developing open information exchange standards

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what is interoperability?

“a property referring to the ability of diverse systems and organizations to work together.”

what is interoperability?

“The ability of software and hardware on multiple machines from multiple vendors to communicate.”

ref: *DLI Glossary*, Grainger Engineering Library, University of Illinois at Urbana-Champaign, http://dli.grainger.uiuc.edu/glossary.htm (cited 30-June-08)
what is interoperability?

“The ability of different types of computers, networks, operating systems, and applications to work together effectively, **without prior communication**”

what is interoperability?

“to work with other systems or products without special effort on the part of the customer.”

what is interoperability?

The ability to ...

“implement and manage collaborative relationships among members of cross-disciplinary teams”

“manage and communicate electronic product and project data among collaborating firms”

how is it defined?

Please, tell us what you want...  ...can’t you tell us what we want?

Unfortunately....

User’s inability to clearly define detailed requirements requires software companies to make assumptions that may not work for a wider audience.
tightly coupled interoperability

**Pro’s**
- inexpensive to define limited requirements
- rapid implementation in vendor software

**Con’s**
- resulting capability limited
- directly linked to vendor-specific solutions
- custom software development
- expensive to maintain
- may be “owned” by one or more participants

*provides rapid, expensive, short-lived solutions*
loosely coupled interoperability

Pro’s
inexpensive evaluation of cursory requirements
rapid demonstrations

Con’s
resulting capability does not solve the problem
resulting capability based on custom platforms
directly linked to vendor-specific solutions

provides rapid, state-of-practice descriptions
interoperability is overrated!

• vagueness in process allows sloppiness in result
  – “special” configuration settings
  – tech support not aware of “special” settings
  – not repeatable without specific software stack
  – not enforceable by contract

• vagueness of results in misplaced expectations
  – frustration
  – proprietary specifications
performance-driven interoperability

Pro’s
requirements owned by stakeholders
provides open-solution to defined problem
path from current to future requirements
platform/version neutral solutions
empowers market innovation

Con’s
buy-in from major stakeholder (reps.)
buy-in from major professional/trade assns.
meetings & coordination required
management of expectations
requires preparation of contract specifications

provides long-term solutions at least total cost
contracted information exchanges

• in contracts today
• in paper or e-paper formats
• examples in owner-based contracts include:
  – design deliverables
  – quality certifications
  – construction submittals
  – handover documents
contracted information exchanges

*specifications define:*

- information content
  - based on national consensus
  - Likely to be international variation
- deliverable timing
- format of data exchange
  - non-proprietary international standard
  - widely used by vast majority of stakeholders
contracted information exchanges

from e-paper to useful information

– an open process to update these specs
– software to import/export the data
– parties must use the specs
– outreach to community
  • demos with full disclosure of settings
  • repeatable at local end-user offices
information exchange roadmap

process designed to have questions answered up-front

subject matter experts, not consultants, drive the process

it is a “problem solving” not a “technology tinkering” process

technical work and pilots can be done in 12-24 months

goal is to meet 80% solution, don’t let perfection get in the way of progress

industry-wide adoption, well, we’ll all work on that one!
1. form team

teams are formed by subject matter experts to solve specific problems

teams need to have appropriate stakeholder representation

the Alliance supports teams with websites, listserve

if team are Bronze or better, Alliance will hire ‘guide’ through process

a concise statement about specific exchanges causing problem

*lessons learned – don’t start with IFC, start with clear problem statement*
1. form team (cobie)

- today, handover information is created and lost *several* times

- designer creates space and equipment layouts

- construction contractor post-construction survey

- surveys “stored” in boiler rooms

- *(maintenance contractor paid to survey building)*

- hand load data into maintenance system
1. form team (cobie)

owners, designers, builders, operators, 3rd party providers
i.e. all parties who contribute/produce/use handover data
2. process maps

who needs what information when

uses Business Process Modeling Notation (www.bpmn.org)

creates “swim lane” diagrams

identifies what information is given to whom, when

clearly defines the exchanges that, if resolved, would solve the problem
2. process maps (cobie)

ref: http://www.wbdg.org/pdfs/erdc_cerl_tr0730.pdf
2. process maps (cobie)

ref: http://www.wbdg.org/resources/cobie.php
3. exchange requirements

based on “swim lane” diagram

define what information is exchanged, during context of process

compare to existing sources of data for this exchange

find out where the gaps are between today and what’s needed

a concise statement about specific data on “swim lane” arrows
3. exchange requirements (cobie)

Subject matter experts document what data is needed when...

ref: http://idm.buildingsmart.no/confluence/display/IDM/COBIE+Project
4. ifc mapping

first step to consider actual ifc model

ifc modeler support recommended for this step

“model view definition” is coordinated with international IAI

identify if existing IAI activities have/are working on this

implementation formats developed in “human usable” format also
4. ifc mapping (cobie)

**Information Requirements**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Preparer</td>
<td>The provisions of the exchange requirement COBIE-EX-01 must be provided as a wrapper that identifies the entity to which these floor and spaces belong.</td>
<td>Preparer</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Preparer</td>
<td>Site (General) information must be provided to identify the site space which will be the facility context.</td>
<td>Preparer</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Preparer</td>
<td>Facility (General) information must be provided to identify the facilities in which floors and spaces may be found.</td>
<td>Preparer</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Preparer</td>
<td>Provide the name of each conceptual/physical vertical level if each of the buildings in the project wrapper.</td>
<td>Preparer</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Space Name</td>
<td>Provide the same name and floor for each space.</td>
<td>Space Name</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Space Function</td>
<td>Identify the primary function of the space using the OwnClass or locally assigned spatial identification schemes.</td>
<td>Space Function</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Space Indicators (Coordinate)</td>
<td>Identify the x and y coordinates, floor type and other information defined in the IfcIndicators which are used to identify the space.</td>
<td>Space Indicators</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Space Area (Area)</td>
<td>Provide one or more numerical values to manage the space size. These values are defined by ANL2070 or other authoritative sources that are logically identified in the exchange data.</td>
<td>Space Area (Area)</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Space Noting</td>
<td>Identify sensor or space identifiers that control the space. The name of these spaces will typically refer to various conceptual names within the building that have a similar or general pattern of use. For example, zones may refer to mechanical heating, cooling, electrical systems, etc.</td>
<td>Space Noting</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>Authoritative Source</td>
<td>The user responsible for creating the project wrapper data set.</td>
<td>Authoritative Source</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
<tr>
<td>History</td>
<td>All versions of information captured in the project will be provided in the IfcSplash that is explicitly identified.</td>
<td>History</td>
<td>Designed</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

Ref: [http://idm.buildingsmart.no/confluence/display/IDM/COBIE+Project](http://idm.buildingsmart.no/confluence/display/IDM/COBIE+Project)

**ICF Entities Required**

- IfcElement
- IfcObject
- IfcProduct
- IfcRoot
- IfcSpace
- IfcSpatialStructureElement
- IfcSpaceModule
- IfcTask

**ICF Datatypes Required**

- IfcElementCompositions
- IfcGloballyUniqueID
- IfcDescription
- IfcOrderable
- IfcRelPlacement
- IfcRelParameterAssignment
- IfcText
- IfcLengthMeasure

**IFC Functions Required**

- *

**ICF Property Sets Required**

- Piet_SpaceCommon

**IDM Functional Parameters**

- fp_address
- fp_aggregates
- fp_apply_owner_history
- fp_apply_quantity
- fp_contains_in_space
- fp_define_by_properties
- fp_defines_in_space

Ref: [http://idm.buildingsmart.no/confluence/display/IDM/Model+Space+%28FP%29](http://idm.buildingsmart.no/confluence/display/IDM/Model+Space+%28FP%29)

5. example files

“a picture is worth a thousand words”

examples from real, but “sanitized” projects for public release

examples should exercise several exchange parts

examples should demonstrate who provides what data

examples help exercise problem statement and prior steps
5. example files (cobie)

multiple mappings to formal ifc definitions may be required

ifcXML file of ifcSpace object

spreadsheet format (for us humans!) can also be used!

cobie format translator available to vendors
cobie spreadsheet examples available through WBDG
5. example files (cobie)
5. example files (cobie)
6. contract specs

if it is not in a contract, it won’t be used

find current information exchanges on which project is based

modify those examples to change “format” and “content” of deliverable

specification states who provides what data, when

specification must include true cost of information exchange failure
6. contract specs (cobie)

- replaces paper-based specifications
- designer submits space and equipment layouts with plans and specs
- construction contractor loads mfg, serial, and tag no’s
- commissioning agent provides job plans
- final deliverable eliminates paper reproduction

ref: http://www.wbdg.org/pdfs/cobie_specification_sections.pdf
7. pilot project

- Ensure release of “sanitized” data is possible
- Use real project and pay for the data by-hand if needed
- Results verify format and specifications
- Results validate scope of problem statement and value of information
7. pilot projects (cobie)

- Overseas Buildings Operations (OBO), U.S. Dept of State
- NAVFAC
- Corps of Engineers

new electronic submittal process
- OBO
- NASA
8. vendor use

by-hand (or partially by-hand) has value now but has limited application

ultimately these exchanges should be transparent to users

consider the example of the ASCII format

vendors demonstrate compliance with information exchange specification

results of demonstrations made public to allow replication of results
8. vendor use (cobie)

Demonstration of Building Information Modeling (BIM) Information Exchange

Background

Today's dynamic project organizations often suffer from the incompatibilities between data content and format created by different project stakeholders. Such incompatibilities are not limited to the exchange of information between multiple software tools. Incompatibilities also arise when different versions of the same software or users have different configurations of the same software versions.

One of the objectives of the buildingSMART Alliance is to create performance-based information exchange specifications. These specifications help project team members to clearly identify the expected content of a given information exchange. To ensure that the data does not have to be retyped from one system to another, the Alliance requires that its information exchange products be based on open-standard formats. To use these definitions of data content and format, contract specifications are being developed to augment or replace the current requirements for paper-based information exchange.

Introduction

The buildingSMART alliance is deeply involved in establishing new approaches to move products and specification forward to the industry as quickly as possible and then to turn those efforts ultimately into consensus standards via NBIMS. We currently have multiple approaches underway to accomplish our goals. One such effort is buildingSMART alliance Project 08 \( \text{\textcopyright} \) COBIE. The effort described below is a work in progress and a test format for future projects that will eventually follow in a similar path. We request your input as to not only this project but also our approach. Your comments should be sent to the Projects Coordinator, Bill East. For this project, Bill is wearing two hats, as he is also the COBIE project manager.
9. submit results

re-package information per NBIMS guidelines

key 1. demonstrate wide stakeholder participation

key 2. non-proprietary, performance-based specification

key 3. no follow-on “harmonization” with “competing standards”
10. consensus standard

NBIMS voting process allows members to make suggestions

key 1. if you left out a group up-front, they may participate now

key 2. non-proprietary, performance-based specification

key 3. reduce follow-on “harmonization” with “competing standards”
11. operational standards

NBIMS will develop process for updating standards over time

key 1. requirements not technology driven

key 2. changes based on problem statement scope and definition

key 3. integration with wider international efforts following use
subject matter experts, not consultants, drive the process

the problem drives the technology, not the other way around

technical work including contracts and pilots in as little as 12 months

phasing allows rapid, measured progress on complex topics

early adoption reduces client-driven requirements/customizations
why?

**rapid adoption**
of non-proprietary specifications for content, timing (and format)

**Owners’ performance specifications**

**Software companies**

**integrators, support contractors**

**Long term innovation**
Allows support ecosystem for widespread implementation

**Cost effective solution**
stable open standards not subject to client- or project-specific deviations.
Clear reduction in information loss.
developing open information exchange standards

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