The Basics of BIM:
Theory and Practice

Lesson 1 – What is BIM?

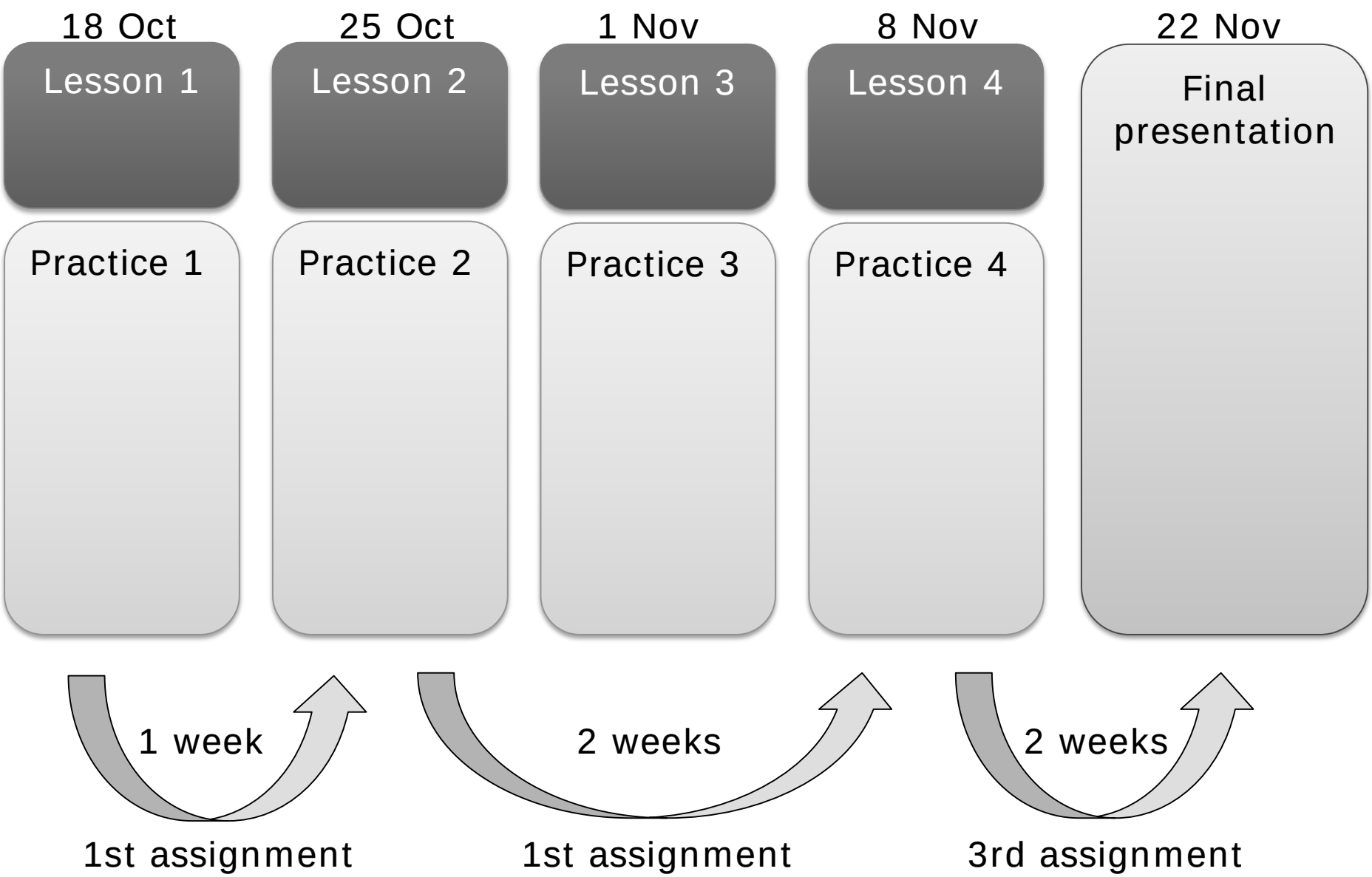
Bence Kovacs

Introduction

Bence Kovacs / ベンツェ　コバーチ

- Born in Budapest, Hungary (1963)
- Graduated as architect at Technical University of Budapest (1989)
- Graduate school at Tokyo Instutute of Technology (1990-1992)
- Working as architect in Tokyo (1992-94)
- Technical Director and General Manager at GRAPHISOFT Japan (1994-2000)
- VP of Product Management in GRAPHISOFT HQ, Budapest (2000-2006)
- Associate Director at (EEA) Erick van Egeraat associated architects (2006-2009)
- Again: General Manager at GRAPHISOFT Japan and later VP of Asia (2009-2016)

What are we going to do?



Lectures

Learn about BIM in theory

What is BIM? (1st lesson)

- The BIM concept
- The origins of BIM
- The benefits
- Current state of BIM WW

The Designers' BIM (2nd lesson)

- The BIM workflow
- Collaborative BIM
- Algorythmic design and BIM

Multi-disciplinary BIM (3rd lesson)

- BIM for coordination
- Structural BIM, MEP BIM
- The OPEN BIM concept

What's next for BIM? (4th lesson)

- Latest trends in BIM

Hands-on

Learn about BIM in practice – using ARCHICAD

1st lesson:

- Basic BIM operation

2nd lesson:

- Advenced modeling
- Algorythmic design (ARCHICAD + Rhino)
- Presentation techniques using BIMx

3rd lesson:

- Consultation for the assignment
- Teamwork in BIM

4th lesson:

- Presentations and consultations

Assignments

Do design and documentation using BIM

1st assignment: Simple modeling task

Model the space where you live!

- Time: 1 week

2nd assignment: advanced modeling and documentation

Model and document an exisisting building (by Le Corbusier)

- Time: 2 weeks

3rd assignment: BIM design in teamwork

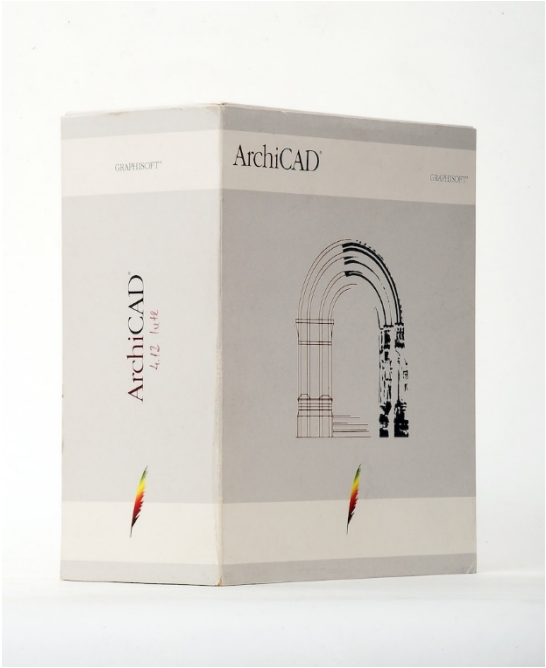
Model and document your own design (working in groups of 3-4 people)

- Time: 2 weeks

My BIM story

All have started with this:

- But I need a CAD software...



Next: ARCHICAD 4.0

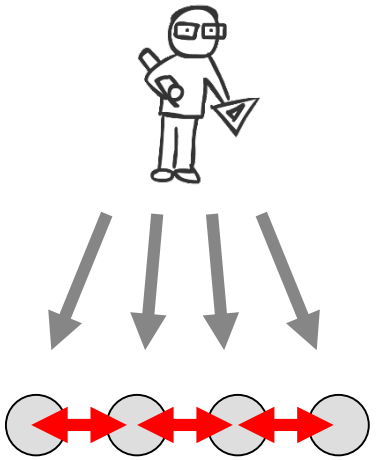
3 Stages of BIM excitement

- 1st stage: 3D is wonderful...!
- 2nd stage: I can do the drawings faster!!
- 3rd stage: I am in control!!!

BIM = control over the design

The keyword: CONTROL

- Hand drawing >> do it again!
- Copy machine >> minimal level of control
- 2D CAD >> control over 1 drawing
- BIM >> Changing things only ONCE



The key concept: SINGLE SOURCING

- Physical address book
- Address book(s) on the computer, smartphone etc

BIM = control over the design

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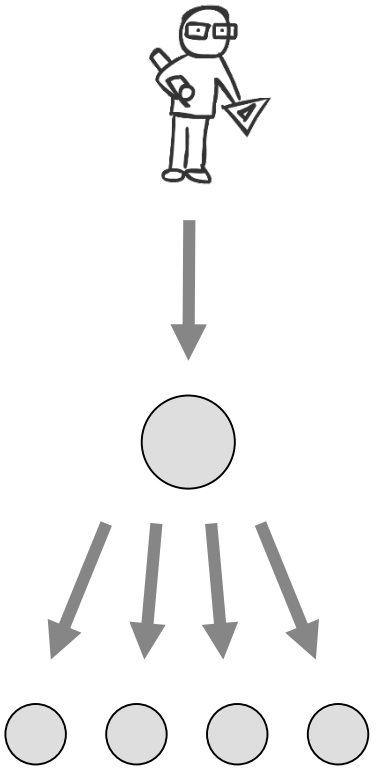
The key concept: SINGLE SOURCING

- Physical address book
- Address book(s) on the computer, smartphone etc
- Address book in the cloud
- BIM data in the computer, in the cloud



BIM – the industry demand

The manufacturing industry

Tremendous increase in productivity

- From custom build to mass production
- From manual to automatic

High level of ICT usage

The construction industry

A hugely wasteful industry

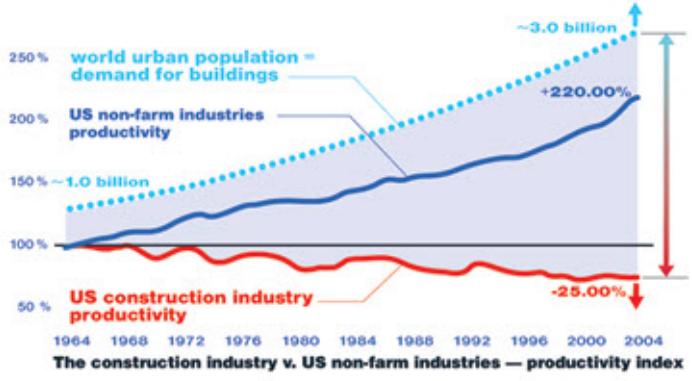
- DROP in productivity
- No significant change in the technology
- 40% of Energy Consumption
- 40% of Solid Waste
- Large amount of lost effort (25%?)

An unsustainable model

- Lack of manpower
- Lack of skills

Low level of ICT usage

- Lowest among most of the industries



US Department of Commerce,
Bureau of Labor Statistics

BIM – why is is so late?

Lack of mass production

- Cost of design per building is high...
- ...but the total design costs is low

1 design

10.000+ built

1 design

1 building built

BIM – why is is so late?

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Buildings are complicated

- Perhaps simpler components...
- ...but a lot more!

VS

BIM – why is is so late?

Lack of mass production

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Buildings are complicated

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- ...but a lot more!

Resistance of change

- Do not want to use computers
- Cannot use computers

Evolution of AEC CAD

2D solutions

Electronic drafting board

3D solutions

Modeling for pure visualization purposes

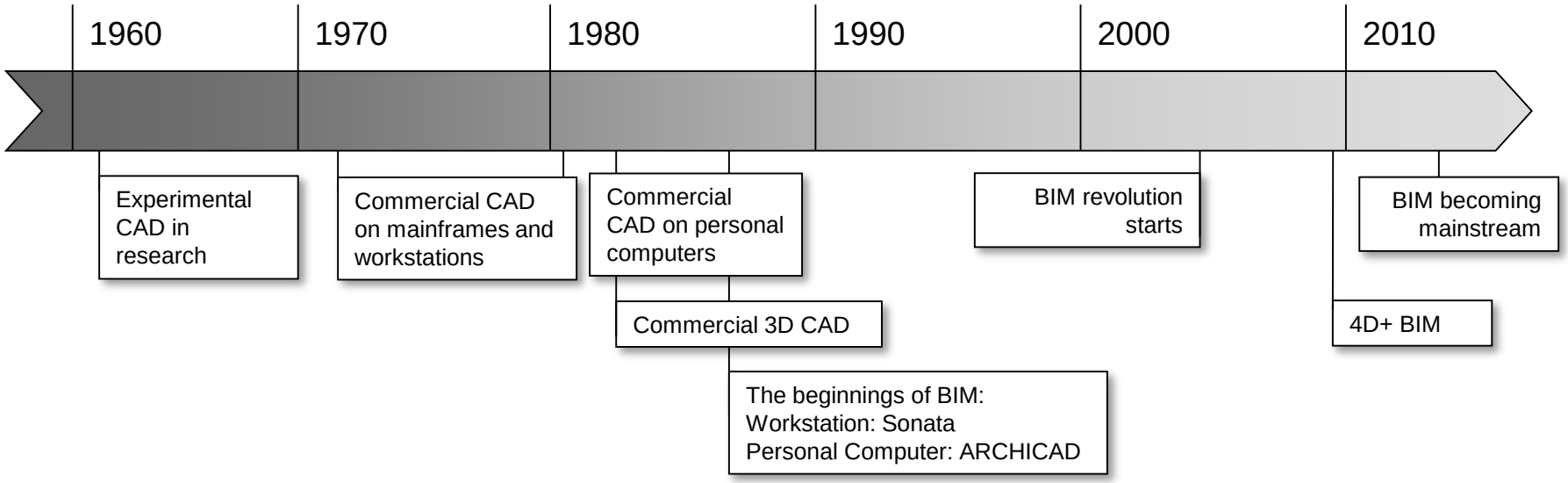
BIM solutions

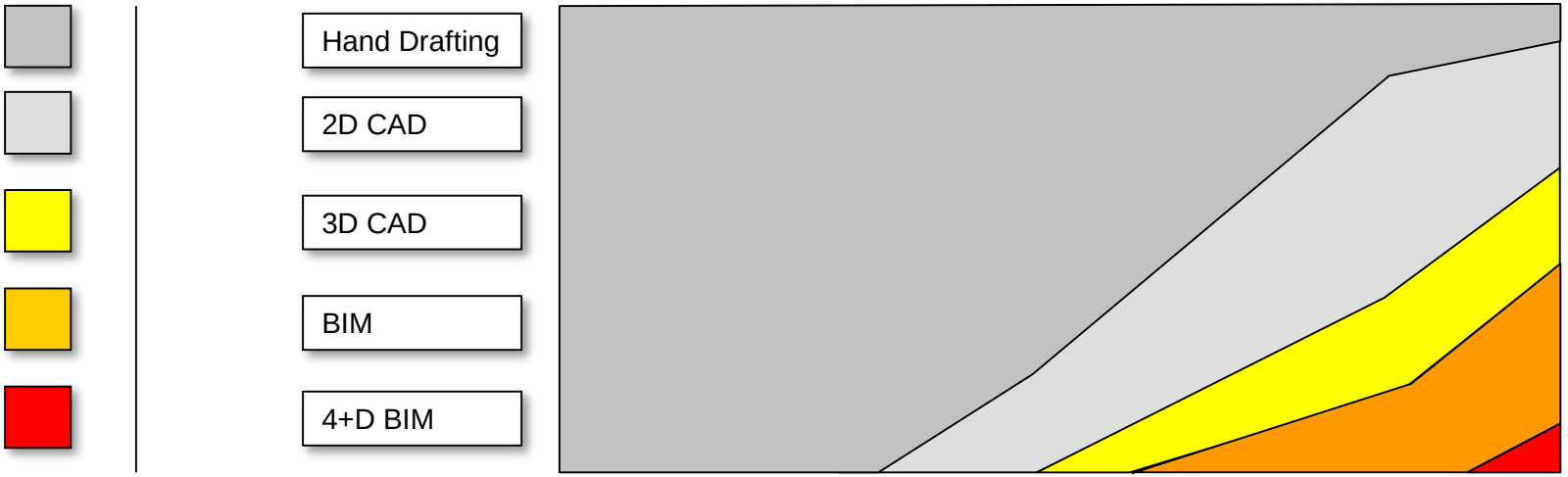
Models with integrated architectural information

4D-5D+ BIM - Construction Coordination

Timing/scheduling and Cost estimation

A/E/C CAD Timeline





2D CAD - Workflow

Design and document all in 2D

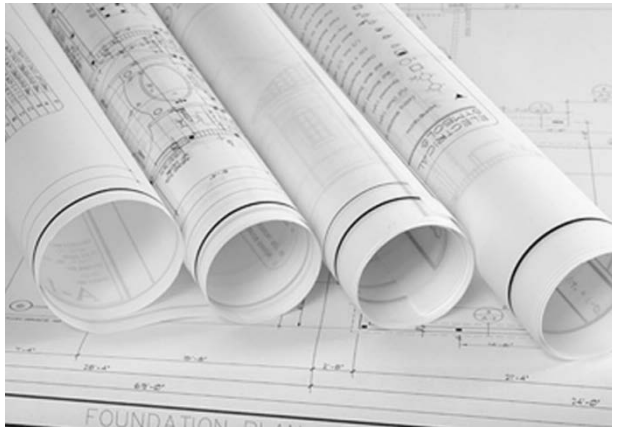
No 3D model

Drawings in separate files

Manual coordination of drawings

No visualization and calculation tools

2D CAD - Evaluation



Benefits

Compared to hand drafting

- Fast modifications
- Accuracy
- Intelligent drafting tools (fills, dimensions)
- Repetitive element handling (blocks, xrefs)

Compared to 3D CAD and BIM

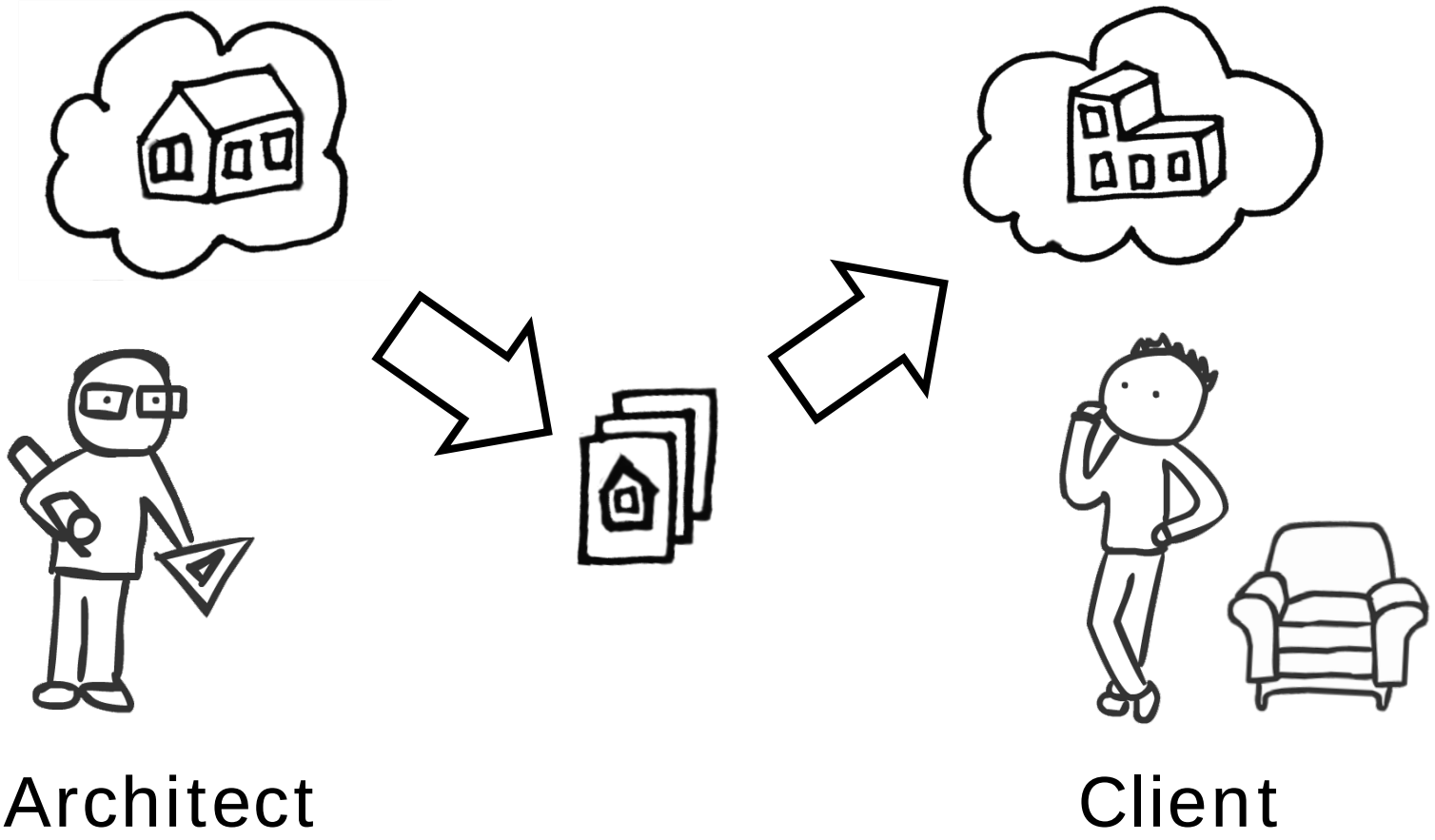
- Simple working concept (electronic drafting)
- Relatively small file size (only 2D data)
- Workflow is applicable for all building types

Drawbacks

Compared to 3D CAD and BIM

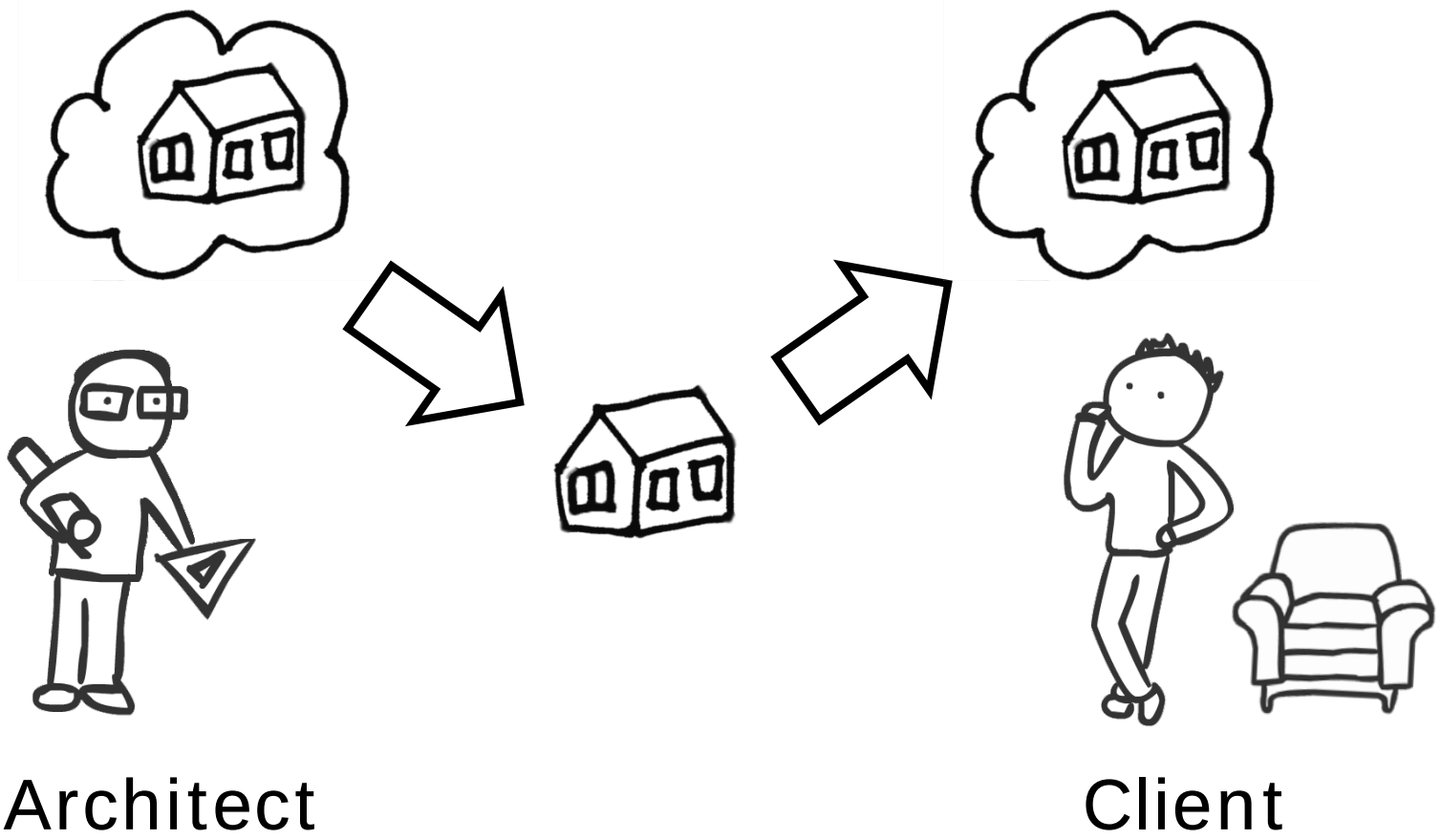
- Drawings are not coordinated automatically
- No 3D visualization
- No automatic calculations, quantity take-offs or schedules
- No collision detection
- No analyis

BIM = Communication



Information is „lost in translation”

BIM = Communication



Architect

Client

Less translation → less info loss

3D CAD - Workflow

CAD application has 2D & 3D capabilities

Buildings can be modeled in 3D

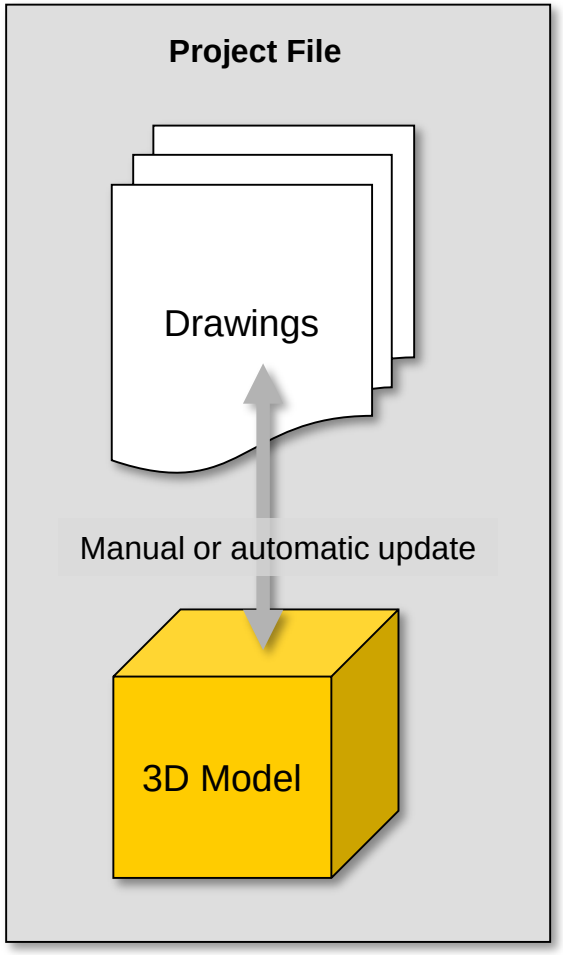
3D and 2D information can be included in one file

Drawings are (partially) derived from the model

No automatic documentation

Applications mostly works with 2D and 3D tools instead of real architectural elements

Basic visualization and calculation tools



3D CAD - Evaluation

Benefits

Compared to 2D CAD

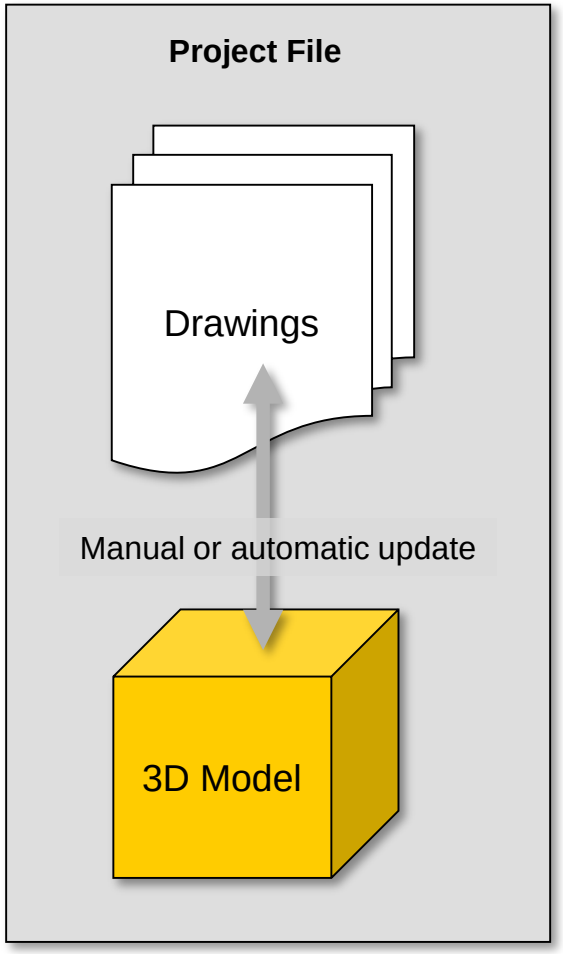
- Easier identification of design problems
- Faster change management
- Visualization and calculation capabilities

Compared to BIM

- 3D modeling is optional
- Smaller file size

Drawbacks

- Concept doesn’t follow the architectural design process
- No automatic documentation
- No real architectural elements



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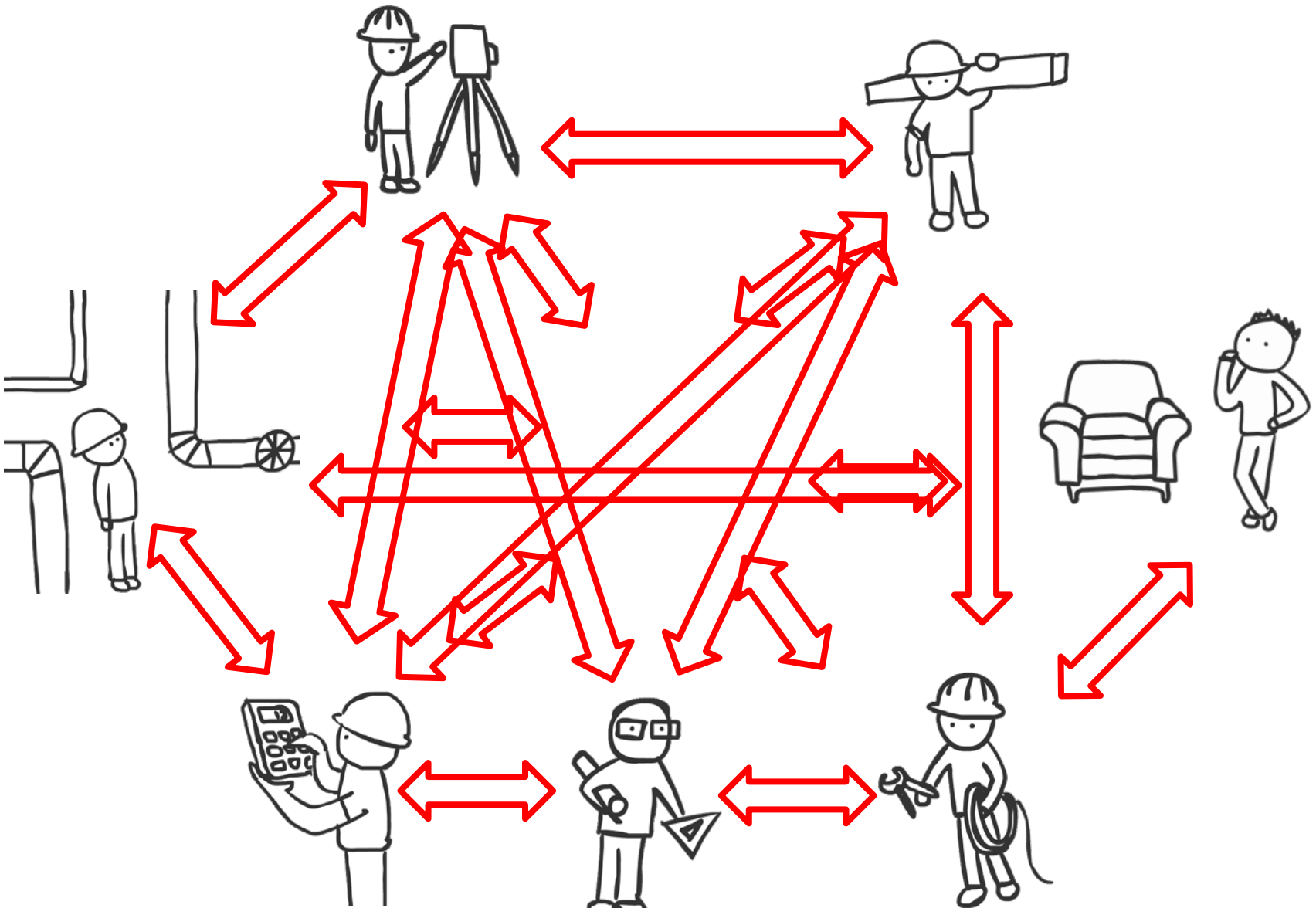

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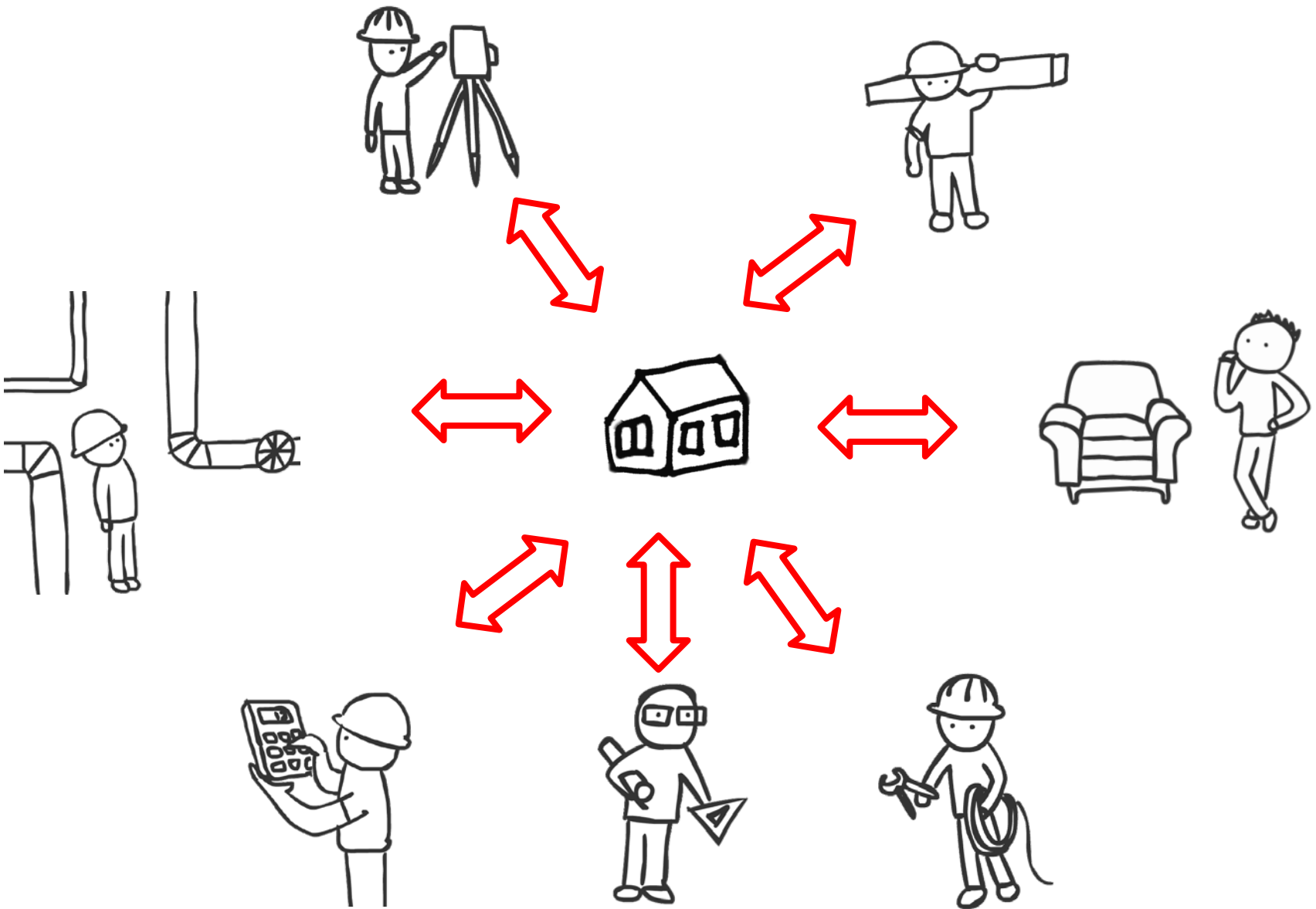
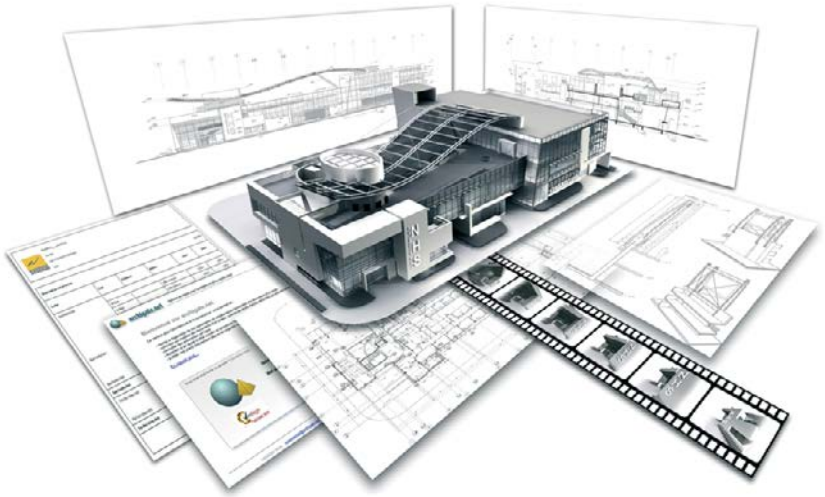


The BIM Concept



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BIM = **B**uilding **I**nformation **M**odeling

Also known as „Virtual Building” or „Building Simulation”

Drawings, model views, visualizations, calculations and quantity take-offs are automatically derived from the 3D model.

BIM definition

Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.

US National Building Information Model Standard Project Committee

BIM - Workflow

Single file concept:

The complete building model and all of it’s representations are included in the virtual building file

Real architectural elements used for modeling

Changes of the model affects all drawings, and vice versa

Automatic documentation workflow

Rich architectural content (libraries)

Building information data attached to the elements

Internal visualization tools

Calculations, schedules

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BIM - Evaluation

Benefits

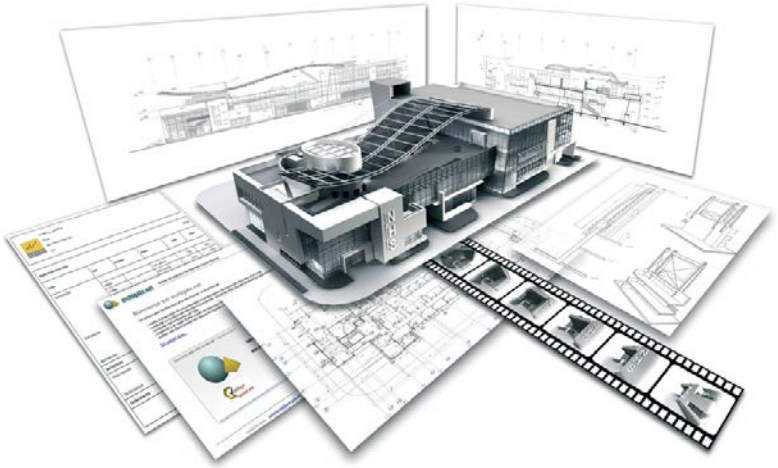
Compared to 2D and 3D CAD

- Real architectural elements
- Automatic drawing coordination
- Rich visualization content (animation, sun studies, renderings etc.)
- Automatic quantity take-offs, schedules
- Connection to structural, MEP, energy calculation and collision detection applications

Drawbacks

Compared to 2D and 3D CAD

- Might be difficult to learn the BIM approach for 2D cross-graders
- Needs strong HW
- Price



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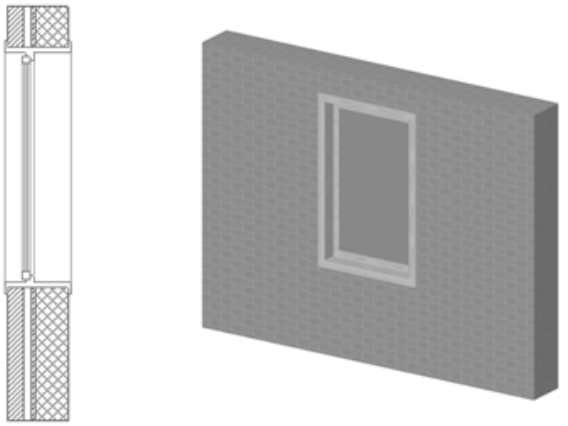
BIM - Real Architectural Elements

Drawing representation

- Floor plan, section and elevation views
- Adjustable contours, fills, backgrounds
- Scale sensitivity



Model representation

- 3D shapes connected to drawing element
- Surface color and texture

Non-graphical information

- Material descriptions
- Quantities, volumes,
- Cost data
- Metadata

BIM - Model Based Documentation

Coherence between model and drawing

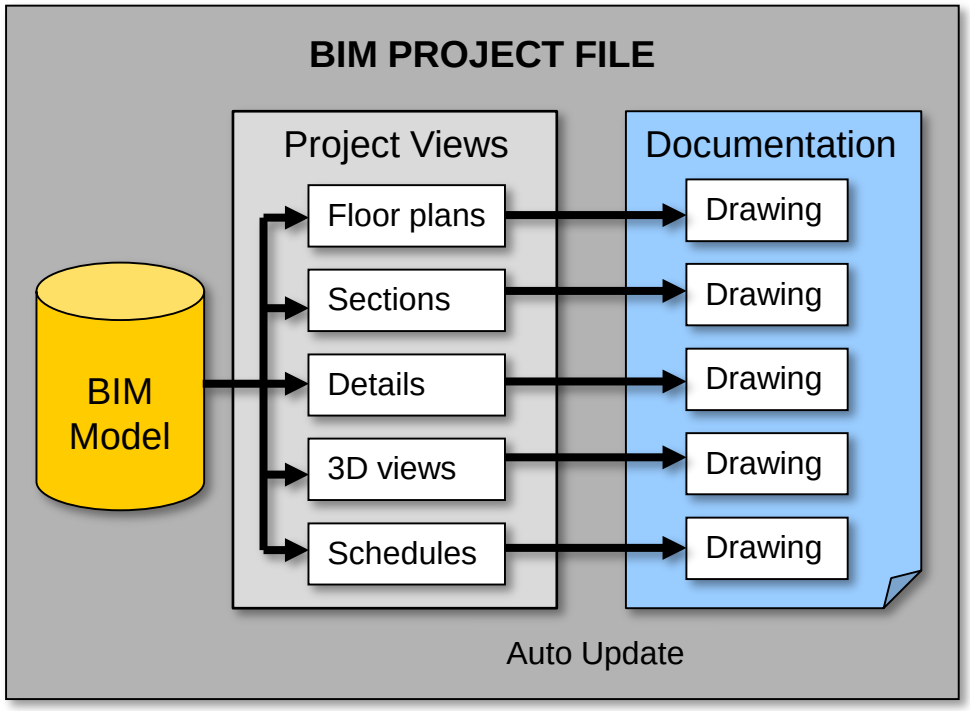
All drawings derived from the model

Model coordinates drawings

Scale sensitive elements

The complete project lifecycle can be controlled from a single file

Rich 3D visualization content



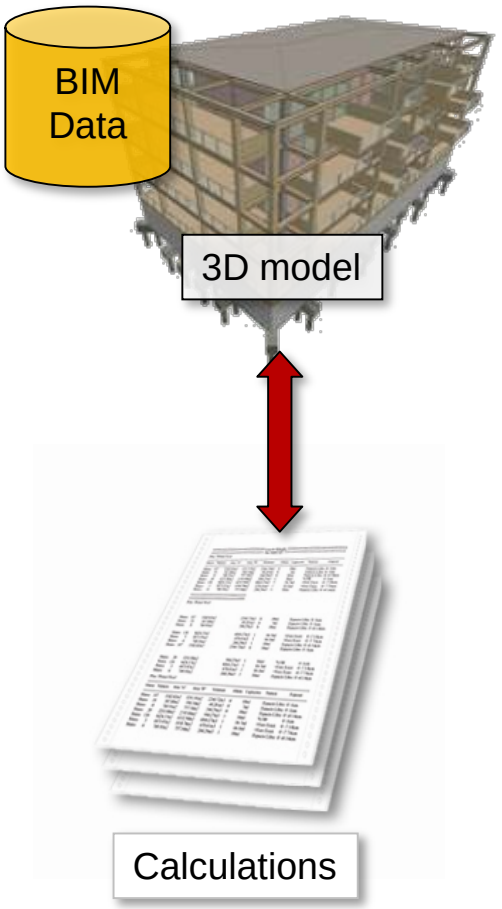
BIM – the Information Model

Additional information attached to a model

- Quantity
- Materials
- Descriptions („metadata”)
  - Product details
  - Construction details
  - Safety details
- Cost data

Instant accessibility to information

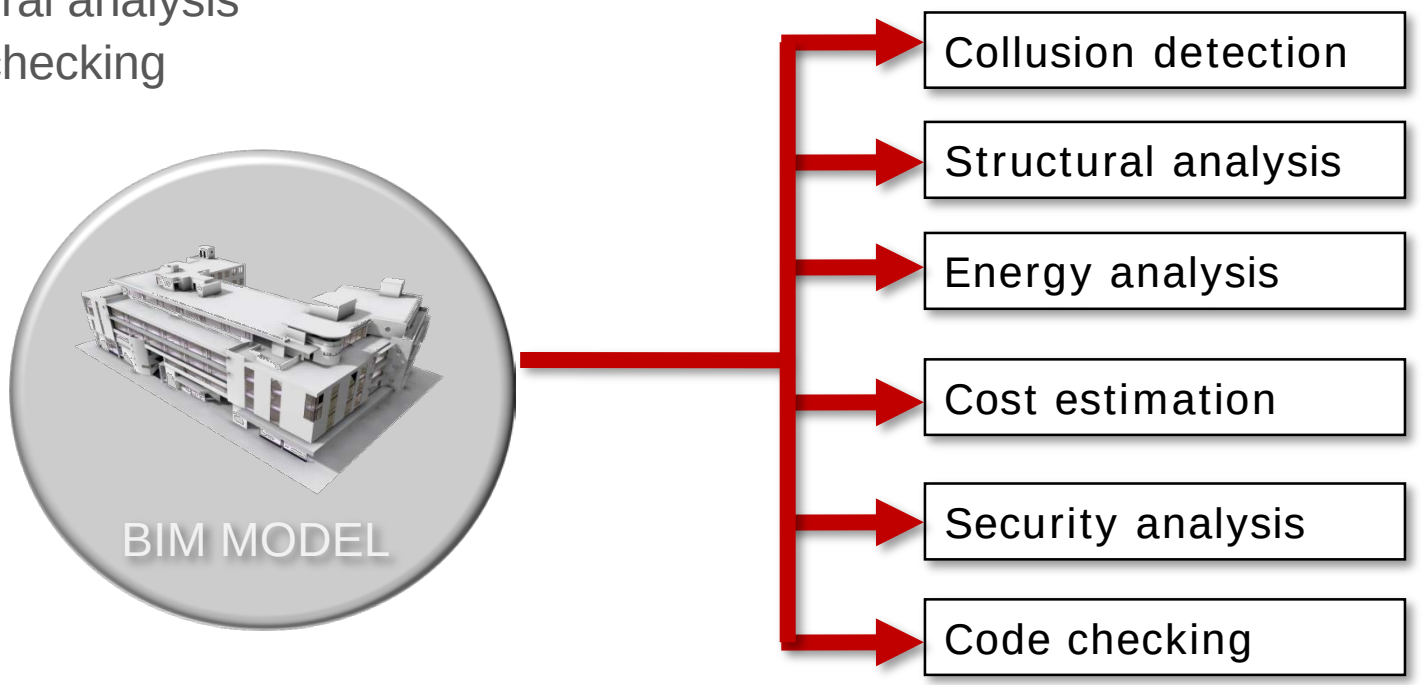
- Quantity takeoffs
- Room Inventories
- Door & Window schedules
- Output to analytical tools



BIM - Analysis, Coordination

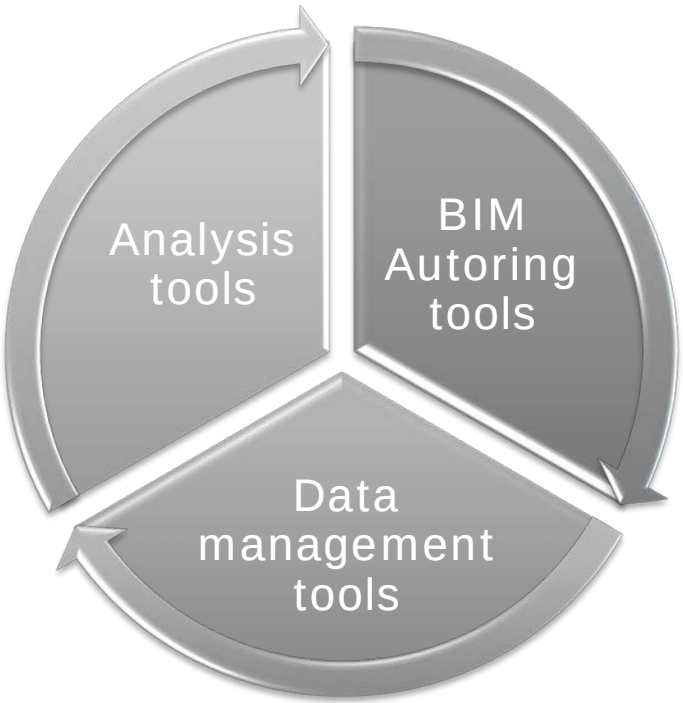
Further processing the BIM data in third party applications allows a wide range of analytical activities:

- Collision detection
- Energy efficiency analysis
- Structural analysis
- Code checking



Types of BIM software

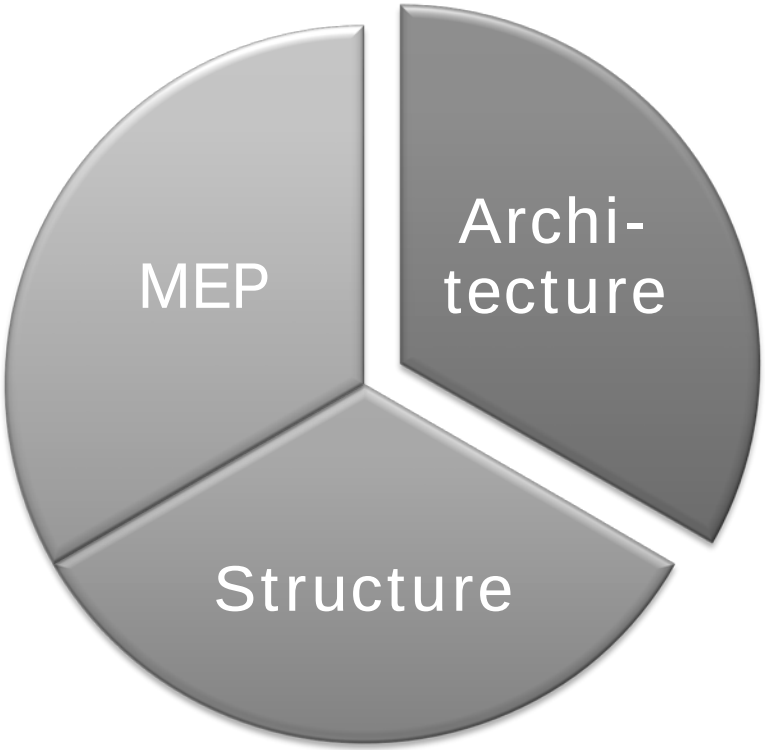
To analyze the BIM data
- Collusion detection
- Thermal analysis
- Structural analysis
- etc.



To create the BIM data
- Architecture
- Structure
- MEP

To manage the BIM data
- share
- view
- store
- etc.

BIM authoring software



ARCHICAD (GRAPHISOFT)

- Developed for architecture from the scratch
- Intuitive and easy-to-use, widespread in Europe

Revit (Autodesk)

- Most widely used WW

AECOsim (Bentley)

- Infrastructural projects, plant design

Gloobe (Fukui Computer)

- Distributed only in Japan

Vectorworks (Vectorworks Inc.)

- 2D / 3D CAD with some BIM capabilities

BIM – the software and the process

BIM is a process, not just a tool

- BIM process = BIM software + know-how
- Know-how is more than just knowing the functionality...
- ...it is about how you work using the tool

You have to build your own know-how!

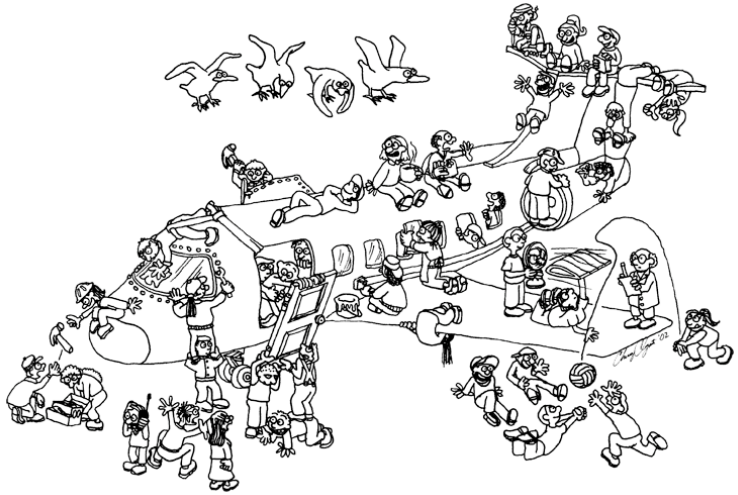
- Learn the functions
- Read the literature (books, blogs etc.)
- Consult with friends/collegues/teachers
- +
  - THINK
  - TRY
  - IMPROVE

Functions	Know-how
Filtering and classifying techniques	How should I organize my data?
The use of modeling tools	What should I model and what keep as a 2D?
The use of teamwork / workspaces	How should I collaborate with my collegues?
Exporting data to other formats	How can I collaborate with other disciplines?
	What kind of organizational changes I have to do?

BIM – work in progress

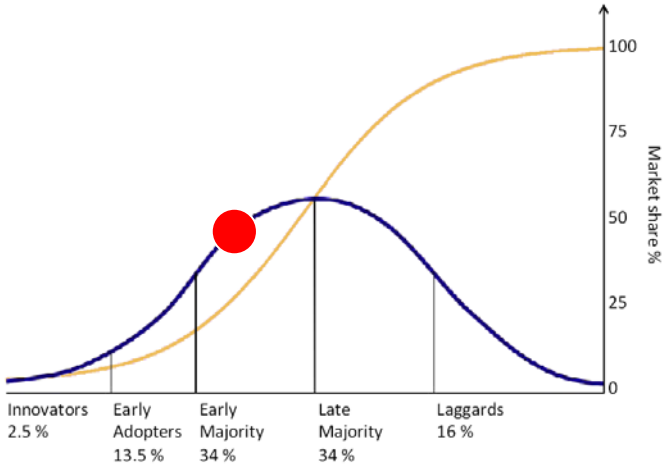
The excuses:

- BIM is difficult - *hmmmm...yes*
- BIM is slow - *not any more!*
- BIM is inflexible - *it is less and less true*
- BIM is expensive – *but not for students*



BIM is far from completed

- Tons of new functionality is required
- Interoperability is much to be improved
- Ease-of-use can be better
- Know-how is not yet standardized
- There is no such a thing as „fast enough”



Is it good enough to use it?

- YES!
- What if I just wait until it is ready?
- It is no fun to be the last...

BIM is just a tool / process

It will not:

- Think instead of you
- Design instead of you
- Prevent you making bad decisions

YOU are the architect...