*

---

- Support requests for data sets using pre-defined and ad hoc selection mechanisms for building views and related parameter and attribute and product data - cross applications
- Support different levels of granularity - sort out irrelevant information
- Support nested query as well as aggregation and inheritance hierarchies
- Service instance-based for short and long data base transaction

# Considering Cross Building and Urban Area Life Cycle Agreements

---

- **IFC** - data representation standard and file format for defining architectural and constructional CAD graphic data as 3D real-world objects (ifc 2x3 and 2x3g)
- **AGC - AGCxml** is an exchange language dealing with transactional data normally exchanged in construction and business-to-business documents.
- **AEC - aecXML** is a data representation standard designed for all the non-graphic data involved in the construction industries
- **AEX** - The Automating Equipment Information Exchange (AEX) project is developing, demonstrating and deploying XML specifications to automate information exchange for the design, procurement, delivery, operation and maintenance of engineered equipment.
- **BACnet (ASHRAE)** - defines an XML data model and Web service interface for integrating facility data from disparate data sources with business management applications. Conforms to Simple Object Access Protocol (SOAP) 1.1 over Hypertext Transfer Protocol
- **cfiXML** - use of XML in the capital facilities industry. including industrial, commercial and institutional facilities, buildings and infrastructure. focuses on technical descriptions of facility items (such as pumps, heat exchangers and other equipment items) that participate in larger business processes such as Request for Quote, Quote, Purchase Order, etc.,
- **GML/CityGML** - geographic mark up language and foundation for OGC Web Services for communication between geographic objects and enterprise applications and a common information model for the representation of 3D urban objects
- **GBxml** - transfer of building information between standalone CAD, engineering analysis and modeling software
- **ASHRAE Guideline 20P: XML Definitions for HVAC&R** - Guideline 20 provide an initial set of XML schemas for HVAC&R information, a development process for ASHRAE and other organizations to develop compatible schemas, and guidance on how to use these schemas for accomplishing HVAC&R related work.

## *Considering a Number of Model Views*

---

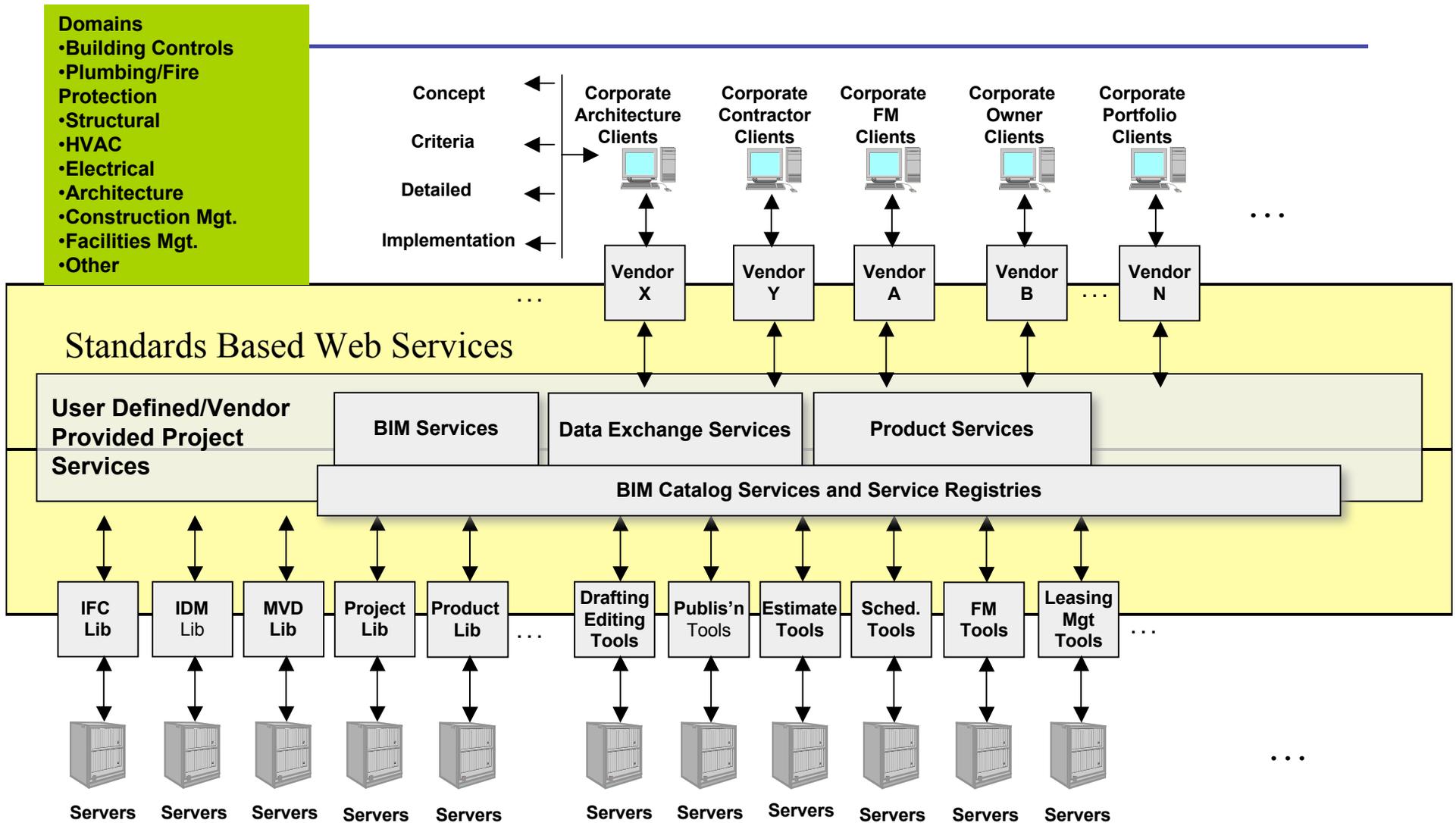
- Architectural to Structural Model View for IFC2x3
  - Evaluating use of pre-cast
- Model View Definition Architectural to Structural
- Model View Definitions Quantity Take-off Levels 1,2, and 3
- Model View Definition Architectural Design to Thermal Simulation

## Considering Existing and New Service Interfaces

---

- Thick Clients and Servers
  - file exchange only
  - Consensus wrappers for file exchange
    - Whole BIM exchange
    - Model View extract to subset file and exchange
- Thin Clients and Servers
  - Community specific data and object exchange Extension of standards as required by the user
    - OGC Web Services Common
    - OGC Web Processing Service
    - OGC Catalog Service
    - OGC Coordinate Transformation Service
    - OGC Feature Portrayal Service
    - Information Framework for Dictionaries API
    - OGC Web Feature Service For BIM
    - Integration with other AEC community xml
  - OASIS Standards for workflow
  - Internet Standards - HTTP, WSDL

# A Notional Reference Information Architecture

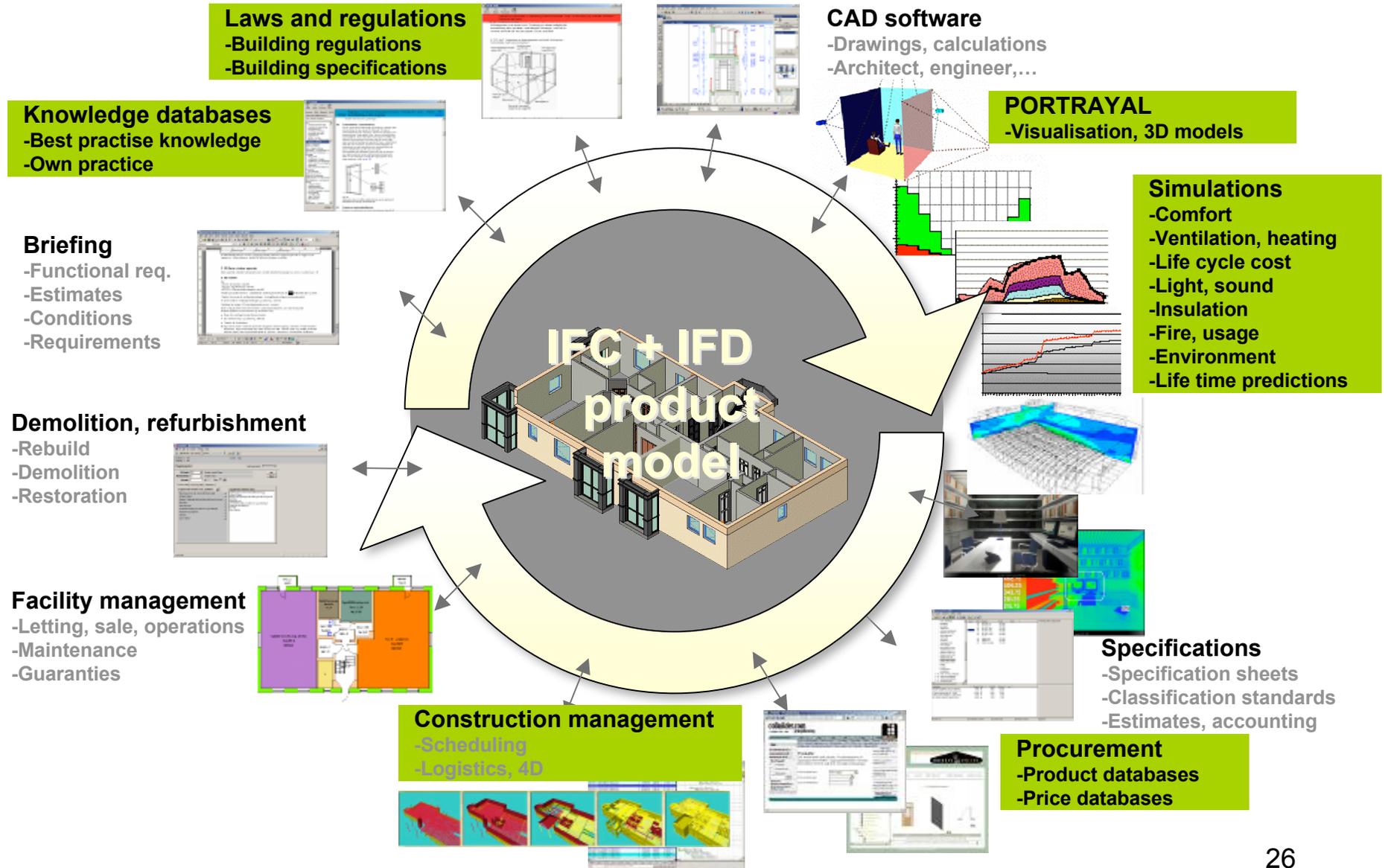


## Considering Demonstration Objectives

---

- Build and demonstrate reference test cases that enable software vendors and end users to know whether specific products can interoperate effectively
- Demonstrate in workflow setting
  - Client and servers working together to show information capability to query and view a model, or its parts and to be notified of changes with thick and thin clients
  - Use of IDM and IFD practices
  - Integration of model development, costing and energy analysis approaches
  - Data and data subset messaging using service and information specifications for workflows with thick and thin clients
  - Data re-usability and seamless machine interpretability
  - Communication of relevant information to tradecrafts (plumbing, electrical, etc) with information discovery, sharing, publishing and editing capabilities
  - Collaborative tools for sharing cost estimating input and output and energy analysis in rich internet application settings
  - Quality assurance methods and procedures

# Business Processes - Demonstration Aspects



## *Preliminary AECOO Testbed Development Schedule*

---

- November 2007 to March 2008 - Concept Development Phase
  - Develop preliminary reference (standards) architecture by defining Enterprise, Information and computational viewpoints (based on Sponsor business cases)
  - Emphasis on relevant / existing standards - IAI, OASIS, CSI, OGC...
  - Prepare and release a Request for Technology (RFT) to industry
  - Prepare and release a Request for Quotation / Call For Participation (RFQ/CFP) for industry proposals
- March 2008 - Execution Phase
  - Period for response to and evaluation of Request for Quotation/Call for Participation
  - Negotiations with Participants; Sponsor approval to proceed
- April / May 2008 - Test Bed Execution Kick-off
- December 2008 - Public Demonstration

## *RFT Responses*

---

- Preliminary definitions of Architecture Viewpoints
  - Scenarios featuring stakeholder communications and business work flow using BIM, energy analysis and cost estimating - sharing information more seamlessly
  - Enterprise,
  - Information, and
  - Computational
- Request industry comment and response
  - Suggested ways to address the 3 questions
  - Respond with ideas on ways to address our “considerations”
  - Suggestions on ways to deal with MasterFormat/UniFormat in standards
    - across design and construction stakeholders - can OmniClass fill the gap
  - Suggestions about computational standards to derive partial model views
  - Suggestions about connecting building coordinates with the outside world

# The buildingSMART™ Programs

## STAKEHOLDERS

Enhance Economic Impact

Educate Practitioners & Users

**The Information Interoperability Challenge -  
Addressing User Driven Requirements  
for Market Adoption**

Support Business Practice

Empower Users

Provide Visualization

Foster Alliances & Standards

Support Real Property Community

Promote Research & Development

**Thank You**

© 2004 ABC Infosystems, Inc.  
Building Image - Graphisoft

buildingSMART

Foundation of Construction Information in the US  
Supporting Productivity Transformation



***The Information Interoperability  
Challenge - Addressing User Driven  
Requirements for Market Adoption***

***Thank You***