ITalab Lab.for Information Technology in AEC

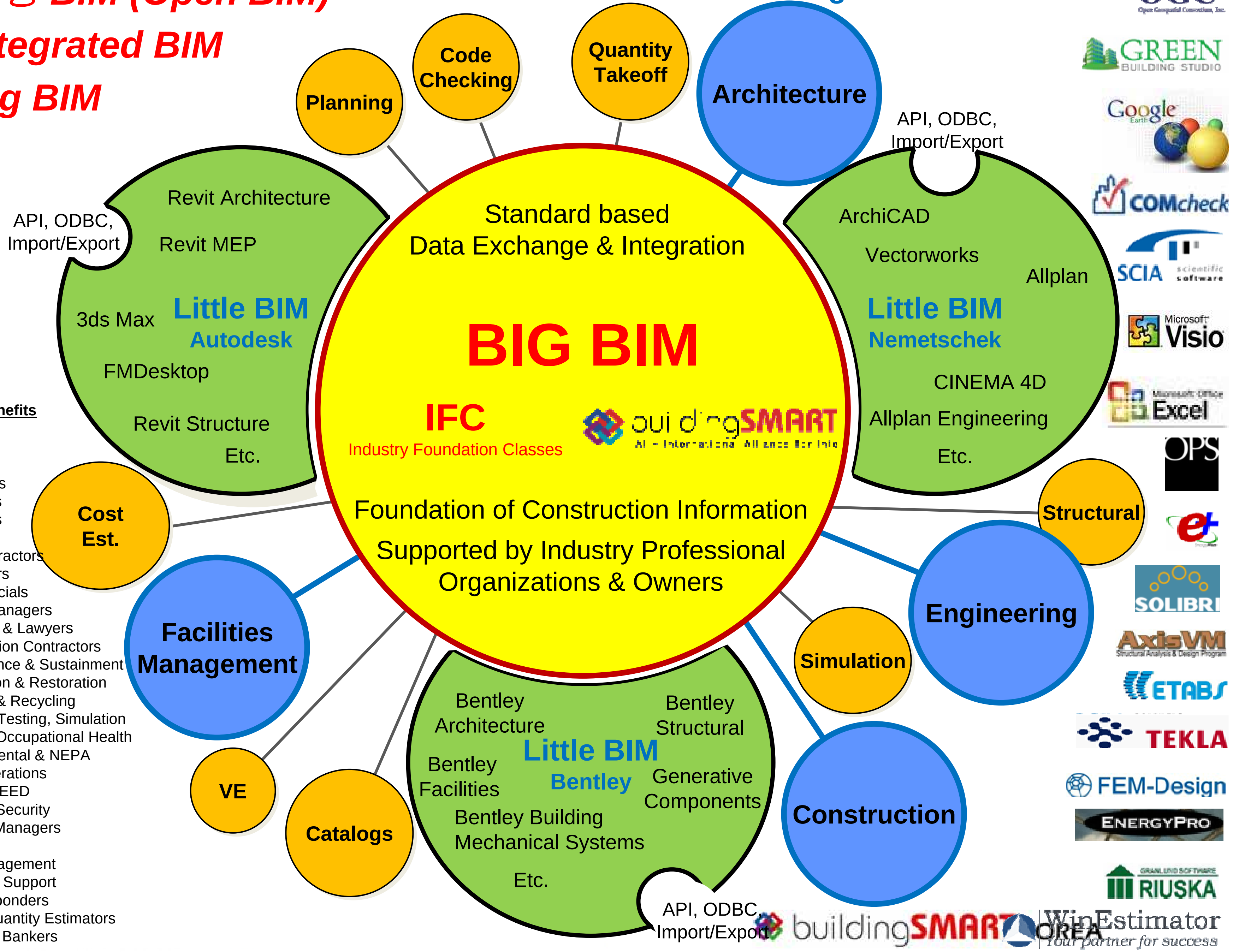
BIM/VDC:Virtual Design Construction
New paradigm in Design/Construction

2008. 10. 19

Inhan Kim
Kyung Hee University

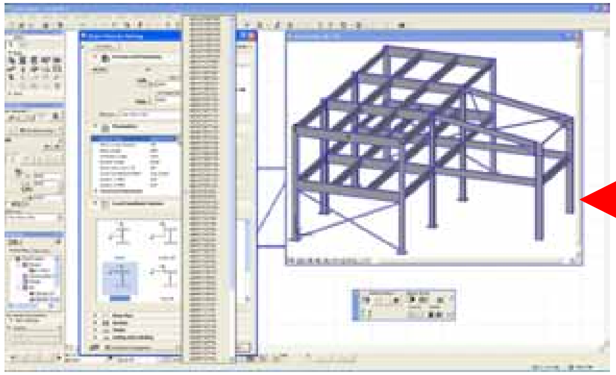
개방형 BIM (Open BIM)
= Integrated BIM
= Big BIM

•Big BIM vs. Little BIM

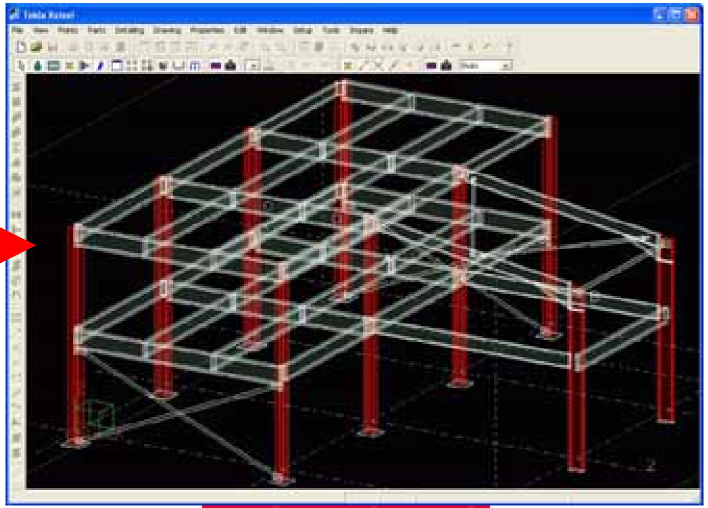

Planning
Code Checking
Quantity Takeoff
Architecture
API, ODBC, Import/Export
Revit Architecture
Revit MEP
3ds Max
Little BIM
Autodesk
FMDesktop
Revit Structure
Etc.
API, ODBC, Import/Export
ArchiCAD
Vectorworks
Allplan
Little BIM
Nemetschek
CINEMA 4D
Allplan Engineering
Etc.
Standard based
Data Exchange & Integration
BIG BIM
IFC
Industry Foundation Classes
buildingSMART
IAI - International Alliance for Info
Foundation of Construction Information
Supported by Industry Professional Organizations & Owners
Cost Est.
Facilities Management
VE
Catalogs
Structural
Engineering
Simulation
Construction
Bentley Architecture
Bentley Structural
Little BIM
Bentley
Bentley Facilities
Generative Components
Bentley Building Mechanical Systems
Etc.
API, ODBC, Import/Export
OGC
GREEN BUILDING STUDIO
Google Earth
COMcheck
SCIA scientific software
Microsoft Visio
Microsoft Office Excel
OPS
e+
SOLIBRI
AxisVM
ETABS
TEKLA
FEM-Design
ENERGYPRO
RIUSKA
buildingSMART KOREA
WinEstimator
Your partner for success

- ***Who Benefits**
- Owners
- Planners
- Realtors
- Appraisers
- Designers
- Engineers
- Specifiers
- Sub-Contractors
- Fabricators
- Code Officials
- Facility Managers
- Contracts & Lawyers
- Construction Contractors
- 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
- Cost & Quantity Estimators
- Mortgage Bankers

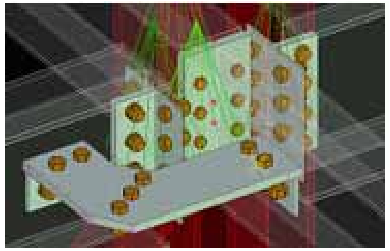
Case Study: Steel Construction

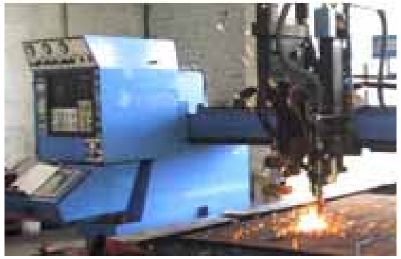


GRAPHISOFT ARCHICAD



TEKLA

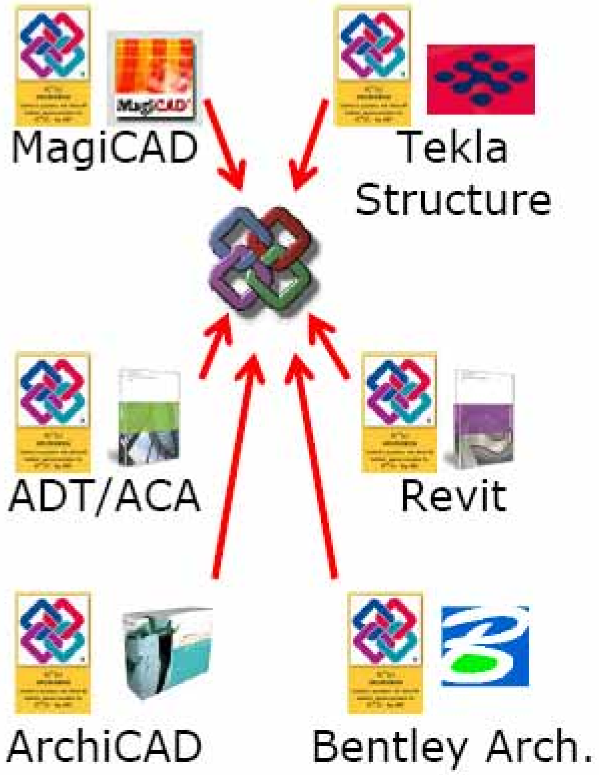




*Source: BIM Seminar Lectures, GraphiSoft

Rambøll principles – why we use IFC

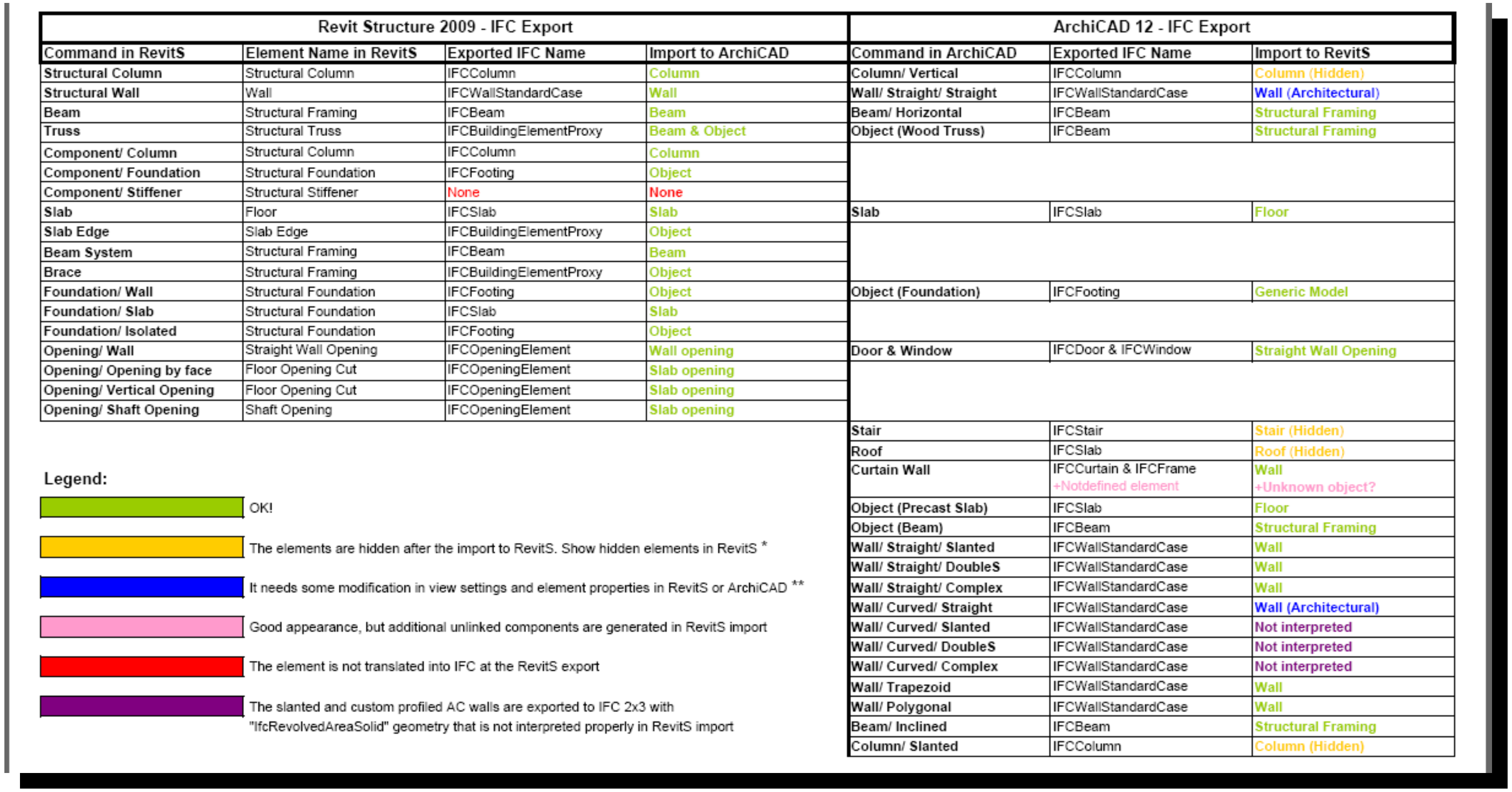
- **The best tool for the job**
  - ➔ Optimal work process
- **Different design partners**
  - ➔ Attract projects/clients
- **Use of IFC**
  - ➔ Allow for flexibility
- **Close dialog with vendors**
  - ➔ Reliable IFC quality


MagiCAD
Tekla Structure
ADT/ACA
Revit
ArchiCAD
Bentley Arch.

*원문: Niels Treldal, Rambøll Headquarters-Using IFC in a real project

IFC Test

- Swedish IFC Workshop, 2008. 09, Stockholm
  Participants: AC, Revit, ADT, Allplan, VectorWorks, MicroStation and Tekla
  Result:
- IFC Validation by buildingSMART Korea



Revit Structure 2009 - IFC Export

Command in RevitS	Element Name in RevitS	Exported IFC Name	Import to ArchiCAD
Structural Column	Structural Column	IFCColumn	Column
Structural Wall	Wall	IFCWallStandardCase	Wall
Beam	Structural Framing	IFCBeam	Beam
Truss	Structural Truss	IFCBuildingElementProxy	Beam & Object
Component/ Column	Structural Column	IFCColumn	Column
Component/ Foundation	Structural Foundation	IFCFooting	Object
Component/ Stiffener	Structural Stiffener	None	None
Slab	Floor	IFCSlab	Slab
Slab Edge	Slab Edge	IFCBuildingElementProxy	Object
Beam System	Structural Framing	IFCBeam	Beam
Brace	Structural Framing	IFCBuildingElementProxy	Object
Foundation/ Wall	Structural Foundation	IFCFooting	Object
Foundation/ Slab	Structural Foundation	IFCSlab	Slab
Foundation/ Isolated	Structural Foundation	IFCFooting	Object
Opening/ Wall	Straight Wall Opening	IFCOpeningElement	Wall opening
Opening/ Opening by face	Floor Opening Cut	IFCOpeningElement	Slab opening
Opening/ Vertical Opening	Floor Opening Cut	IFCOpeningElement	Slab opening
Opening/ Shaft Opening	Shaft Opening	IFCOpeningElement	Slab opening

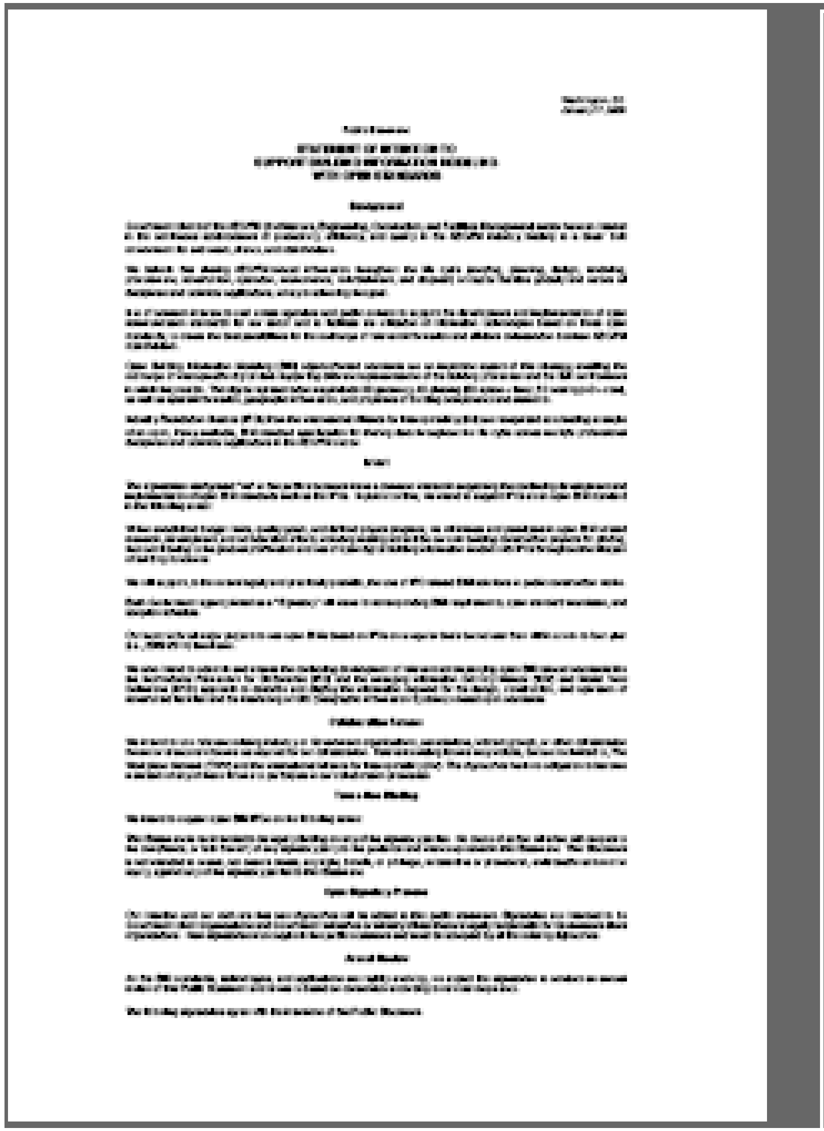
ArchiCAD 12 - IFC Export

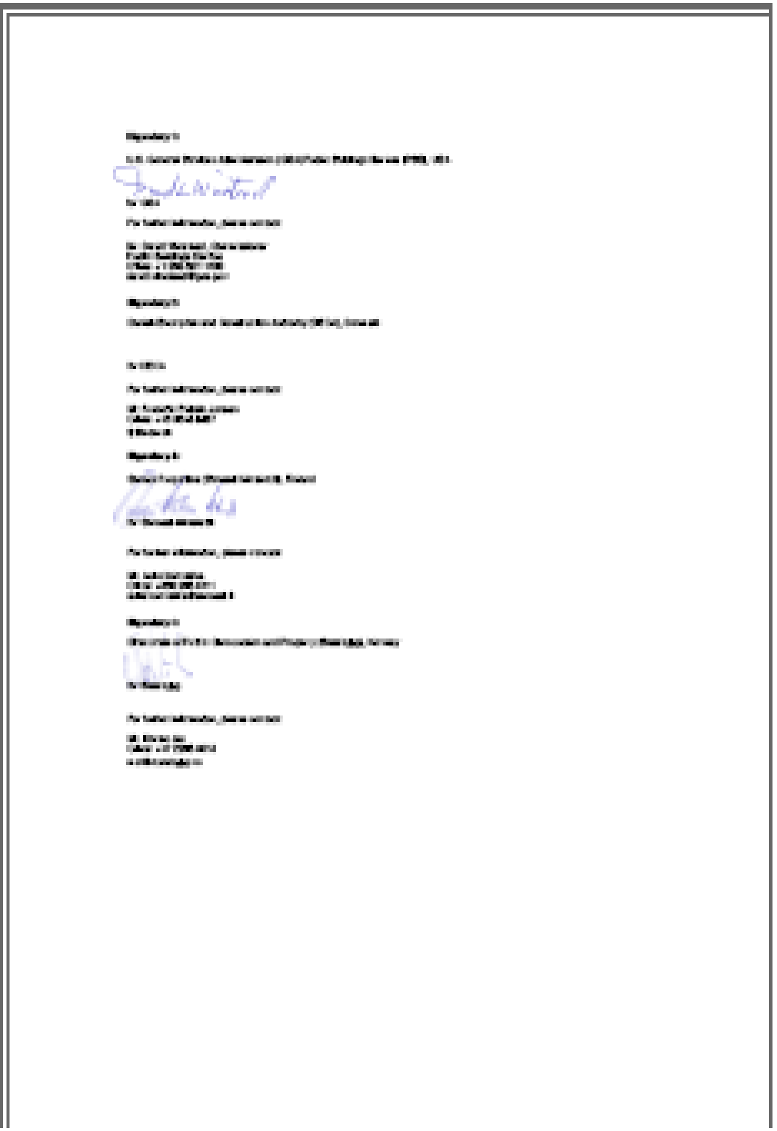
Command in ArchiCAD	Exported IFC Name	Import to RevitS
Column/ Vertical	IFCColumn	Column (Hidden)
Wall/ Straight/ Straight	IFCWallStandardCase	Wall (Architectural)
Beam/ Horizontal	IFCBeam	Structural Framing
Object (Wood Truss)	IFCBeam	Structural Framing
Slab	IFCSlab	Floor
Object (Foundation)	IFCFooting	Generic Model
Door & Window	IFCDoor & IFCWindow	Straight Wall Opening
Stair	IFCStair	Stair (Hidden)
Roof	IFCSlab	Roof (Hidden)
Curtain Wall	IFCCurtain & IFCFrame +Notdefined element	Wall +Unknown object?
Object (Precast Slab)	IFCSlab	Floor
Object (Beam)	IFCBeam	Structural Framing
Wall/ Straight/ Slanted	IFCWallStandardCase	Wall
Wall/ Straight/ DoubleS	IFCWallStandardCase	Wall
Wall/ Straight/ Complex	IFCWallStandardCase	Wall
Wall/ Curved/ Straight	IFCWallStandardCase	Wall (Architectural)
Wall/ Curved/ Slanted	IFCWallStandardCase	Not interpreted
Wall/ Curved/ DoubleS	IFCWallStandardCase	Not interpreted
Wall/ Curved/ Complex	IFCWallStandardCase	Not interpreted
Wall/ Trapezoid	IFCWallStandardCase	Wall
Wall/ Polygonal	IFCWallStandardCase	Wall
Beam/ Inclined	IFCBeam	Structural Framing
Column/ Slanted	IFCColumn	Column (Hidden)

Legend:

🟩	OK!
🟨	The elements are hidden after the import to RevitS. Show hidden elements in RevitS *
🟦	It needs some modification in view settings and element properties in RevitS or ArchiCAD **
▨	Good appearance, but additional unlinked components are generated in RevitS import
🟥	The element is not translated into IFC at the RevitS export
🟪	The slanted and custom profiled AC walls are exported to IFC 2x3 with "IfcRevolvedAreaSolid" geometry that is not interpreted properly in RevitS import

협정 - 미국, 덴마크, 노르웨이, 핀란드





Agreement Draft – Korea, Japan, Singapore, Australia, China(to be confirmed): 2008. 9. 17

1. Membership

- It is proposed that SG, JP, KR, CN and AU form the buildingSMART Asia regional alliance.

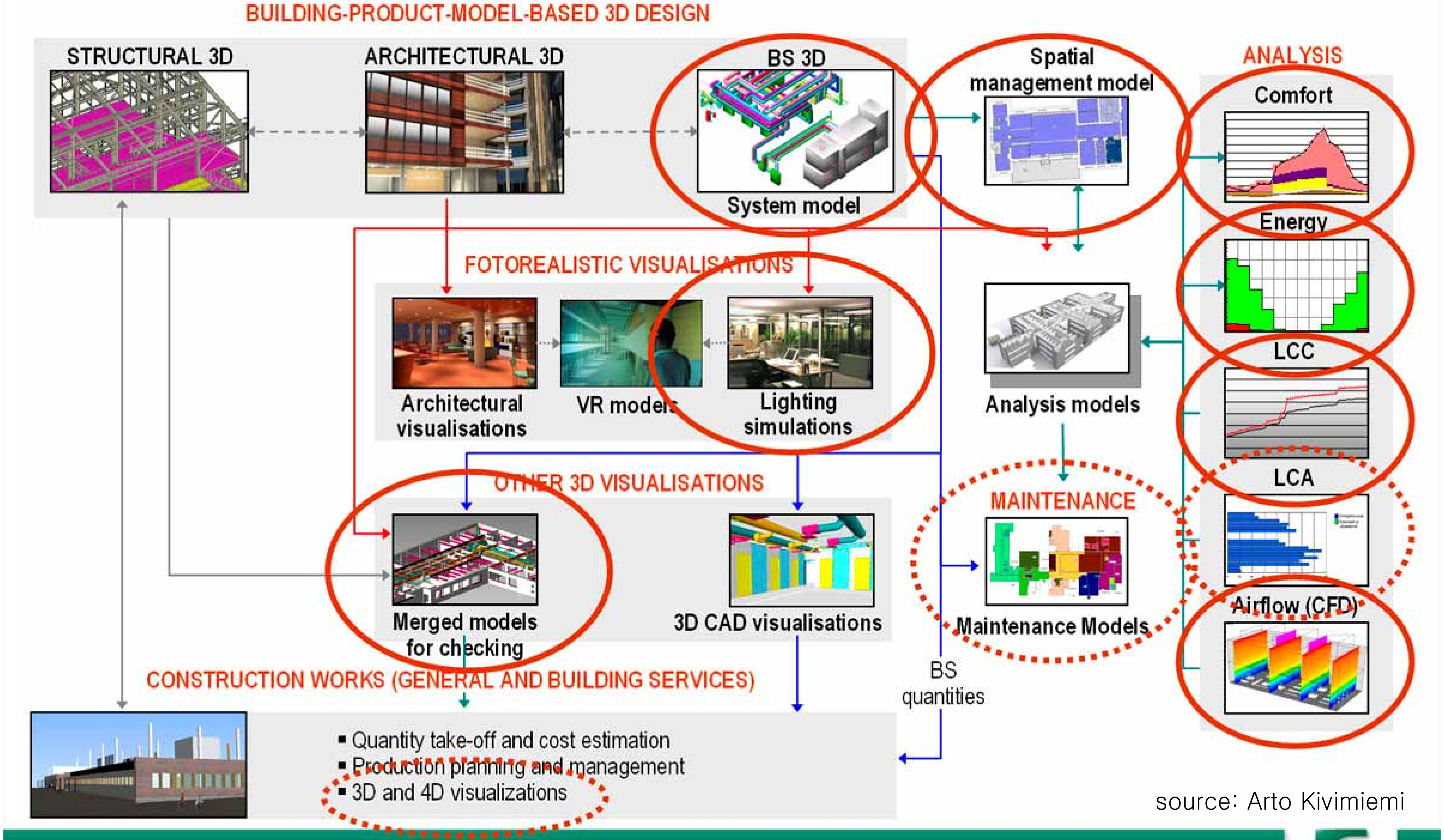
2. Draft Charter

- The Asian alliance would work together to carry out the following:
- share information about how each country is working /collaborating with Government agencies
- share BIM guideline work
- provide an Asian industry forum, assisting each other at local meetings etc
- provide a lobbying/networking function
- provide an Asian IFC technical/certification service
- identify common objectives/priorities and work together to achieve them (eg sustainability etc)
- It was noted that all countries had complementary industry organisations that may already have some Asian collaboration for example as the respective Institutes of Architects (SIA, JIA, ?, AIA, ?). It was agreed each member would develop a list of such key organisations (eg product manufacturers, engineers, owners, architects, green building, contractors, facility managers and government (building) agencies) with contact information, so we can develop a plan to lobby these groups in a coordinated way.

3. buildingSMART Asia Contacts

SG	William Lau
JP	Yoshinobu Adachi
KR	Inhan Kim
AU	John Mitchell
CN	Cui Lu (to be confirmed)

Building Product Models / Aurora 2 Project (Building Services)



BUILDING-PRODUCT-MODEL-BASED 3D DESIGN

STRUCTURAL 3D

ARCHITECTURAL 3D

BS 3D

System model

Spatial management model

ANALYSIS

Comfort

Energy

LCC

LCA

Airflow (CFD)

FOTOREALISTIC VISUALISATIONS

Architectural visualisations

VR models

Lighting simulations

Analysis models

OTHER 3D VISUALISATIONS

Merged models for checking

3D CAD visualisations

MAINTENANCE

Maintenance Models

BS quantities

CONSTRUCTION WORKS (GENERAL AND BUILDING SERVICES)

- Quantity take-off and cost estimation
- Production planning and management
- 3D and 4D visualizations

source: Arto Kivimiemi

내용

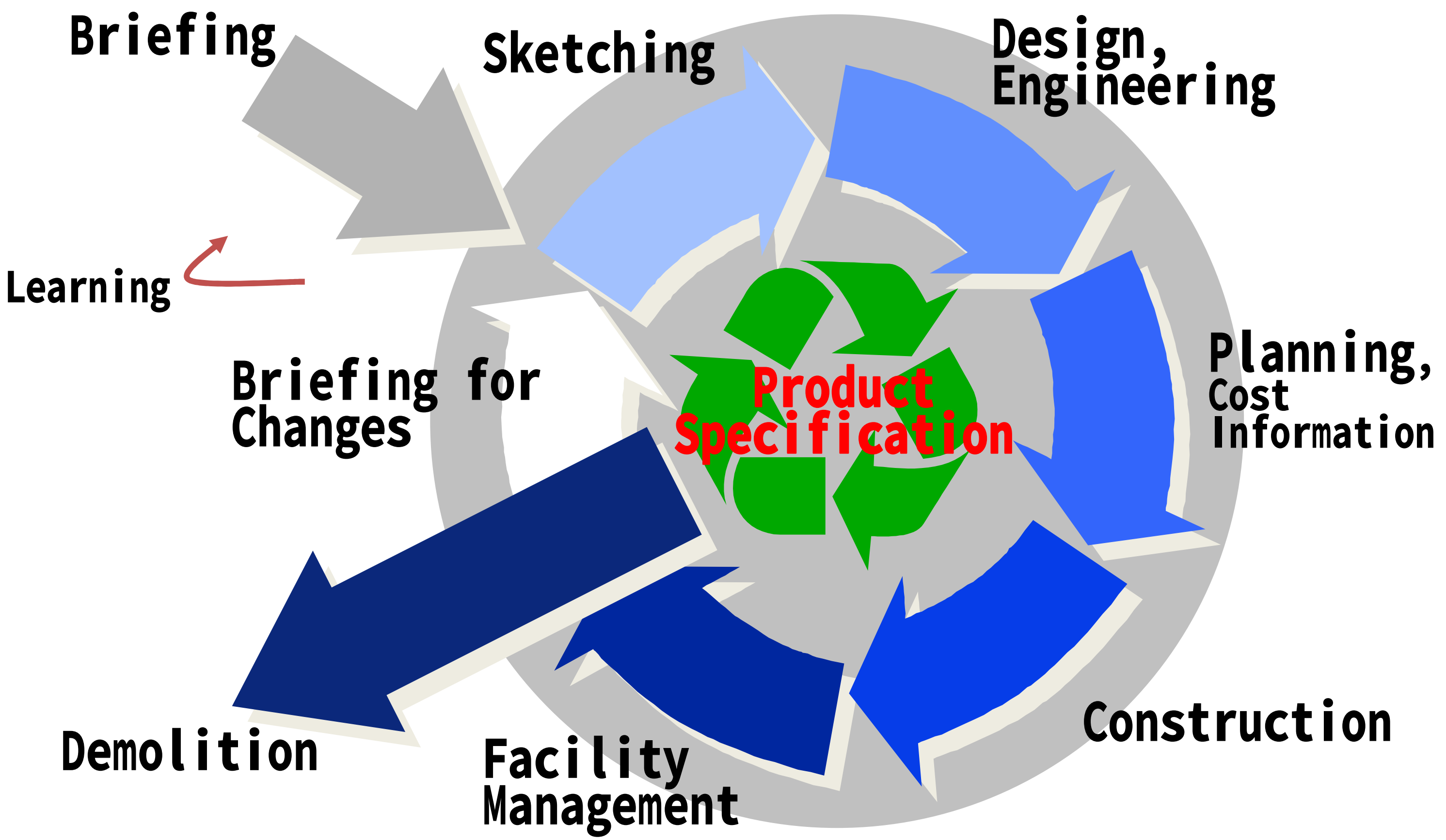
- **Prolog: Why BIM?**
- **BIM-> Modeling**이란
- **BIM**의 다양한 적용 분야
- 해외 선진국 현황
- 설계사 **BIM** 적용 **Best Practice**
- **BIM** 적용을 위한 요소기술

“Everything that can be invented has been invented”
Charles H Duell, US Patents Office, 1899

BIM이란?

Open BIM vs. Closed BIM

Digital Architecture & Building Lifecycle Information



Briefing

Sketching

Design, Engineering

Learning

Briefing for Changes

Product Specification

Planning, Cost Information

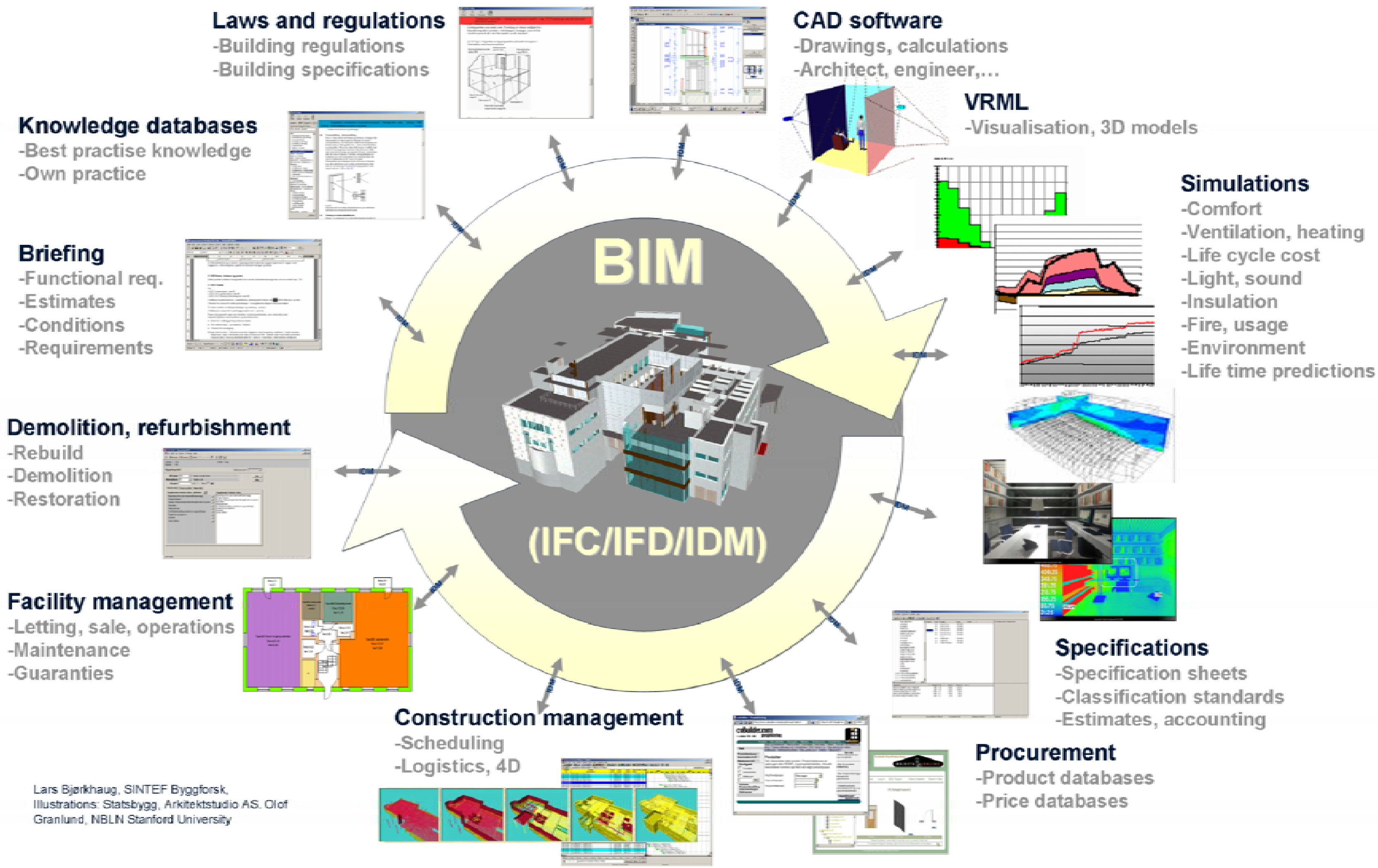
Construction

Demolition

Facility Management

Construction

Open BIM



Laws and regulations
-Building regulations
-Building specifications

CAD software
-Drawings, calculations
-Architect, engineer,…

VRML
-Visualisation, 3D models

Knowledge databases
-Best practise knowledge
-Own practice

Simulations
-Comfort
-Ventilation, heating
-Life cycle cost
-Light, sound
-Insulation
-Fire, usage
-Environment
-Life time predictions

Briefing
-Functional req.
-Estimates
-Conditions
-Requirements

Demolition, refurbishment
-Rebuild
-Demolition
-Restoration

Facility management
-Letting, sale, operations
-Maintenance
-Guaranties

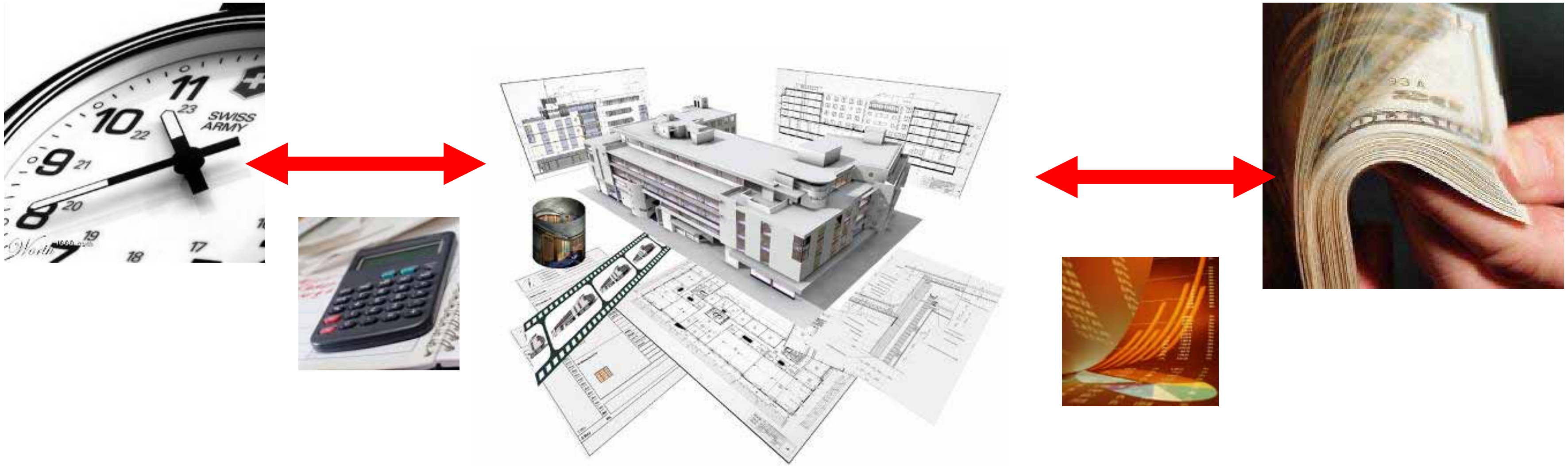
Specifications
-Specification sheets
-Classification standards
-Estimates, accounting

Construction management
-Scheduling
-Logistics, 4D

Procurement
-Product databases
-Price databases

Lars Bjørkhaug, SINTEF Byggforsk,
Illustrations: Statsbygg, Arkitektstudio AS. Olof
Granlund, NBLN Stanford University

The Virtual Construction Model (5D)



Time (4D)

BIM Model (3D)

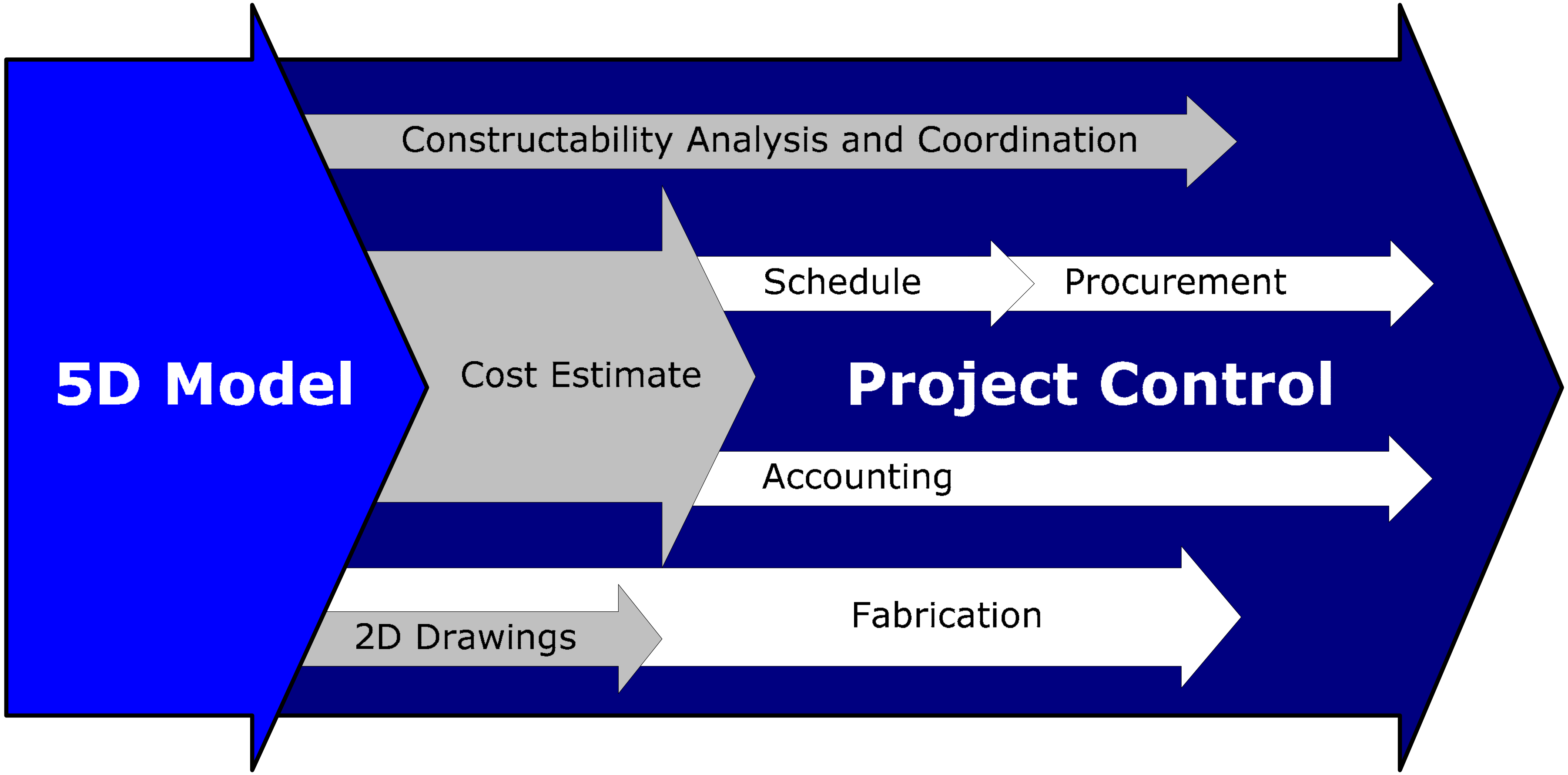
Cost (5D)

Linked Schedules

Linked Estimating Recipes

*Source: BIM Seminar Lectures, GraphiSoft

5D Work Flow



5D Model

Constructability Analysis and Coordination

Cost Estimate

Schedule

Procurement

Project Control

Accounting

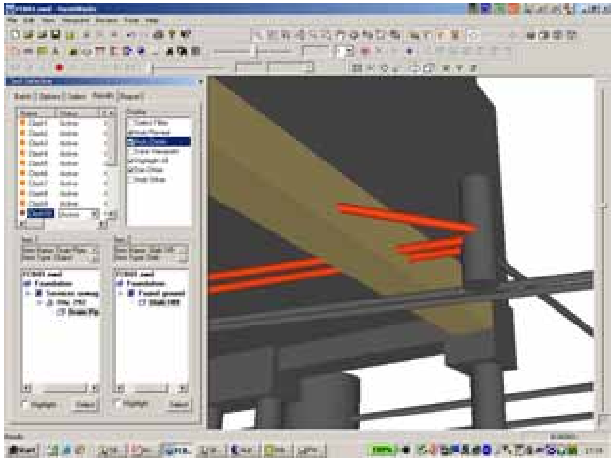
2D Drawings

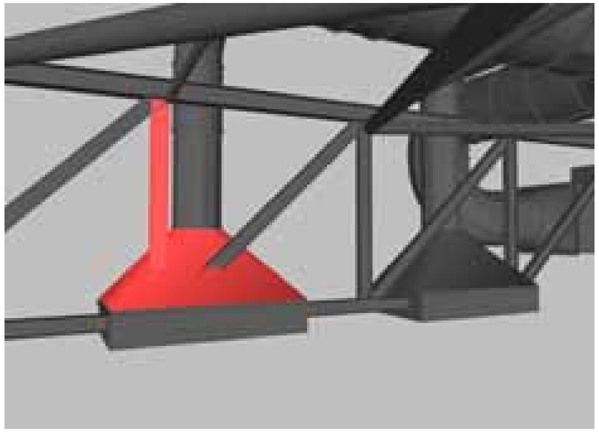
Fabrication

*Source: BIM Seminar Lectures,
GraphiSoft

Benefits: Clash Detection

- Conventional methods of coordination are extremely time consuming and error-prone.
- Using internal or external clash detection software helps to identify the construction errors in the BIM model
- Construction risks and costs can be reduced significantly





*Source: BIM Seminar Lectures, GraphiSoft

Sustainable Design

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

*Source: BIM Seminar Lectures, GraphiSoft

Regulations & Market Incentives

- All federal buildings in the U.S. must achieve Silver LEED certification
- From Jan. 2006, EPD came into force across all the EU states
- By 2007, demand for green projects expected to grow by 300%

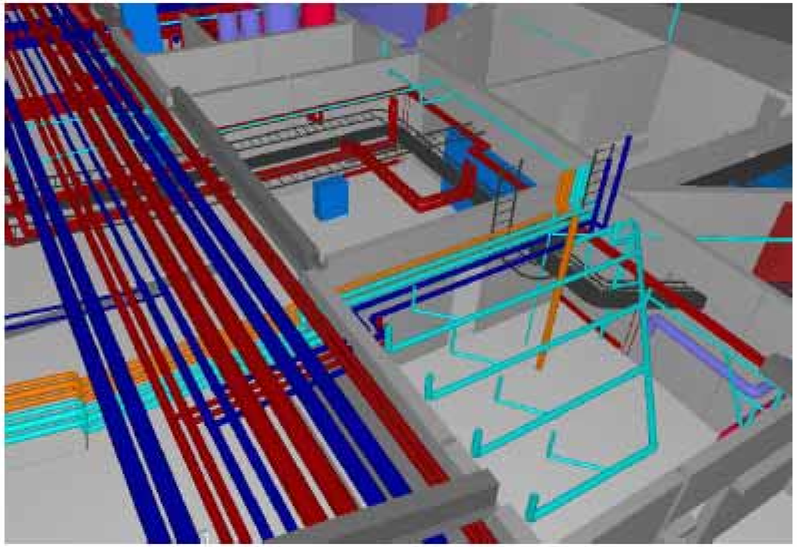
US Canada Spain Taiwan Australia India Mexico World

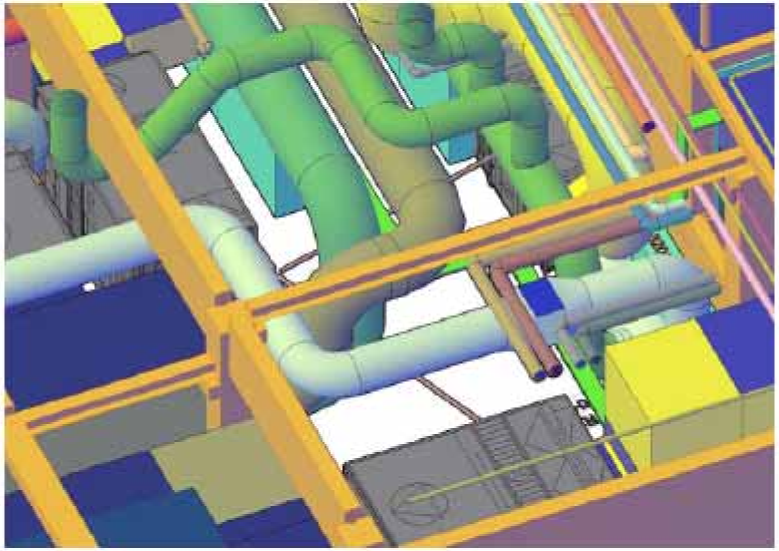
„Intelligent use of energy must be regarded as a fundamental element in formulating the energy objectives of the European Union."

Bendt Bendtsen, EU-Presidency, Minister for Economic and Business Affairs, DK

***Source: BIM Seminar Lectures, GraphiSoft**

For space management

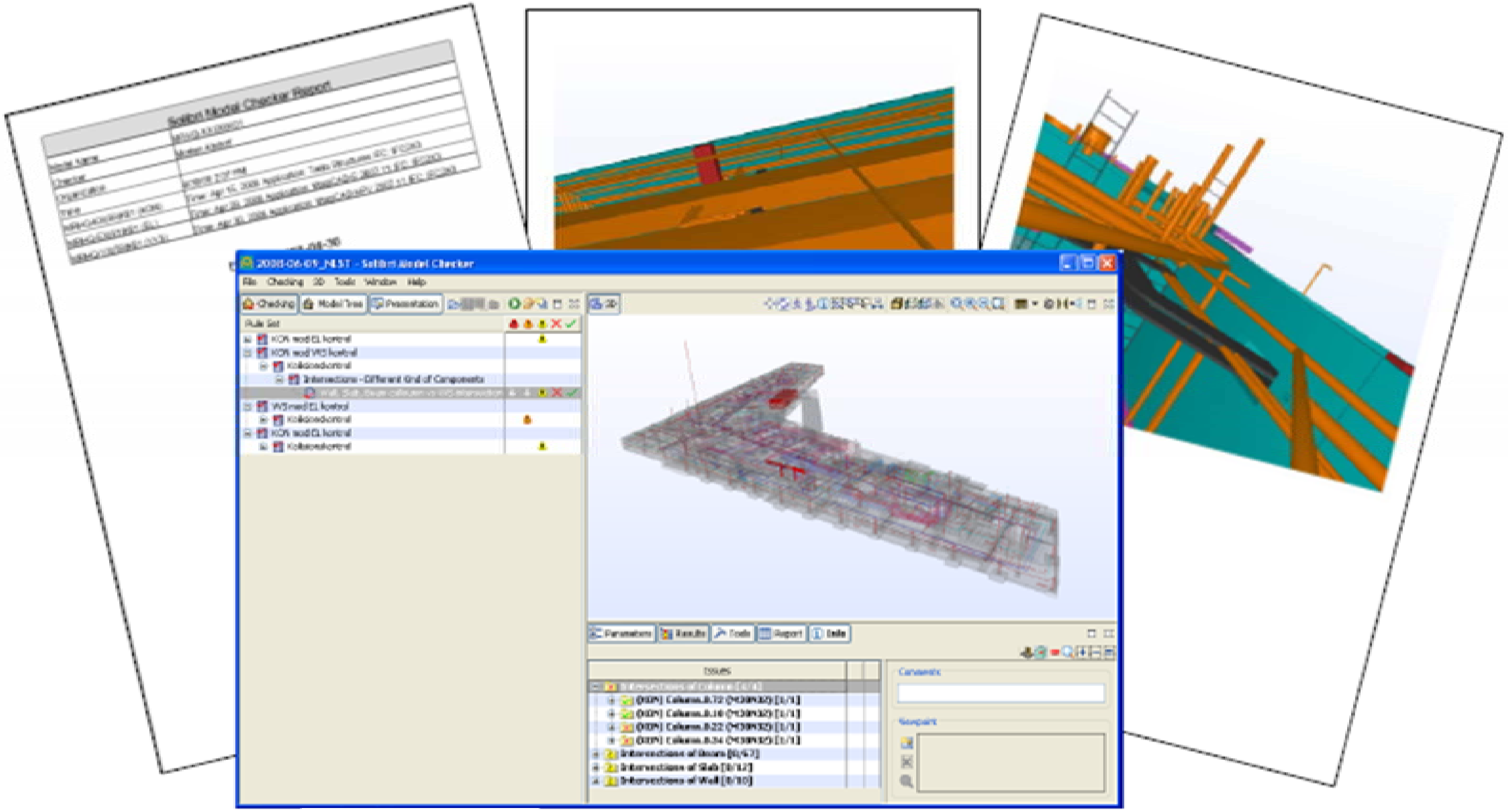




*원문: Niels Treldal, Rambøll Headquarters-Using IFC in a real project

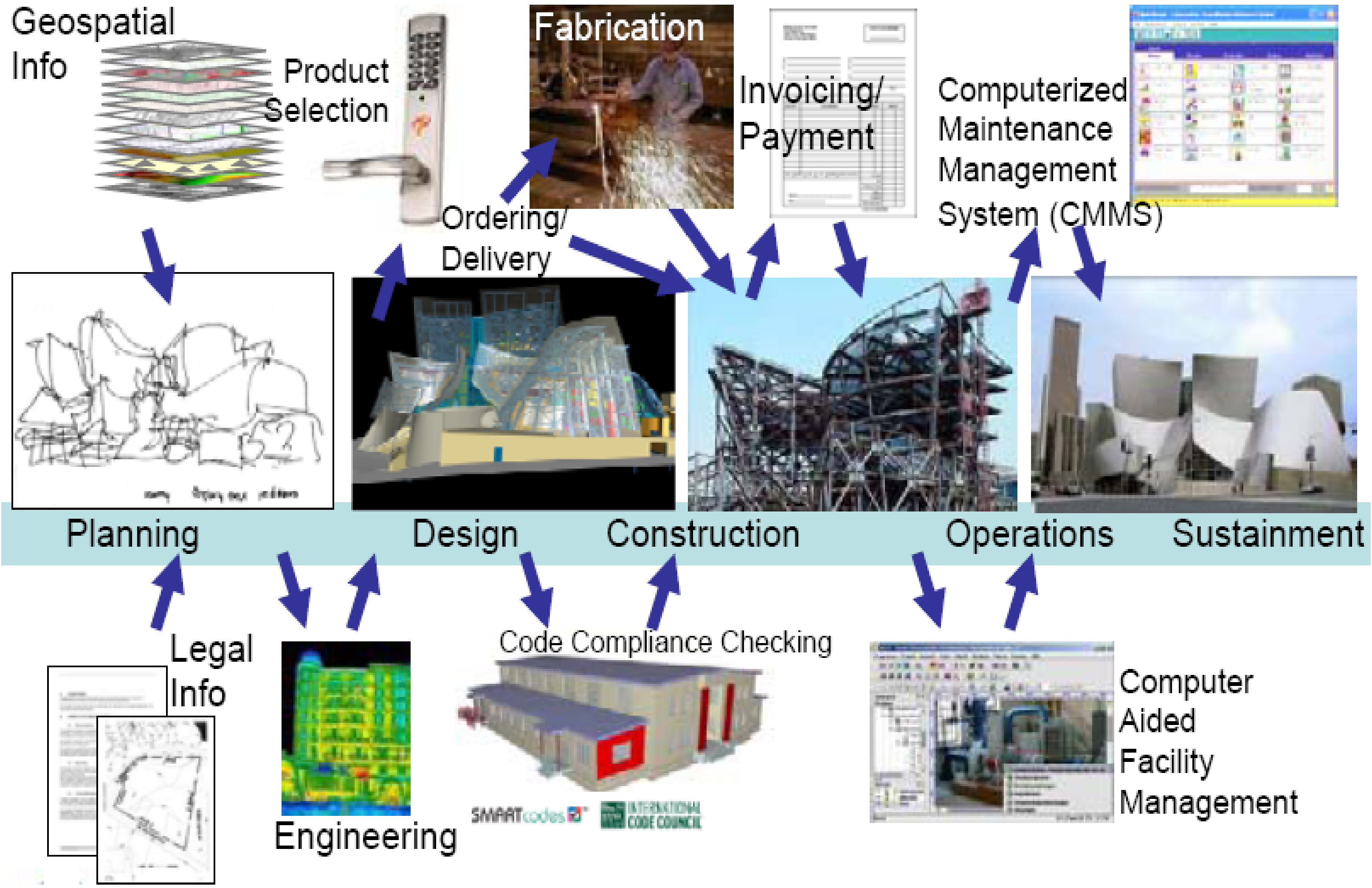
Model based quality assurance

Solibri Model Checker – with reports and viewer


Solibri Model Checker Report

*원문: Niels Treldal, Rambøll Headquarters-Using IFC in a real project

BIM Based Technology



Geospatial Info

Product Selection

Fabrication

Invoicing/ Payment

Computerized Maintenance Management System (CMMS)

Ordering/ Delivery

Planning

Design

Construction

Operations

Sustainment

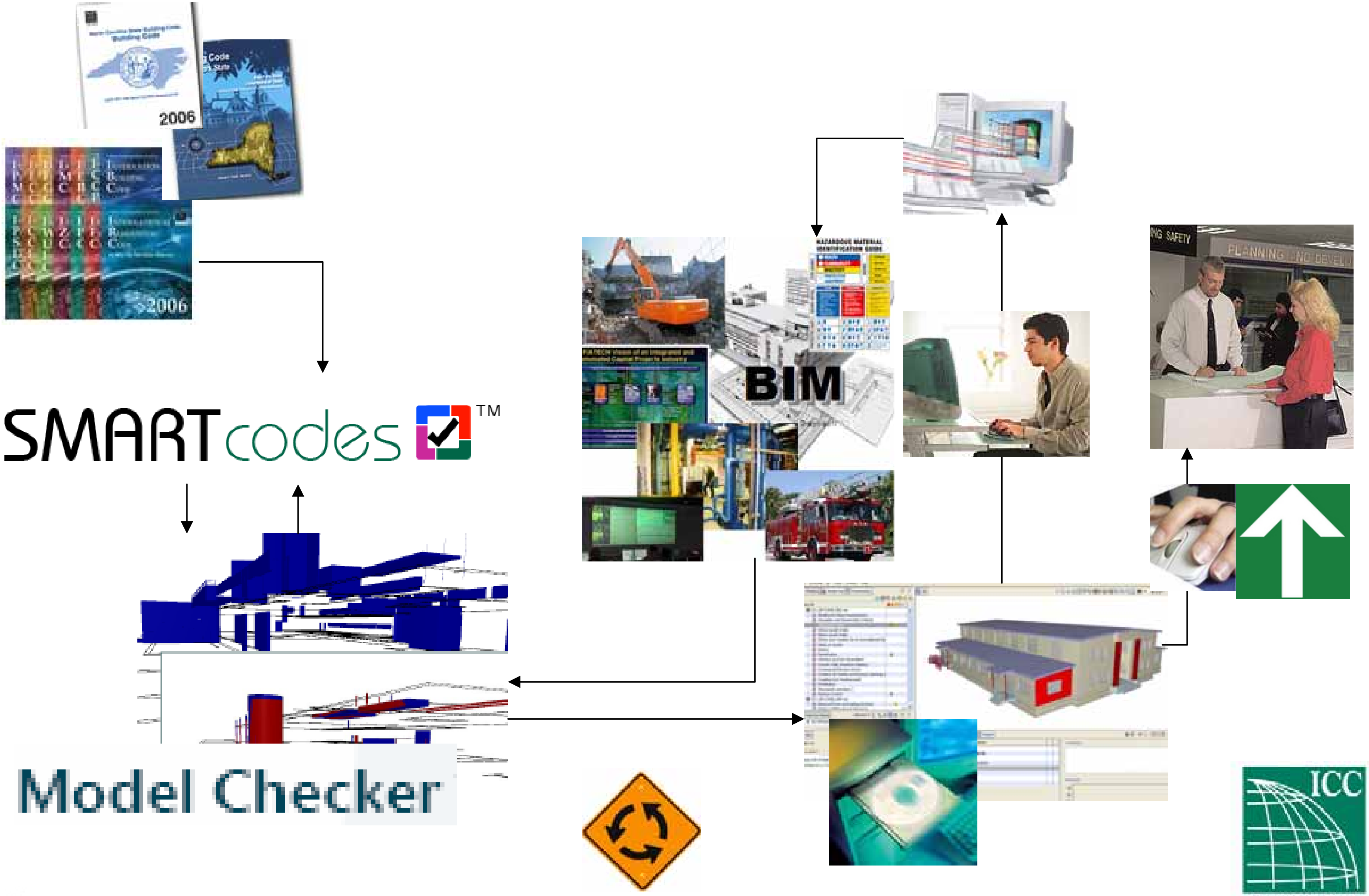
Legal Info

Engineering

Code Compliance Checking

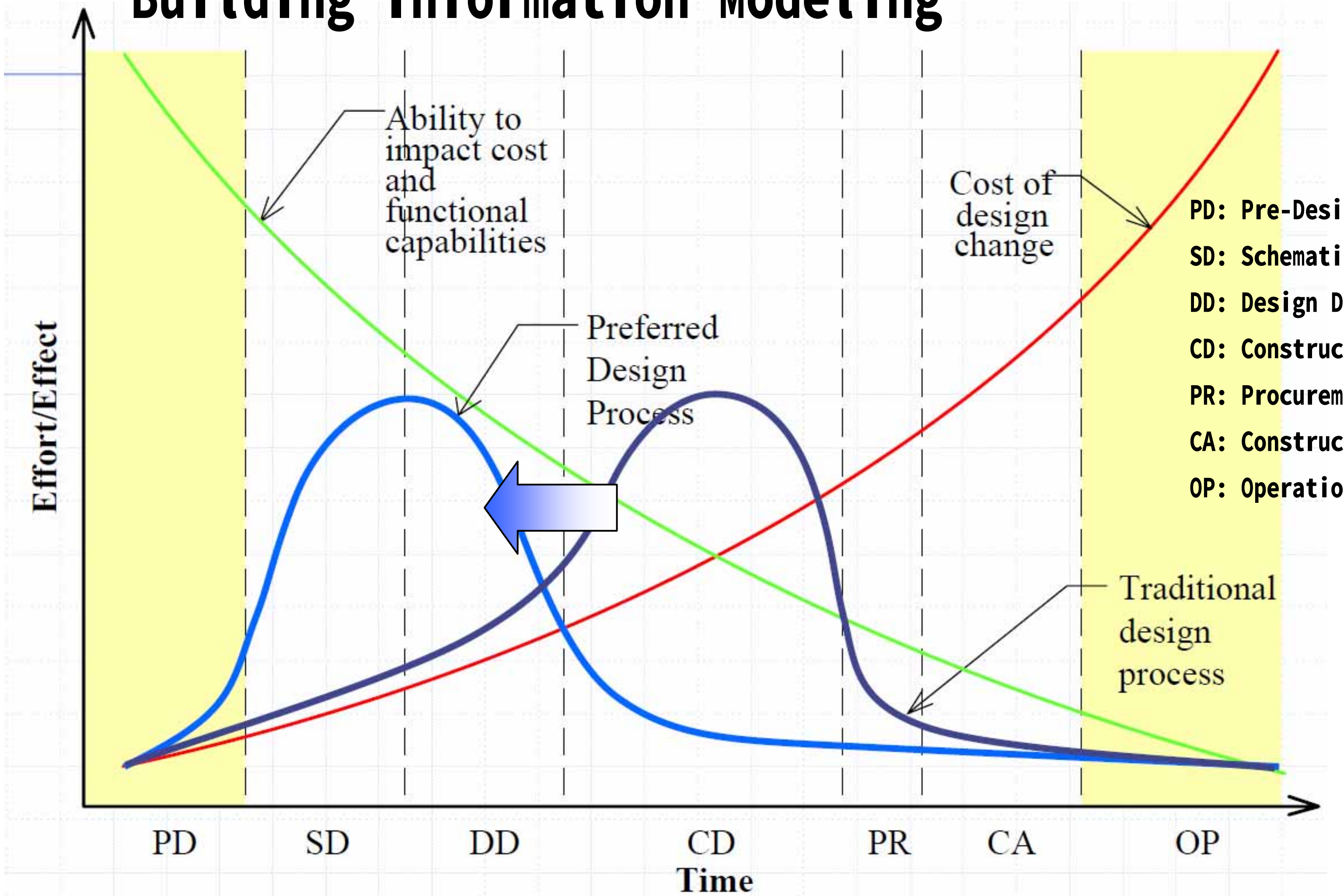
Computer Aided Facility Management

SMARTcodes의 법규검토 프로세스


2006
2006
SMARTcodes™
BIM
Model Checker

BIM Expectation

Building Information Modeling



PD: Pre-Design
SD: Schematic Design
DD: Design Development
CD: Construction Documentation
PR: Procurement
CA: Construction Administration
OP: Operation

*출처:CURT (Construction User Round Table),
IAI-NA Council -National Institute of Building Sciences, buildingSMART Forum Oslo, 2005

ITalab Lab.for Information Technology in AEC

BUILD LONDON LIVE

48 Hours to make design work for LONDON

“48 HOURS TO MAKE DESIGN WORK FOR LONDON”

◆ ‘Build LONDON Live’ BIMSTORM

- 48 hours to design a major London landmark, with awards and prizes

buildingSMART
International Alliance for Interoperability

Build LONDON Live - 2008
48 HOURS TO MAKE DESIGN WORK FOR LONDON

GLOBAL REAL TIME MULTI USER

BIMStorm의 목적

- 주어진 조건에서 최신 **IT**기술 및 **BIM**을 활용해 최상의 설계안을 도출

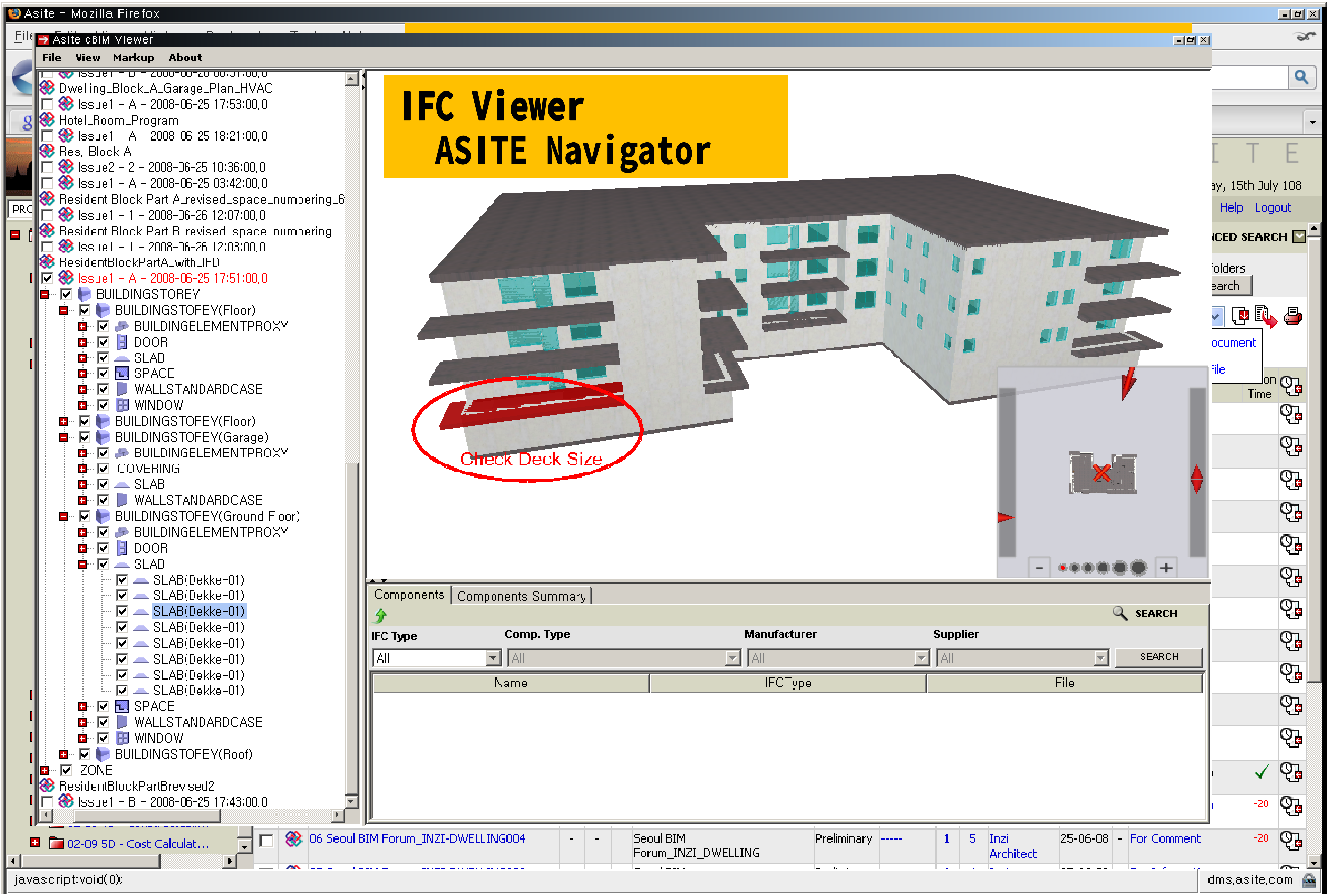
◆ 공개표준 기반의 협업을 통한 프로젝트의 진행을 경험할 수 있는 기회 제공

◆ 이를 통해 사람들의 인식 변화와 기술의 가능성을 느낄 수 있기를 바라는 것

Build London Live 개요

- 영국 런던 템즈강변 약 **185,000m²**의 부지
- **8**개국 **12**개 팀 참가
- 온라인 협업을 통한 건축 계획 진행
- **BIM** 기술 활용 방법에 대한 다양한 시도
- 공개표준 기반의 데이터 교환

ASITE Interface



IFC Viewer
ASITE Navigator

Check Deck Size

Dwelling_Block_A_Garage_Plan_HVAC
☐ Issue1 - A - 2008-06-25 17:53:00,0
Hotel_Room_Program
☐ Issue1 - A - 2008-06-25 18:21:00,0
Res. Block A
☐ Issue2 - 2 - 2008-06-25 10:36:00,0
☐ Issue1 - A - 2008-06-25 03:42:00,0
Resident Block Part A_revised_space_numbering_6
☐ Issue1 - 1 - 2008-06-26 12:07:00,0
Resident Block Part B_revised_space_numbering
☐ Issue1 - 1 - 2008-06-26 12:03:00,0
ResidentBlockPartA_with_IFD
☑ Issue1 - A - 2008-06-25 17:51:00,0
- ☑ BUILDINGSTOREY
  - ☑ BUILDINGSTOREY(Floor)
    - ☑ BUILDINGELEMENTPROXY
    - ☑ DOOR
    - ☑ SLAB
    - ☑ SPACE
    - ☑ WALLSTANDARDCASE
    - ☑ WINDOW
  - ☑ BUILDINGSTOREY(Floor)
  - ☑ BUILDINGSTOREY(Garage)
    - ☑ BUILDINGELEMENTPROXY
    - ☑ COVERING
    - ☑ SLAB
    - ☑ WALLSTANDARDCASE
  - ☑ BUILDINGSTOREY(Ground Floor)
    - ☑ BUILDINGELEMENTPROXY
    - ☑ DOOR
    - ☑ SLAB
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
      - ☑ SLAB(Dekke-01)
    - ☑ SPACE
    - ☑ WALLSTANDARDCASE
    - ☑ WINDOW
  - ☑ BUILDINGSTOREY(Roof)
- ☑ ZONE

ResidentBlockPartBrevised2
☐ Issue1 - B - 2008-06-25 17:43:00,0

02-09 5D - Cost Calculat...

IFC Type: All
Comp. Type: All
Manufacturer: All
Supplier: All

Name	IFCType	File

☐	06 Seoul BIM Forum_INZI-DWELLING004	-	-	Seoul BIM Forum_INZI_DWELLING	Preliminary	-----	1	5	Inzi Architect	25-06-08	-	For Comment	-20

ay, 15th July 108

javascript:void(0);

dms.asite.com

Asite - Mozilla Firefox
File
Asite cBIM Viewer
File
View
Markup
About
Components
Components Summary
SEARCH
SEARCH
Help
Logout
ICED SEARCH
olders
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ocument
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on
Time
-20
PRC

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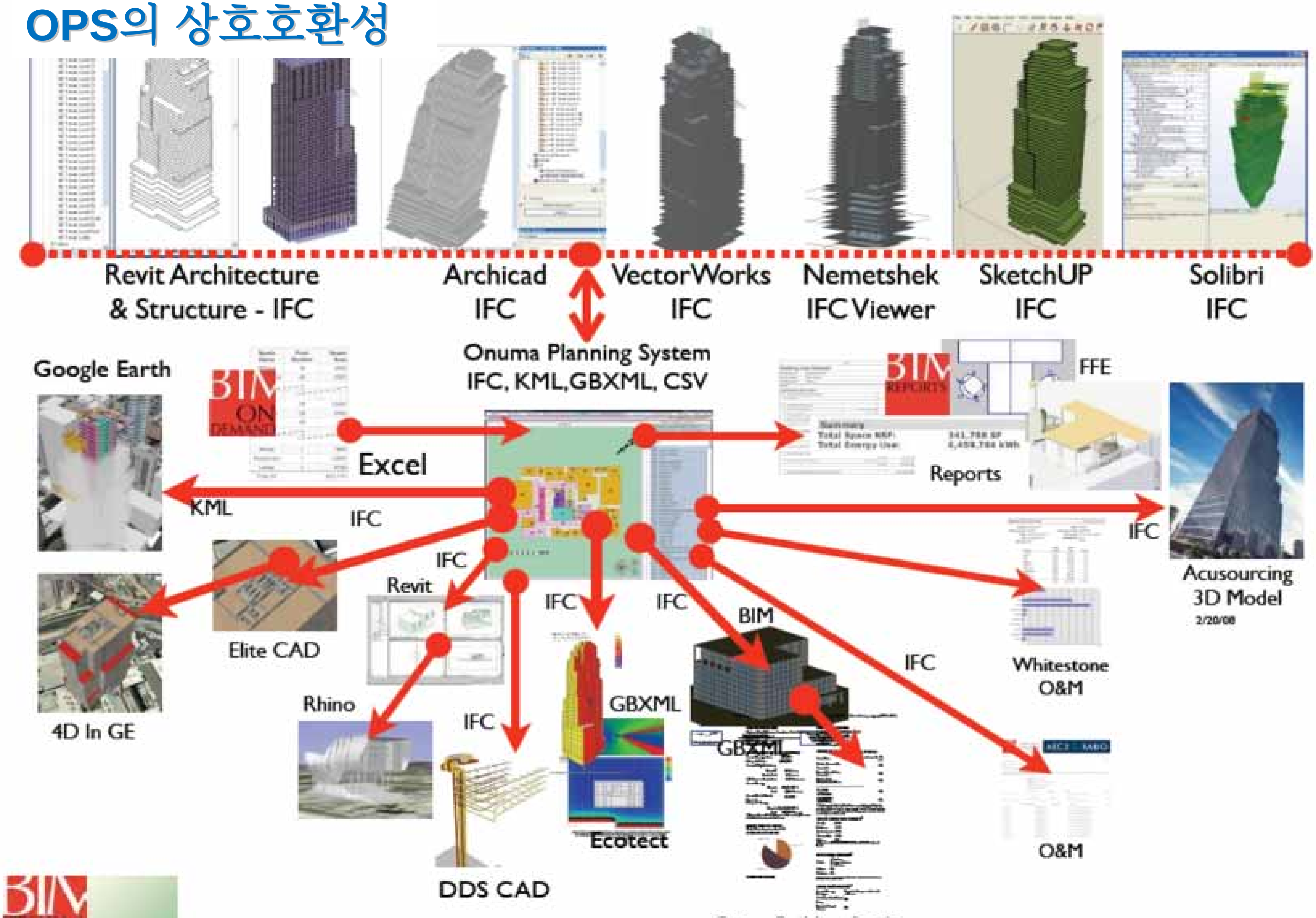
OPS의 상호호환성


Revit Architecture
& Structure - IFC
Archicad
IFC
VectorWorks
IFC
Nemetshek
IFC Viewer
SketchUP
IFC
Solibri
IFC
Onuma Planning System
IFC, KML,GBXML, CSV
Google Earth
BIM ON DEMAND
Excel
BIM REPORTS
FFE
Reports
KML
IFC
IFC
Revit
IFC
Acusourcing
3D Model
2/20/08
Elite CAD
IFC
IFC
BIM
IFC
Whitestone
O&M
4D In GE
Rhino
IFC
GBXML
GBXML
Ecotect
O&M
DDS CAD
Green Building Studio

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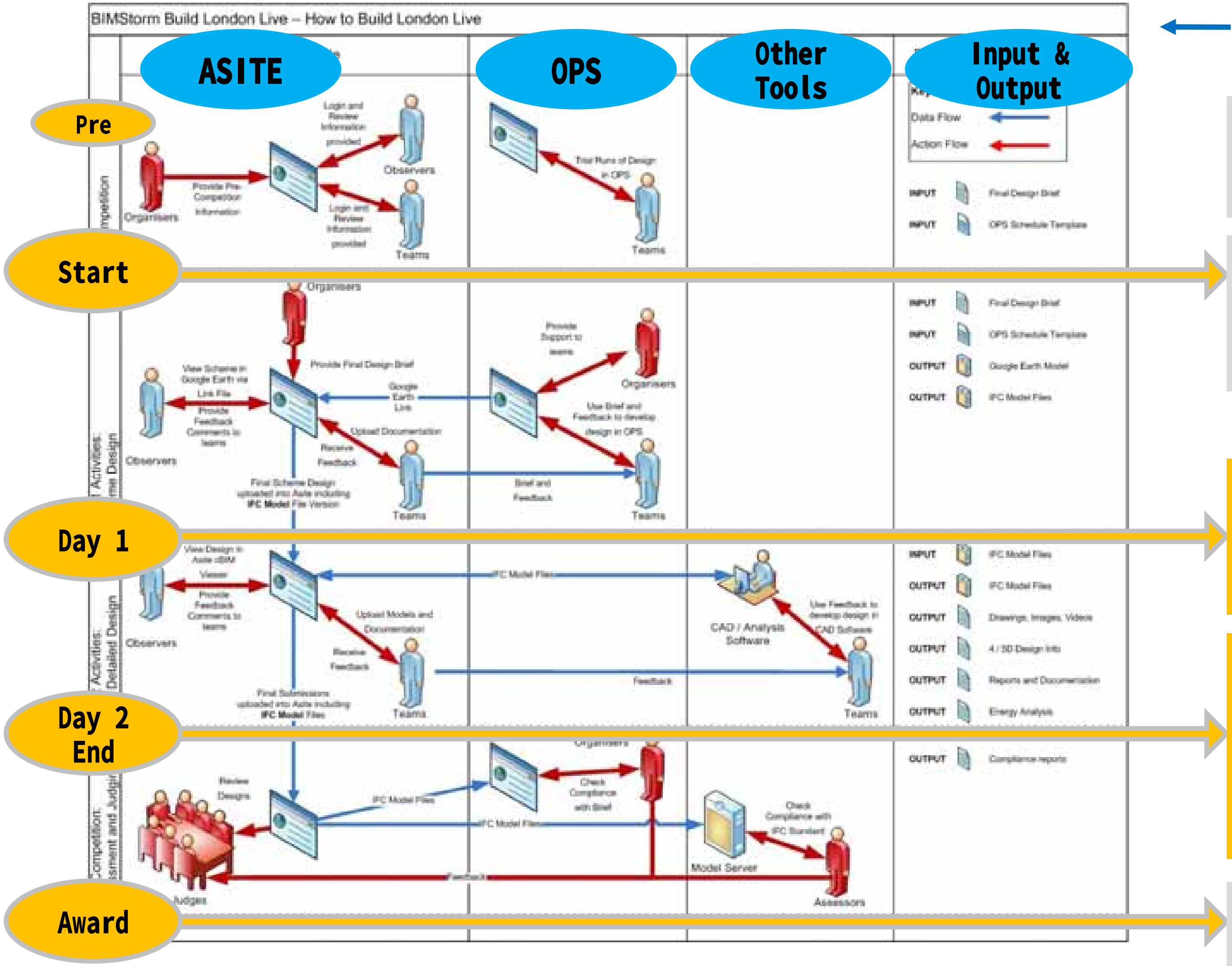
AIA Technology in Architectural Practice (TAP) Presentation, Boston - 5/14/08

How to Build London Live


BIMStorm Build London Live – How to Build London Live
ASITE
OPS
Other Tools
Input & Output
Pre
Start
Day 1
Day 2 End
Award
Organisers
Observers
Teams
Judges
Assessors
CAD / Analysis Software
Model Server
Data Flow
Action Flow

← Data Flow ← Action Flo

Design Brief
Asite, OPS Account
Google Earth Site

Final Design Brief
OPS Schedule Template
Google Earth Site
Site Context 3D Model(DXF)

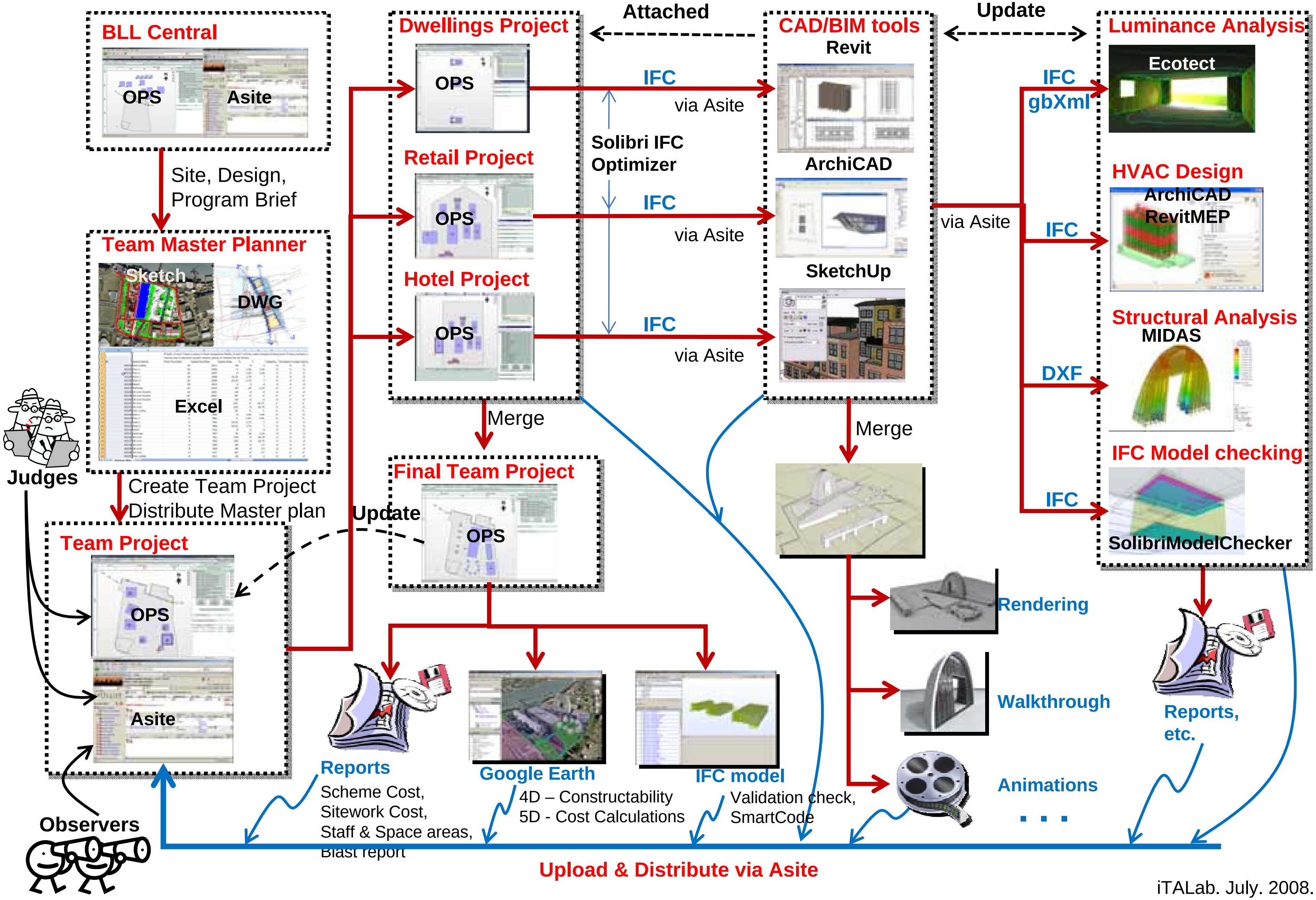
OPS Final Scheme Design
Google Earth Model
IFC Model Files
Etc.

IFC Model Files
Drawings, Images, Videos
4D/5D Design Information
Reports, Documentation
Energy Analysis
Etc.

Compliance Reports
Awards

BIMStorm Progress map. Build London Live 2008.

* There are no limits for use of CAx/BIM tool s.



BLL Central

OPS

Asite

Site, Design, Program Brief

Team Master Planner

Sketch

DWG

Excel

Judges

Create Team Project

Distribute Master plan

Team Project

OPS

Asite

Observers

Dwellings Project

OPS

Retail Project

OPS

Hotel Project

OPS

Attached

IFC

via Asite

Solibri IFC Optimizer

IFC

via Asite

IFC

via Asite

Merge

Final Team Project

OPS

Update

Reports

Scheme Cost,
Sitework Cost,
Staff & Space areas,
Blast report

Google Earth

4D – Constructability
5D - Cost Calculations

IFC model

Validation check,
SmartCode

CAD/BIM tools

Revit

ArchiCAD

SketchUp

Merge

Update

via Asite

Rendering

Walkthrough

Animations

. . .

Luminance Analysis

Ecotect

IFC
gbXml

HVAC Design

ArchiCAD
RevitMEP

IFC

Structural Analysis

MIDAS

DXF

IFC Model checking

IFC

SolibriModelChecker

Reports,
etc.

Upload & Distribute via Asite

iTALab. July. 2008.

CAD, Analysis, BIM tools

3ds MAX
Adobe Acrobat
Adobe Indesign
Adobe Photoshop
ArchiCAD
Artlantis
Asite
AutoCAD
Cinema 4D
DDS IfcViewer
DDS-CAD Elektro
DDS-CAD VVS
dRofus
Ecotect

EDMmodelServer
ELDAta
FEBDok
Focus Description
Google Earth
MAGI CAD
Midas
MS Excel
MS PowerPoint
MS Word
NOIS Calcus
Octaga Modeller
Onuma Planning System
Piranesi

Powel Gemini
Revit Architecture
Riuska
SINTEF Byggforsk Knowledge system
SketchUp Pro
Snagit
Solibri IFC Optimizer
Solibri Model Checker
Solibri ModelViewer
Staad Pro
StoeryView
Tekla Structures
WALKINSIDE
etc

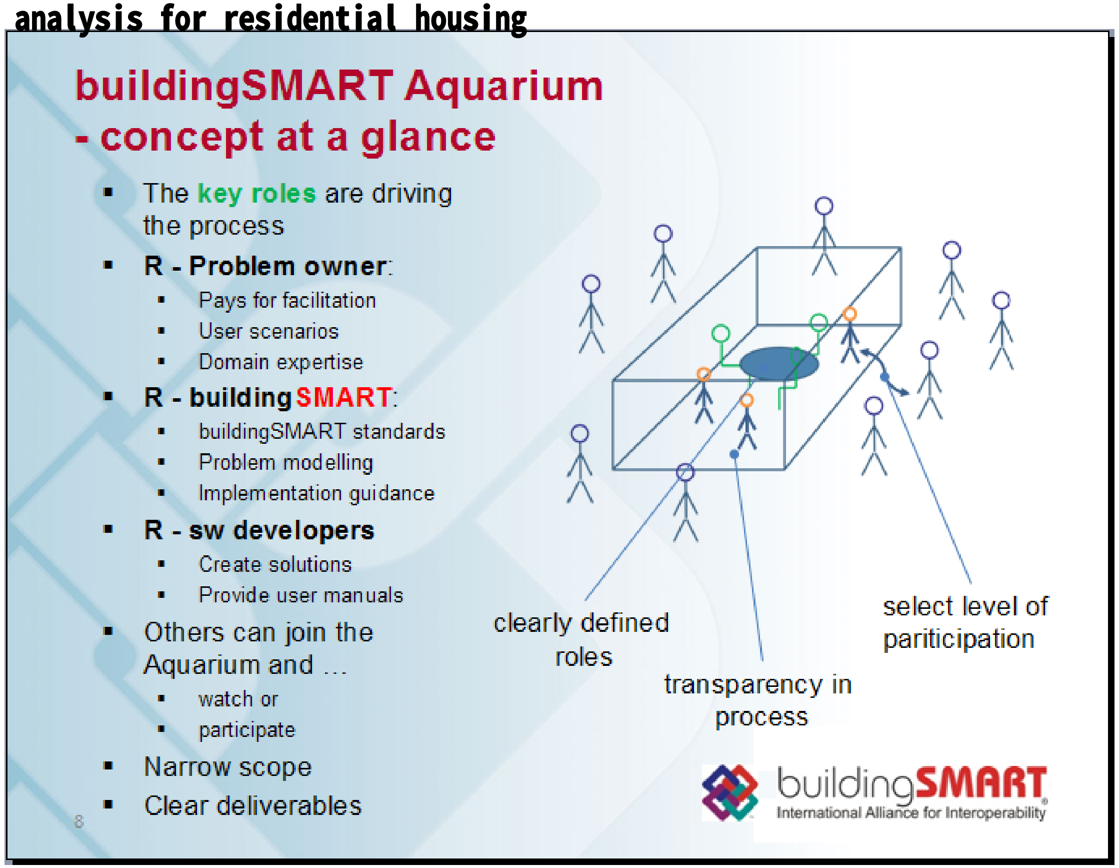
BIM실무 적용을 위한 Aquarium Project

- **client**가 원하는 시나리오를 **IFC**를 통해 구현하는 프로젝트
- 기존의 솔루션을 개선 또는 신규 솔루션 개발

현재 진행 **4**개 프로젝트

- **Statsbygg : QTO and costing of Mechanical Electrical and Plumbing (MEP)**
- **Boligprodusentene : QTO and costing of residential housing**
- **Boligprodusentene : simplified energy analysis for residential housing**
- **HOK : Room Data information logistics**

- 배경
  - **client-SW**벤더에 의한 해결에 한계
  - **Open, Official** 환경 필요
  - 많은 **client** 들이 관심표명
  - **buildingSMART** 단기집중 목표
  - 추후 **22**개 프로젝트 추진 계획



buildingSMART Aquarium
- concept at a glance

- The **key roles** are driving the process
- **R - Problem owner**:
  - Pays for facilitation
  - User scenarios
  - Domain expertise
- **R - buildingSMART**:
  - buildingSMART standards
  - Problem modelling
  - Implementation guidance
- **R - sw developers**
  - Create solutions
  - Provide user manuals
- Others can join the Aquarium and ...
  - watch or
  - participate
- Narrow scope
- Clear deliverables

clearly defined roles

transparency in process

select level of paricitipation

buildingSMART
International Alliance for Interoperability

Thank you

Q&A

- iTALab http://italab.khu.ac.kr
- Contact Name : Inhan Kim

E- ihkim@khu.ac.kr

mail : +82-31-201-2926

Tel :