



Dipartimento di  
**Scienza e Tecnologia dell'Ambiente Costruito**  
Building Environment Science & Technology  
**BEST**



**Arch. Vittorio Caffi**  
Coordinatore Tecnico IAI Italia

### Atto costitutivo: novembre 2004

- Politecnico di Milano - Dipartimento BEST
- La Ducale - Gruppo Tecnocasa
- Lombarda Sistemi e Servizi – Gruppo Banca Lombarda
- AICA - Associazione Italiana di Calcolo Automatico
- AIST - Associazione Italiana Software Tecnico
- STR
- Cigraph
- ASSIMPREDIL
- UNCSAAL - Unione Nazionale Costruttori Serramenti di Alluminio e Leghe
- Collegio degli ingegneri e degli architetti della Provincia di Lecco
- SILP - Sindacato Ingegneri Liberi Professionisti di Milano
  
- Politecnico di Milano – Dipartimento di Architettura e Pianificazione DIAP
- Politecnico di Torino – Dip. di Ingegneria dei Sistemi Edilizi e Territoriali DISET
- Univ. di Padova – Dipartimento di Architettura Urbanistica e Rilevamento DAUR
- Univ. di Trento – Dipartimento di Ingegneria Civile e Ambientale DICA
- Univ. di Genova – Dip. Di Progettazione e Costruzione dell’Architettura DIPARC
  
- Autodesk
- Bentley Systems Inc.
- Nemetschek Italia Srl
- Harpaceas Srl
- STA Data

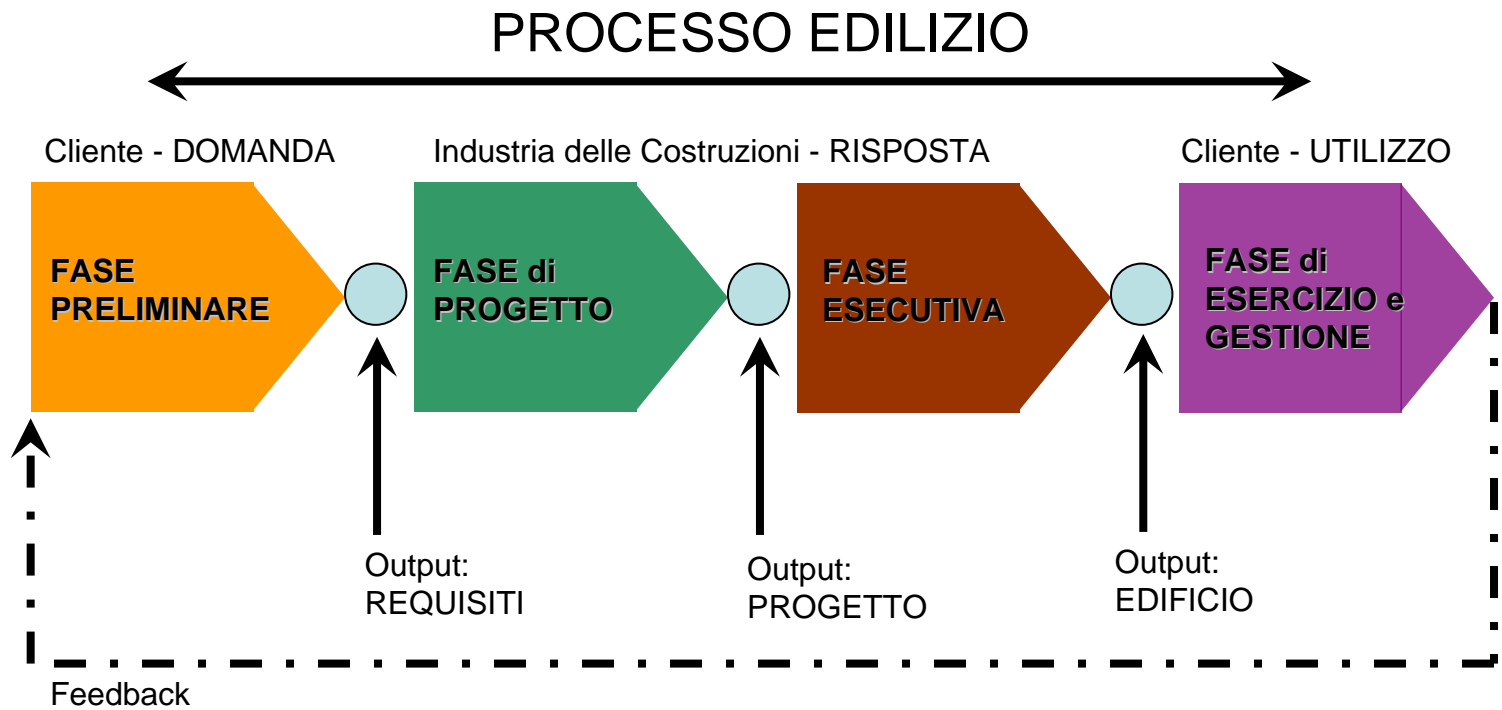
## L'International Alliance for Interoperability - IAI

- Nata nel 1995
- Conta più di 600 membri
- 25 paesi membri
- Organizzata in capitoli
  - Australasia Chapter
  - French Chapter
  - German Speaking Chapter (Germania, Austria, Svizzera)
  - Japan Chapter
  - Korea Chapter
  - Nordic Chapter (paesi scandinavi)
  - North American Chapter (Canada, USA)
  - Singapore Chapter
  - UK Chapter
  - Iberian Chapter
  - Italian Chapter
  - Chinese Chapter (sospeso)

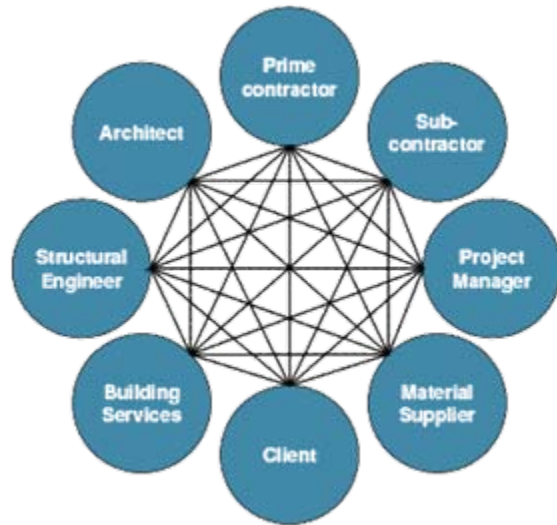


- <http://www.buildingsmart.com>

# I flussi informativi



## Il mondo non interoperabile



- mancanza di standard
- scarsa coordinazione delle applicazioni software
- necessità di continue e ripetitive operazioni di input di dati
- ridondanza di informazione
- rischio di inefficienza e di errori
- interscambio dati non garantito

# I costi nell'industria delle costruzioni

**NIST - National Institute of Standard and Technology, U.S. Department of Commerce  
Technology Administration**

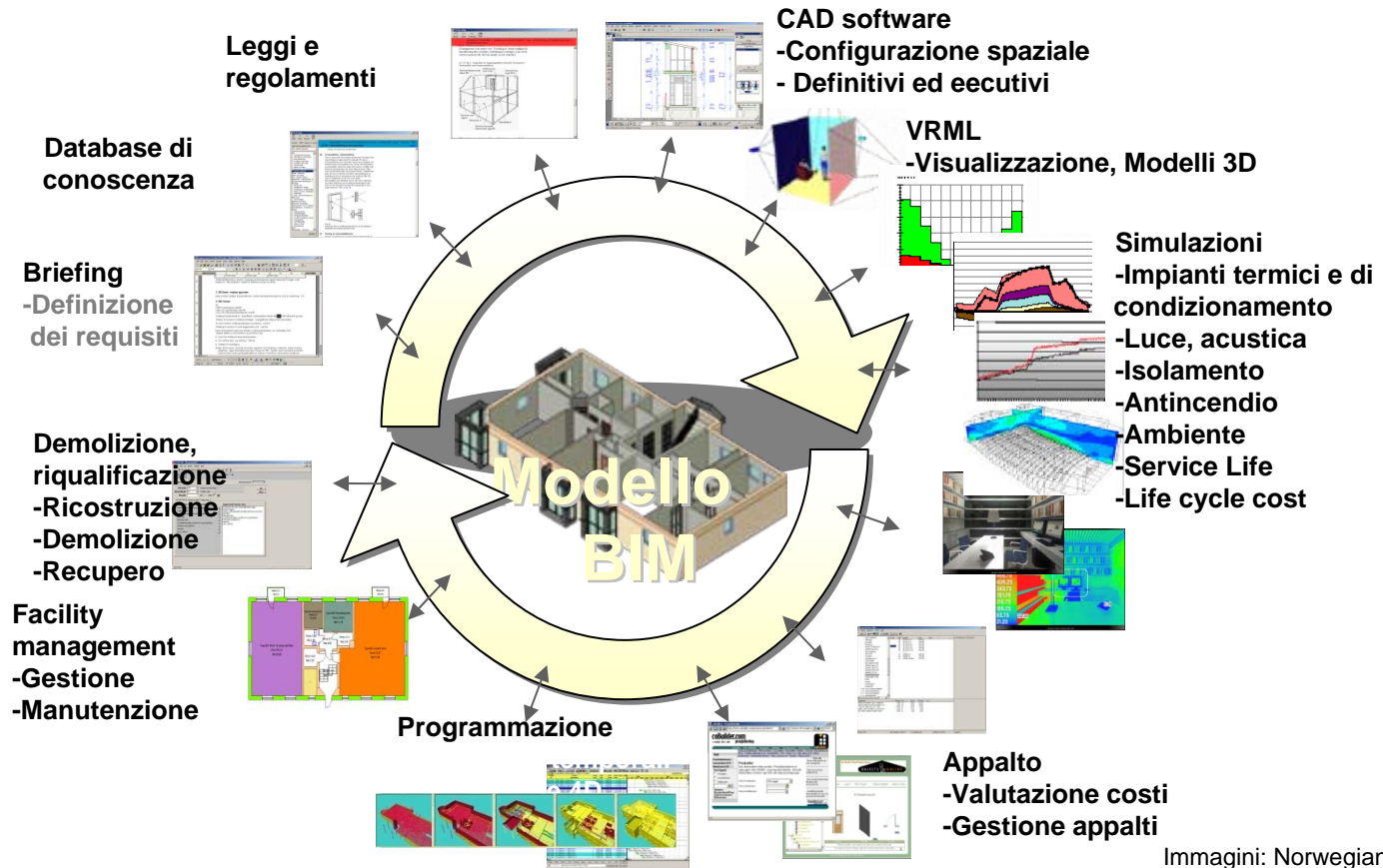
**15 miliardi di dollari all'anno sprecati per mancanza di interoperabilità**

Totale in Milioni di\$	Programmazione e progettazione	Costruzione	Gestione	<b>Totale</b>	%
Progettisti	1'007	147	16	<b>1'170</b>	7
Imprese	468	1'265	50	<b>1'802</b>	11
Produttori	442	1'762	0	<b>2'204</b>	14
Gestione	723	898	9'027	<b>10'648</b>	67
<b>Totale</b>	<b>2'658</b>	<b>4'072</b>	<b>9'093</b>	<b>15'824</b>	100
%	17	26	57		

I costi sono stati valutati sulla base di un patrimonio edilizio di 3,6 miliardi di m<sup>2</sup>, che cresce ogni anno di 106 milioni di m<sup>2</sup>

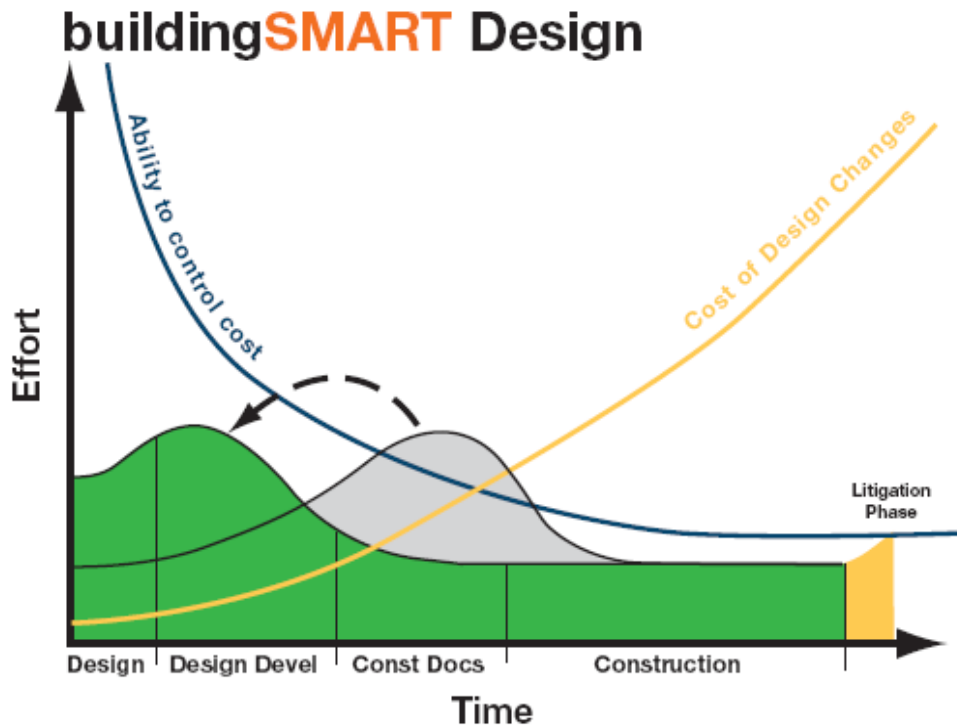
La mancanza di interoperabilità costa 53 Eu/m<sup>2</sup> all'insieme degli operatori coinvolti nella realizzazione di un progetto, e 2 Eu/m<sup>2</sup> per anno a chi si occupa della gestione del patrimonio.

# Informazione Condivisa



Immagini: Norwegian Building Research Institute, Olof Granlund, NBLN University of California, Stanford University

Anticipare la definizione dell'informazione nel processo significa ridurre i costi



- Gli standard buildingSMART facilitano le decisioni nella fase iniziale del processo
- Le decisioni anticipate agevolano il controllo dei costi di un progetto e dell'intero processo
- Le decisioni anticipate riducono il costo dovuto ai cambiamenti nell'arco di realizzazione di un progetto



# Gerarchia dell'Informazione

Theatre / World



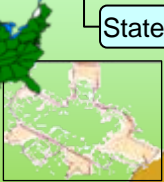
Country

Installation / Region

State / Province

County

City



**Geospatial Information (GIS)**

Natural Asset

Air / Space

Underground

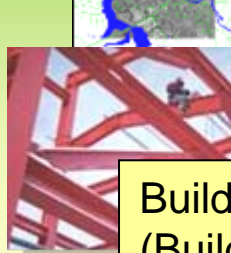
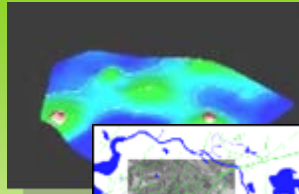
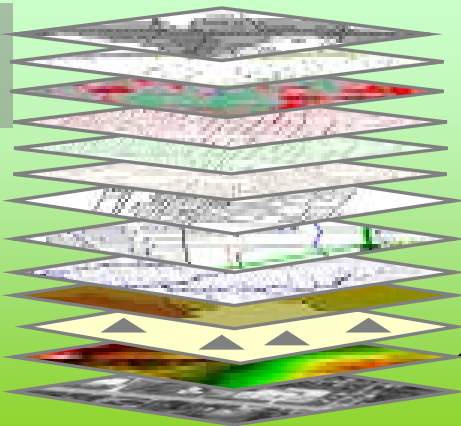
Water / Sea

Site

Real Property Asset

Land / Parcel

Facility / Built



**Building information (Building Information Models)**

Building

System

Space

Overlay

Sub-Systems

Level

Components

Room

Structure

System

Space

Overlay

Sub-Systems

Level

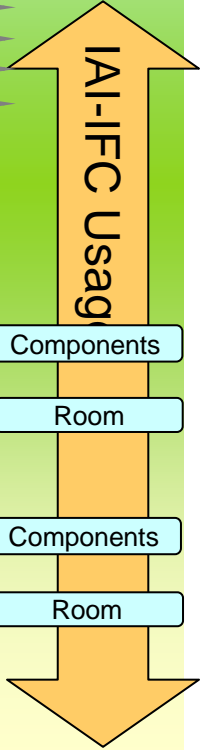
Components

Room

Linear Structure

Node

Segment



## Una visione del BIM



## Building Information Management

- Insieme di software interoperabili (core CAD 3D OO)
- Per la definizione di un archivio di progetto integrato basato su modello informatico, utile per la gestione di tutto il ciclo di vita dell'edificio
- utilizzo di modello di progetto Object oriented, condiviso dagli operatori (committente, progettista, produttori, esecutori, ...)
- possibilità di scambiare i dati indipendentemente dal software utilizzato senza intervento manuale di un operatore per correggere o inserire dati mancanti

## Vantaggi

- possibilità di leggere correttamente oggetti creati da un'applicazione CAD-BIM con una qualsiasi altra applicazione conforme che potrà eseguire, ad esempio, una simulazione energetica
- taglio dei costi e dei tempi non necessari
- riduzione degli errori di elaborazione
- qualificazione e gestione integrata del processo

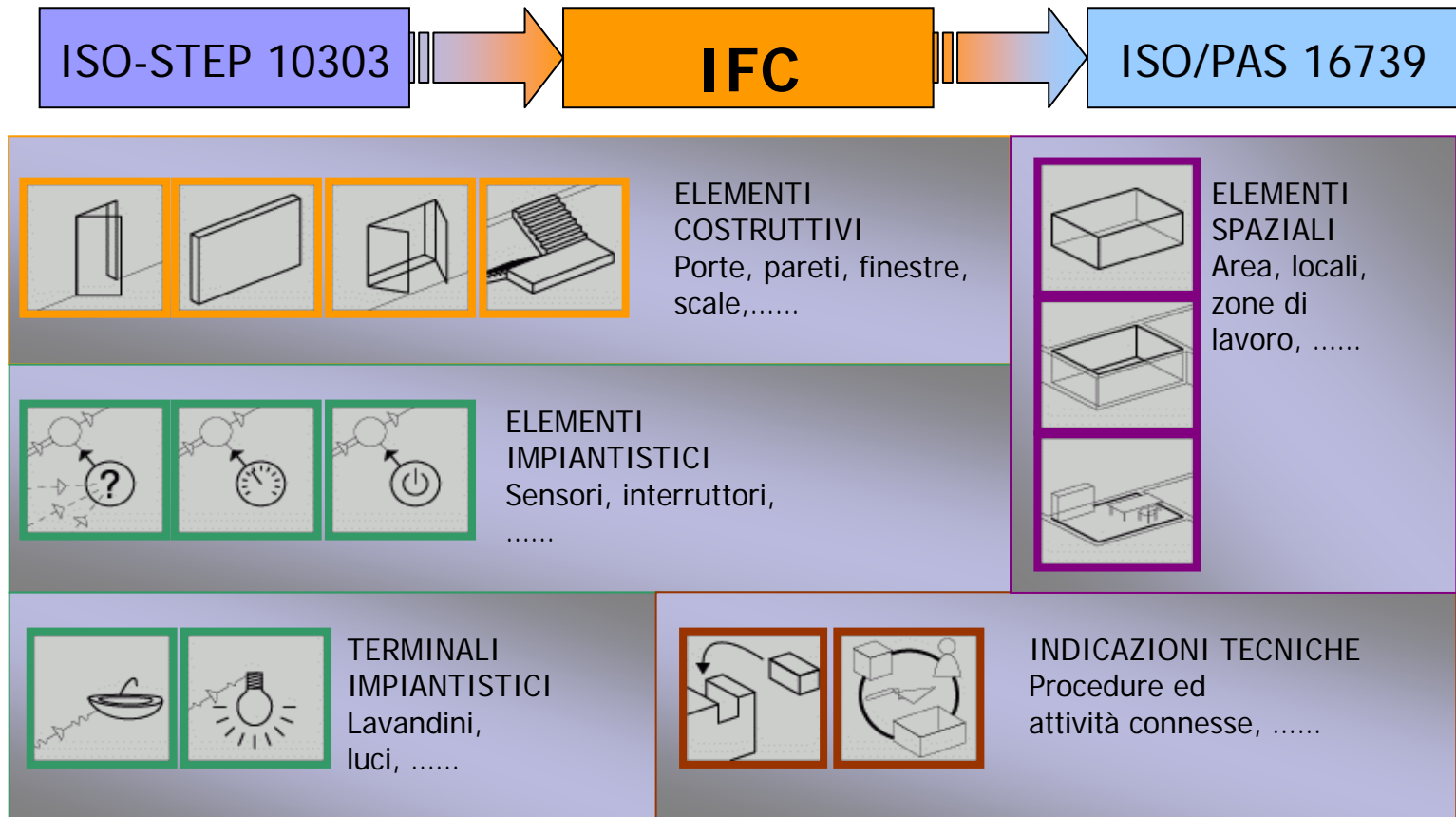


## Il prodotto di buildingSMART – IAI per il BIM: le IFC

### Industry Foundation Classes:

- Standard per classificare e descrivere elettronicamente, in un formato utilizzabile da un software, gli oggetti che possono fare parte di un progetto edile (porte, pareti, finestre, impianti, elementi spaziali eccetera)
- Sviluppato dall'International Alliance for Interoperability sulla base di ISO-STEP 10303
- Oggi norma ISO/PAS 16739
- Disponibile per le aziende che fanno parte dell'IAI, che possono sviluppare le proprie applicazioni sulla base di questo standard
- IDM – Information Delivery Manual
- IFD – International Framework Dictionary
- IFG – IFC For GIS (supporto per City GML)

## Industry Foundation Classes



# IDM – Requisiti per lo scambio di informazione

Who: The Requester of the Information, the Member of the Party Responsible for the Information, the Actor Requesting Information to Support a Process or Decision (Authoritative Reference: Table 32 & 34)

Business Case Development

**WHO** (Actor Requesting Information to Support a Process or Decision) (Authoritative Reference: Table 32 & 34)

Requesting Party Role	Information Provider Role	Information Provider Phase	Information Provider Activity	Information Provider Output	Information Provider Input	Information Provider Process	Information Provider Resource	Information Provider Location	Information Provider Time	Information Provider Other
Client/Owner	Client/Owner	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Contractor	Contractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Product Provider	Product Provider	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Supplier	Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Subcontractor	Subcontractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Supplier	Information Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Consumer	Information Consumer	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing

**1 WHO** (is requesting)  
Actor Requesting Information to Support a Process or Decision (Authoritative Reference OMNI CLASS – Table 32 & 34)

**WHY** (Project/Process Use or Benefit) (Authoritative Reference: Table 31)

Information Provider Role	Information Provider Phase	Information Provider Activity	Information Provider Output	Information Provider Input	Information Provider Process	Information Provider Resource	Information Provider Location	Information Provider Time	Information Provider Other
Client/Owner	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Contractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Product Provider	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Subcontractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Consumer	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing

**2 WHY** (project/process use or benefit)  
Why is this information important for a project activity (Authoritative Reference OMNI CLASS- Table 32)

**WHEN** (stage in project) (Authoritative Reference: Table 31)

Information Provider Role	Information Provider Phase	Information Provider Activity	Information Provider Output	Information Provider Input	Information Provider Process	Information Provider Resource	Information Provider Location	Information Provider Time	Information Provider Other
Client/Owner	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Contractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Product Provider	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Subcontractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Consumer	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing

**WHAT** (Dataset in BIM that supports the request and benefit) (Authoritative Reference: Table 14, 21, 23, 41, 49)

Information Provider Role	Information Provider Phase	Information Provider Activity	Information Provider Output	Information Provider Input	Information Provider Process	Information Provider Resource	Information Provider Location	Information Provider Time	Information Provider Other
Client/Owner	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Contractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Product Provider	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Subcontractor	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Supplier	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing
Information Consumer	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing	Business Phasing

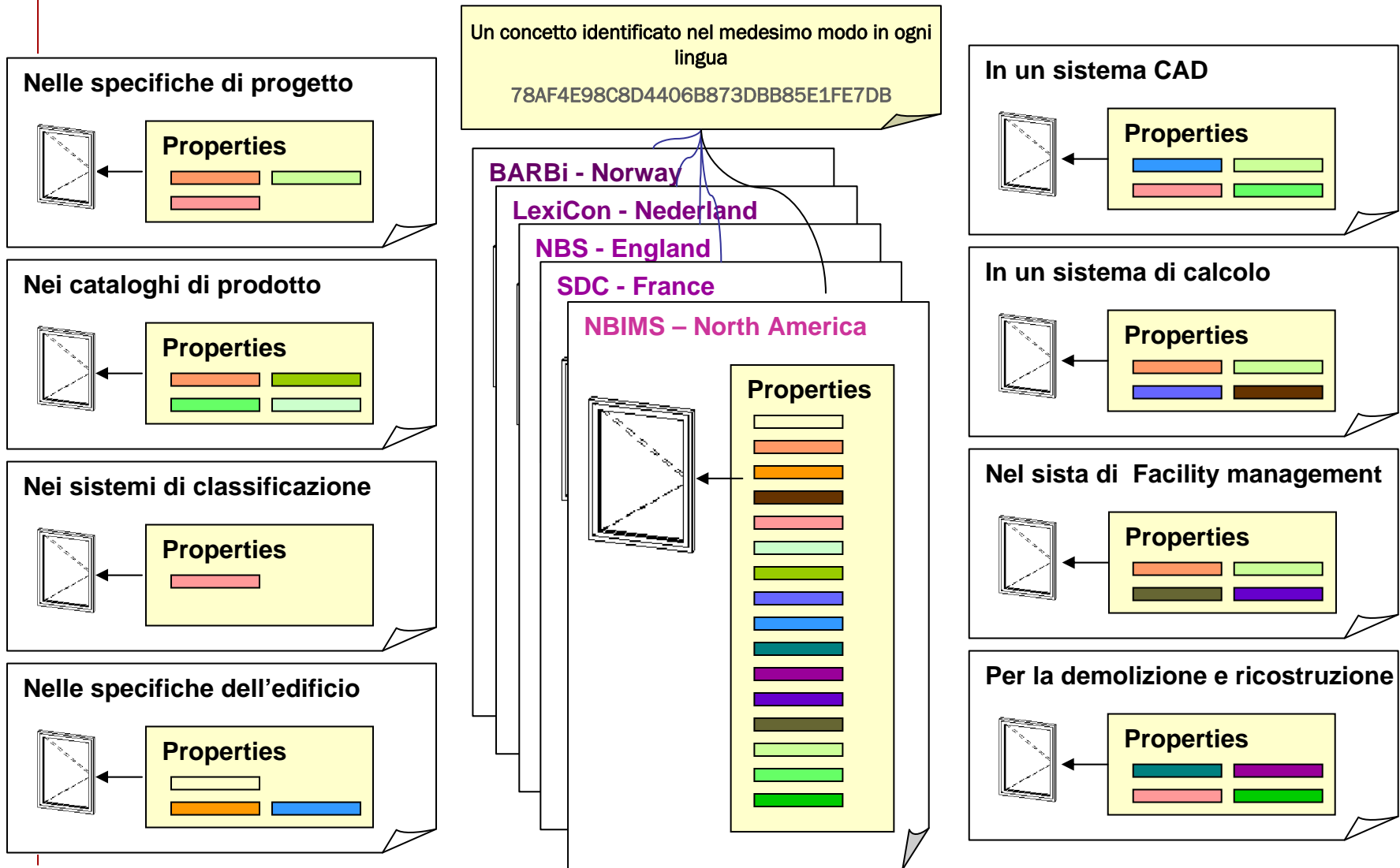
**3 WHEN** (stage in project)  
(Authoritative Reference OMNI-CLASS-Table 31) Table 31 is tied to Ifc Phases (Project Lifecycle) Table 22 for Construction Phasing

**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/fulfills the information need OMNI-Class 33. 34

I requisiti per lo scambio di informazione sono definiti nell'Information Delivery Manual (IDM)

# IFC/IFD – Un oggetto può essere collocato in molteplici contesti



Courtesy of Lars Bjørkhaug, Norwegian Building Research Institute

## Software certificati IFC



jatkuvaa huolenpitoa

Autodesk	Revit	<b>CAD 3DOO per Architettura</b>
Bentley	Triforma	<b>CAD 3DOO per Architettura</b>
DDS	ElectroPartner/ HVACPartner	<b>CAD per impianti elettrici e HVAC</b>
G.E.M. Team Solutions	IFC-Interface for Autodesk ADT	<b>Interfaccia IFC- per CAD architettonico</b>
Graphisoft	ArchiCAD	<b>CAD 3DOO per Architettura</b>
Nemetschek	Allplan / Allplot / Allfem / Alfa	<b>CAD 3DOO per Architettura, Ingegneria Strutturale e Civile, Contractors e Facility Managers</b>
BCA Singapore / novaSPRINT	e-Plan Checking	<b>Strumenti di controllo dei documenti di progetto</b>
Olof Granlund	BSPRO/RIUSKA	<b>Interfaccia IFC e simulazione energetica</b>
Solibri	Model Checker	<b>IFC model checker</b>
Vizelia	Facility on line VRML & CAD	<b>CAD Visualizzatore VRML su base IFC per facility managers</b>
YIT	Cove	<b>Valutazione costi</b>



## IAI Italia - Attività



- Disseminazione
  - Progetto di Architettura e Interoperabilità, Atti del convegno, Milano, 1 settembre 2010, ISBN 9788890545306
  - Roma, Meeting PTIC, ottobre 2008
  - Bologna, SAIE ottobre 2008
  - Bruxelles, STAND INN ottobre 2008
  - Torino, STAND INN luglio 2008
  - Torino, XXIII Congresso UIA luglio 2008
  - Roma, Meeting PTIC, maggio 2008
  - Milano, MADE expo febbraio 2008
  - Milano, STAND INN settembre 2007
  - Bologna, Research2Business, maggio 2007
  - Genova Restructura, aprile 2007
  - Bologna Meeting PTIC, febbraio 2007
  - Lecco, Interoperabilità, novembre 2006
  
- Normativa
  - Collaborazione con UNI



## IAI Italia - Attività

- Formazione

- Attività istituzionale corsi Facoltà di Ingegneria e Architettura – corsi di laurea, PhD, Master

- Corsi di formazione FSE

- Dal CAD al BIM:

400 h di lezione frontale + 200 h di stage a partire da ottobre 2007, in collaborazione con i soci di IAI Italia e la Regione Lombardia  
Concluso a luglio 2008

Formazione trasversale sui concetti di modellazione BIM e sull'utilizzo dei modelli nel processo di progettazione interoperabile (aspetti normativi legati all'interoperabilità, progetto architettonico, energetica, strutture, computi, gestione e programmazione dei lavori)



## IAI Italia - Attività

- Ricerca



### PTIC e ECTP

- Coordinamento della Focus Area ICT & Processes

- Codifiche per la definizione di librerie di oggetti utili per costruire modelli virtuali BIM3D (orientate a produttori di materiali e componenti, progettisti, promotori immobiliari e imprese)
- messa a punto di software e delle relative metodologie e procedure applicative, per la rappresentazione e il controllo del territorio, fino al dettaglio dell'edificio, con l'utilizzo di "iper-documenti" (documenti di tipo ipertestuale, ma realizzati a partire da modelli GIS-BIM)
- sviluppo di metodologie per la gestione dei modelli di cui al punto precedente con l'utilizzo di model servers a base centralizzata
- favorire attraverso l'attuazione di progetti pilota l'adozione delle IFC quale standard per l'interoperabilità richiesto dalla Pubblica Amministrazione Centrale e Locale

## IAI Italia - Attività

- Ricerca
  - International Service Life “Interoperable” Data Base (CSTB - Politecnico di Milano)
    - Service Life Planning – ISO 15686
    - buildingSMART standards
  - L’archivio interoperabile di materiali e componenti per l’industria delle costruzioni italiana Progetto **INNOVANCE** (ANCE - Assimpredil, Politecnico di Milano, etc.):
    - buildingSMART standards
    - Standard Internazionali relativi a :
      - Sostenibilità, efficienza energetica, CPD, Service Life Planning
    - Standard UNI- ANCE sui sistemi di classificazione di materiali e componenti
  - e Government per il Public Procurement nelle costruzioni
    - Validazione del progetto
    - Con Building Information Model basato su standard buildingSMART

**CSTB**  
le futur en construction

**POLITECNICO DI MILANO**

**Reference Platform**

**Database for the evaluation of buildings' Service Life**

Grid's Features External Thermal Insulation Composite Systems  
Family : Superstructure, Category : Outside partitions, Sub Category : Outside protections

Failure waves (List of the failure wave associated to the Grid)

AGENTS		REMARKABLE FACTORS
Agent related to the inherent quality characteristics	A	Quality of components
	B	Design level
	C	Work execution level
Environment	D	Indoor environment
	E	Outdoor environment
Operation conditions	F	In-use conditions
	G	Maintenance level

Manifattura, storage, transport, materials, protective coatings (factory-applied)

Incorporation, sheltering by rest of structure

Site management, level of workmanship, climatic conditions during execution of the work

Aggressiveness of environment, ventilation, condensation

Elevation of the building, microenvironment conditions, traffic emissions, weathering factors

Mechanical impact, category of users, wear and tear

Quality and frequency of maintenance, accessibility for maintenance

## IAI Italia - Attività



**“STAND INN” - Integration of performance based building standards into business processes using IFC standards to enhance innovation and sustainable development** – European Commission funded project

Convegni: Milano 21 settembre 2007  
Torino 2-3 luglio 2008

Progetto terminato con il Convegno  
*Waking a sleeping giant – Innovation and sustainability in construction*, Bruxelles, 14 – 15 ottobre 2008

# IAI Italia - Attività

Ricerca e implementazione software interoperabile da parte dei soci

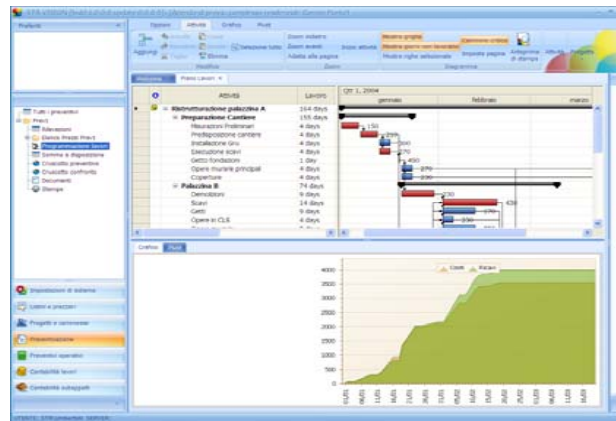
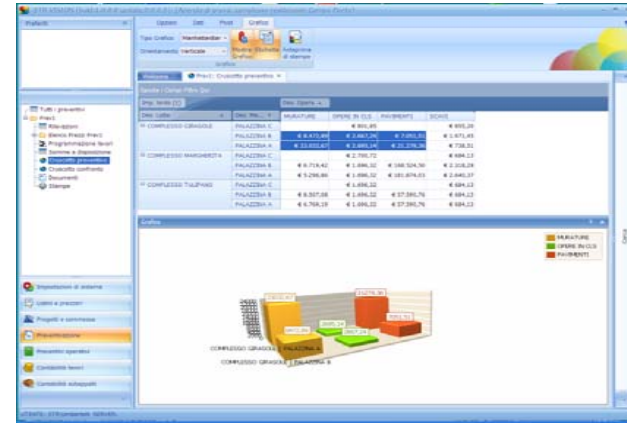
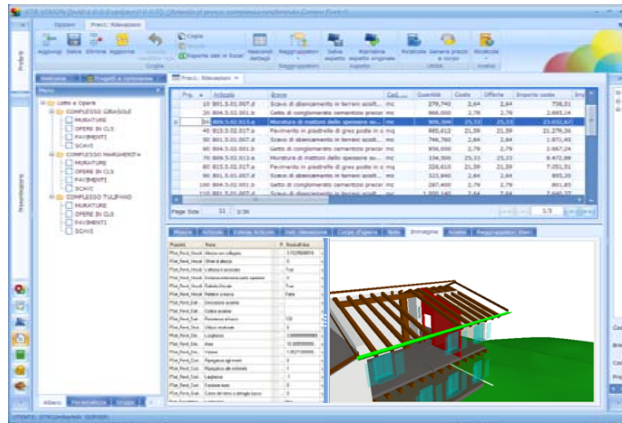


Immagine STR

A red square is located in the top-left corner. A thin red vertical line extends downwards from the bottom of the square, and a thin red horizontal line extends to the right from the right side of the square.

## Riferimenti

- <http://www.iaiitalia.polimi.it>
- <http://www.buildingsmart.it>
- [iaiitalia.best@polimi.it](mailto:iaiitalia.best@polimi.it)

**GRAZIE**