

Critical Success Factors for Management of digital data in Projects

1.3.2023



Zdeněk Rudovský,
BIM manager





Dr. Zdeněk Rudovský

- BIM manager, Department of construction and investment, Rector's Office, CTU in Prague
- BIM manager, Department of Construction, New Nuclear Power Plant in Dukovany Site, ČEZ
- FM-data related specialist, openBIM promoter, experienced in government-BIM data standardisation



Dr. Simon Ashworth, Mitarbeiter am IFM der ZHAW, Moderation

- Forschungsschwerpunkt BIM und andere Digitalisierungsthemen in Bezug auf Immobilien und FM
- Über mehr als 20 Jahre praktische FM-Erfahrung aus den Unternehmen Serco sowie der britischen Verteidigungsakademie
- Seine Forschungsergebnisse sind unter Researchgate frei verfügbar



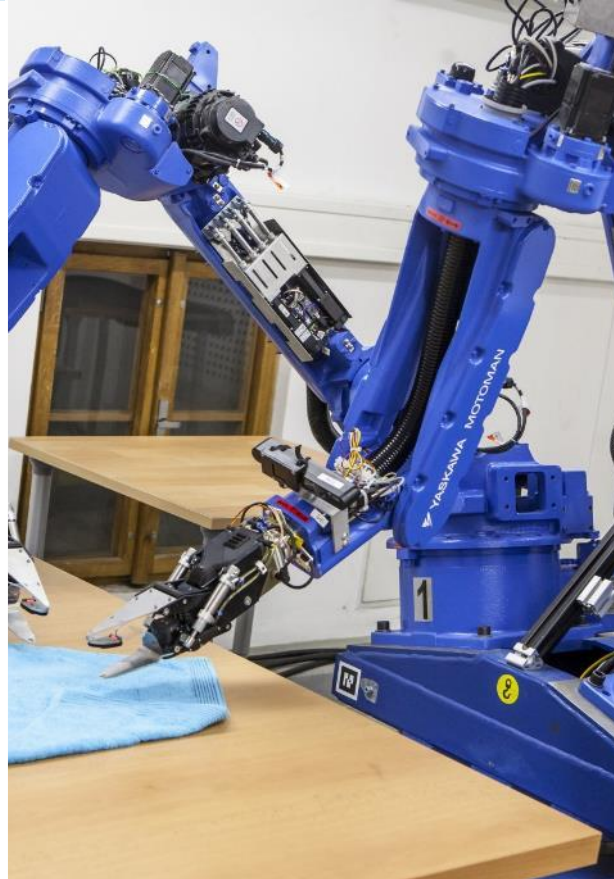
Ing .arch. Zdeněk Rudovský, Ph.D.
Odbor výstavby a investiční činnosti,
ČVUT v Praze

Zdeněk Rudovský

bim.cvut.cz

BIM manager,
Department of Construction and Investment,
Rector's Office,
Czech Technical University in Prague

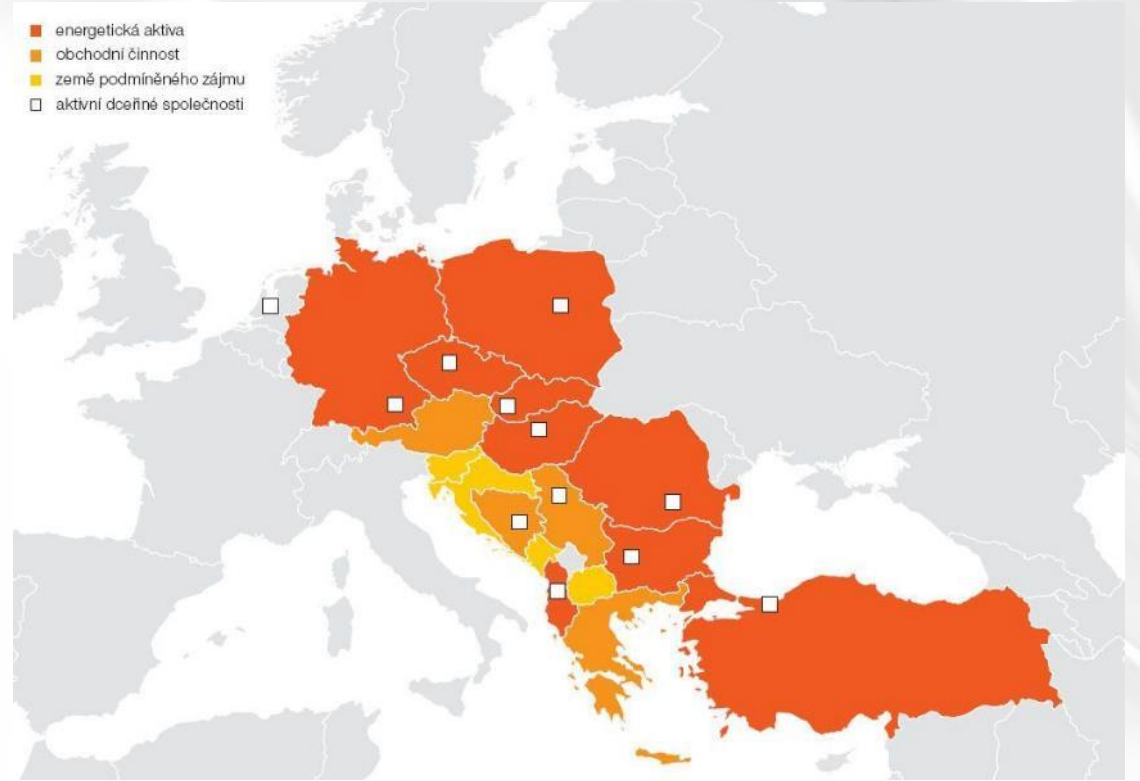




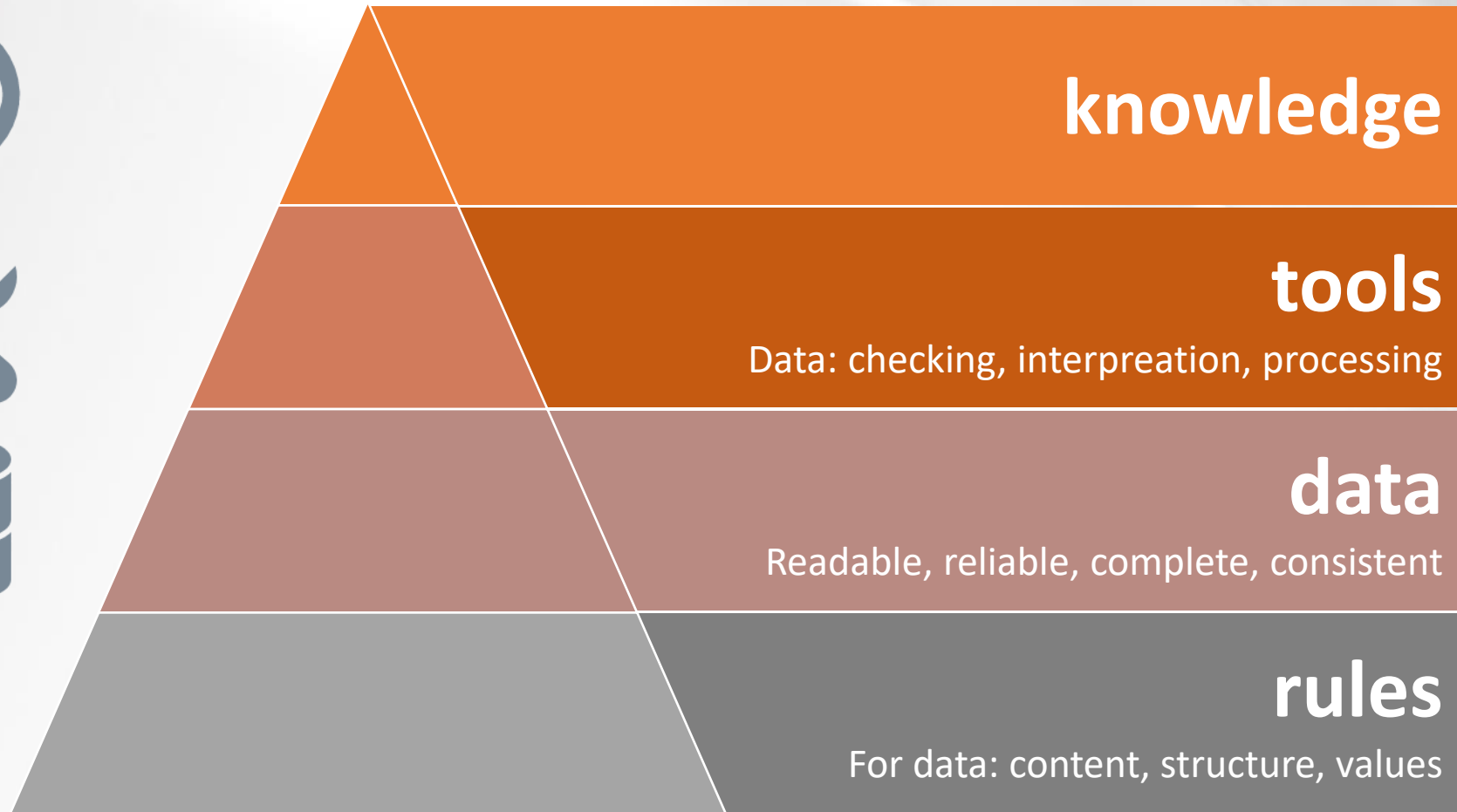
CTU in Prague (ČVUT v Praze)

**BIM manager,
Department of Construction,
New Nuclear Power Plant in Dukovany Site**





Critical success factors





Content

Space
measurement
and
classification
standard

(standard based
on EN 15221-6)

QA/QC in bim
data driven
projects

FindCAFM.com

Benchmark of
CAFM systems

Content

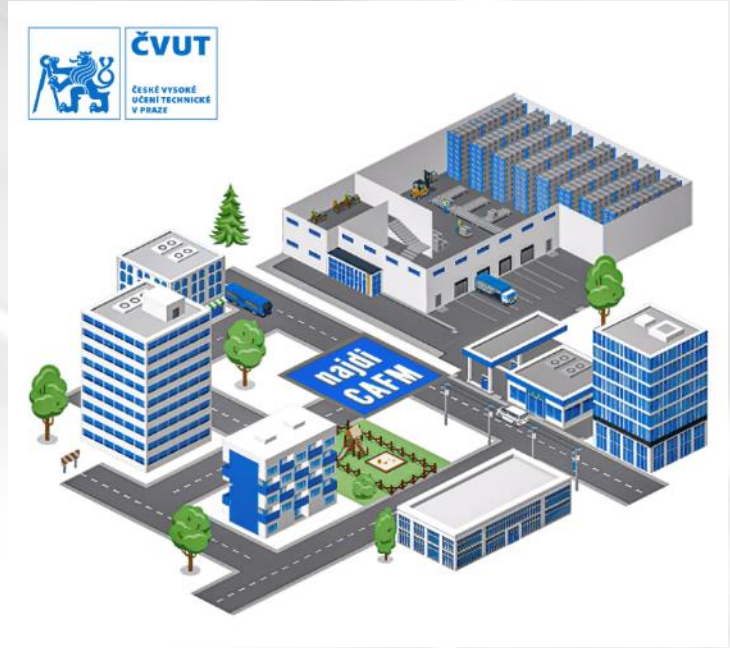
21-6 + further development (2 years)

Architectural section of a multi-story building. The building is color-coded by floor or zone: blue at the bottom, followed by yellow, orange, red, green, and yellow again at the top. Surrounding the section are several inset photos showing interior spaces:

- Top left: Meeting room with a conference table and chairs.
- Top right: Bathroom with a toilet and sink.
- Middle right: Parking garage with cars parked.
- Bottom right: Another view of the parking garage.
- Bottom left: Large open-plan office space.

3D BIM model of the building section, color-coded to match the architectural drawing. Below the model is a 'DECONSTRUCTION TAKEOFF' table:

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1	DEMOLITION OF CONCRETE SLAB	100	m ²	100	10000
2	DEMOLITION OF CONCRETE COLUMN	5	m ³	200	1000
3	DEMOLITION OF BRICK WALL	50	m ²	20	1000
4	DEMOLITION OF GLASS CURTAIN WALL	100	m ²	50	5000
5	DEMOLITION OF ROOF	1000	m ²	10	10000



Content

Space measurement and classification standard

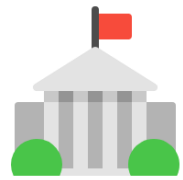


The need for a clear standard

Current/former status of portfolios

21 public universities

110 mil. Euro spent on university construction projects



government



ministry



university



faculty



housekeeper

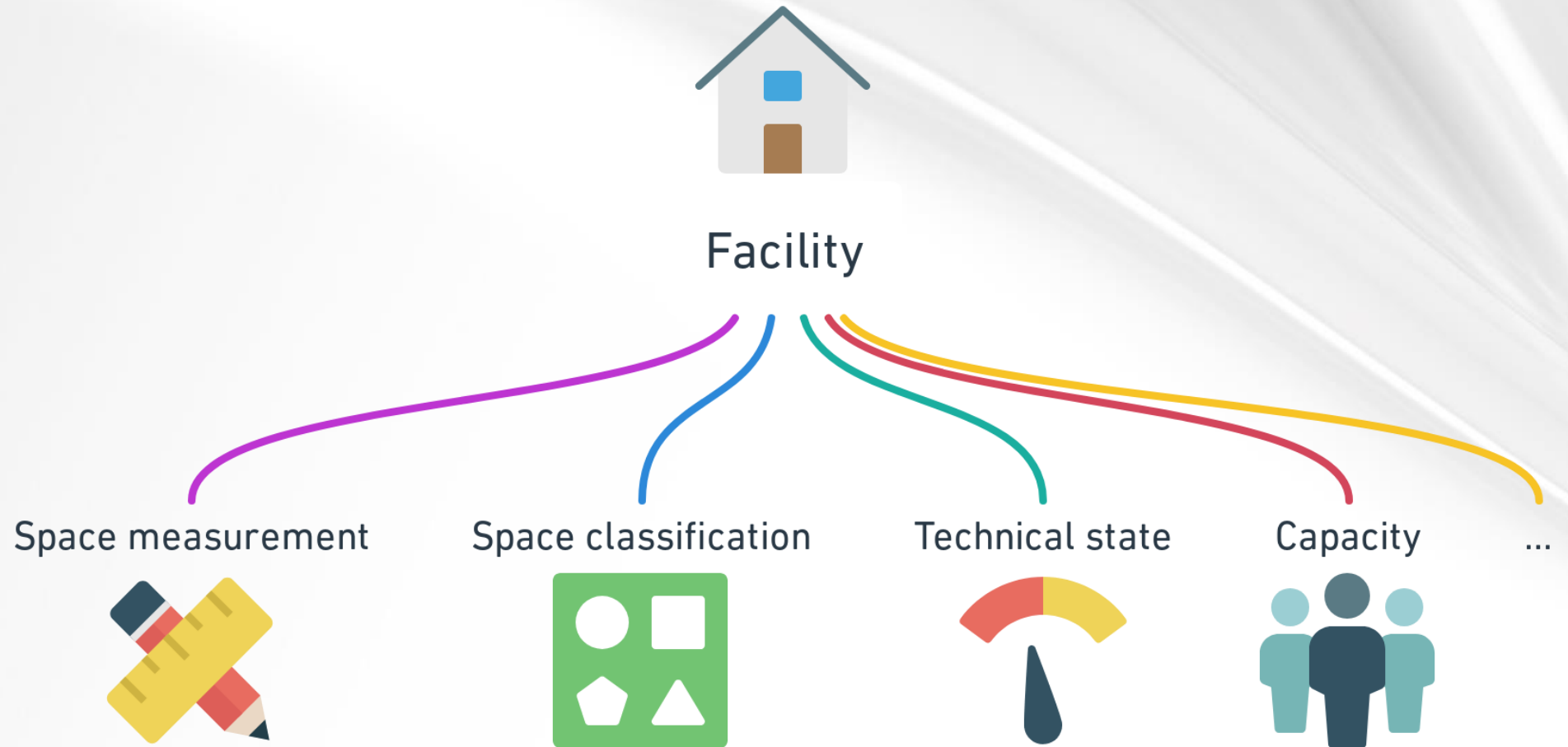
Ministry of education,
youth and sports

10 mil. Euro spent by CTU
in Prague in 2022 on
construction projects

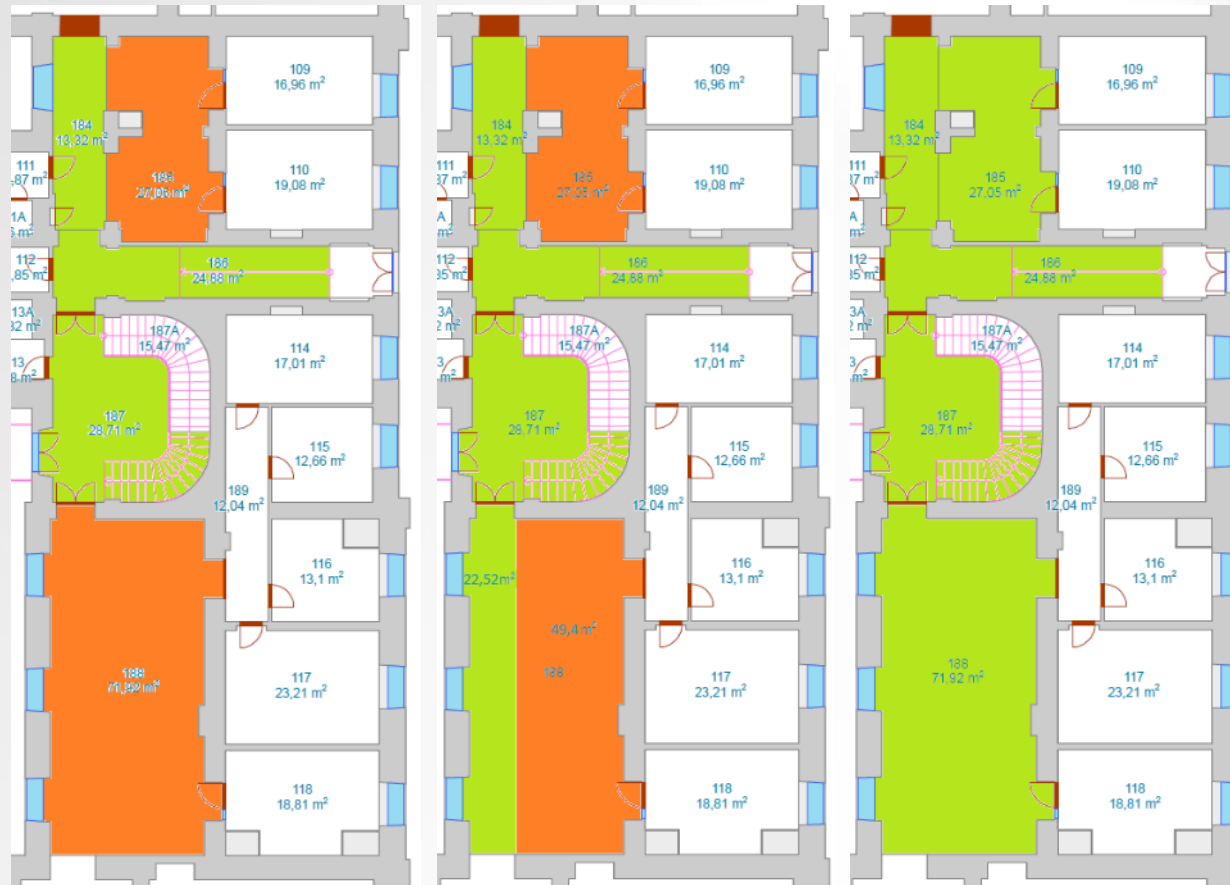
How are the resources distributed



Key values



Inaccuracies in measurement



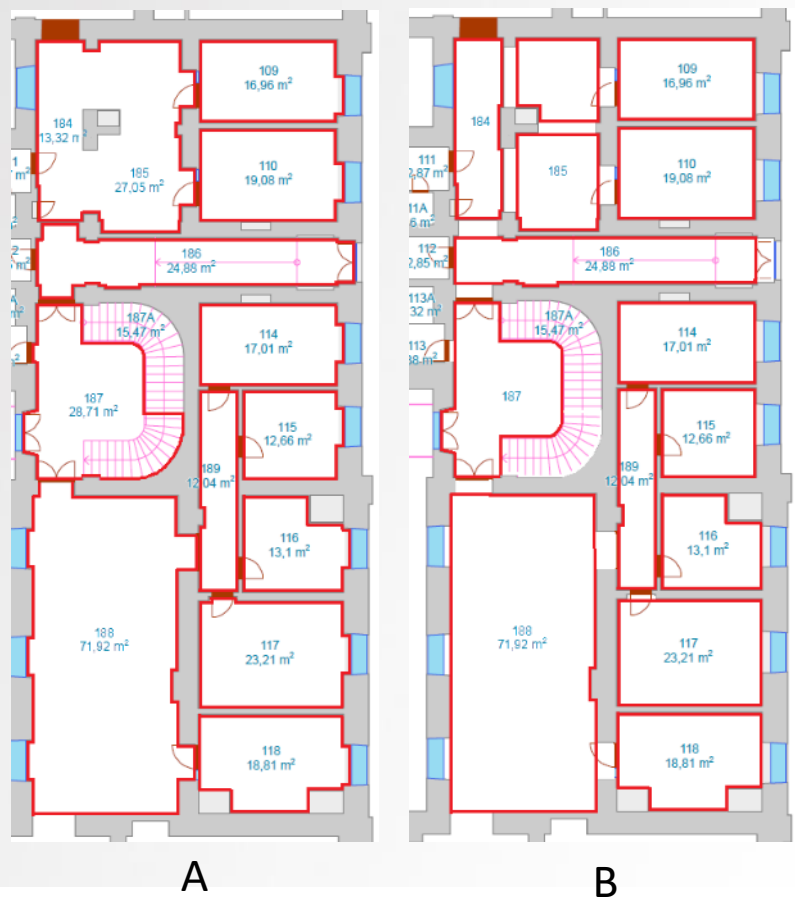
Net usable floor area

Net floor area

Max difference in net usable area
100%

Max difference in net area
60%

Inaccuracies in metrics



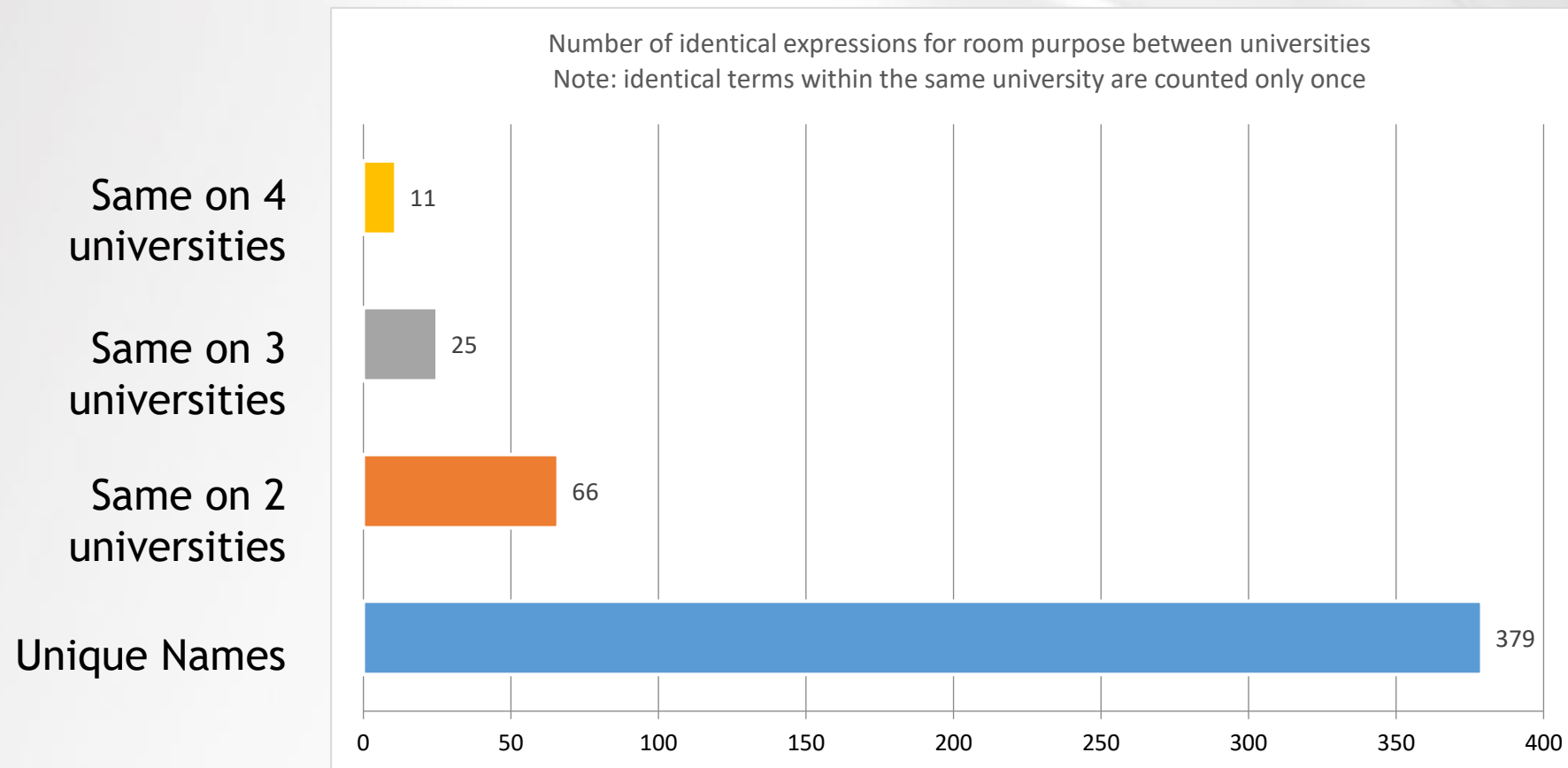
Example A (280,64 m²)

Example B (303,25 m²)

Difference

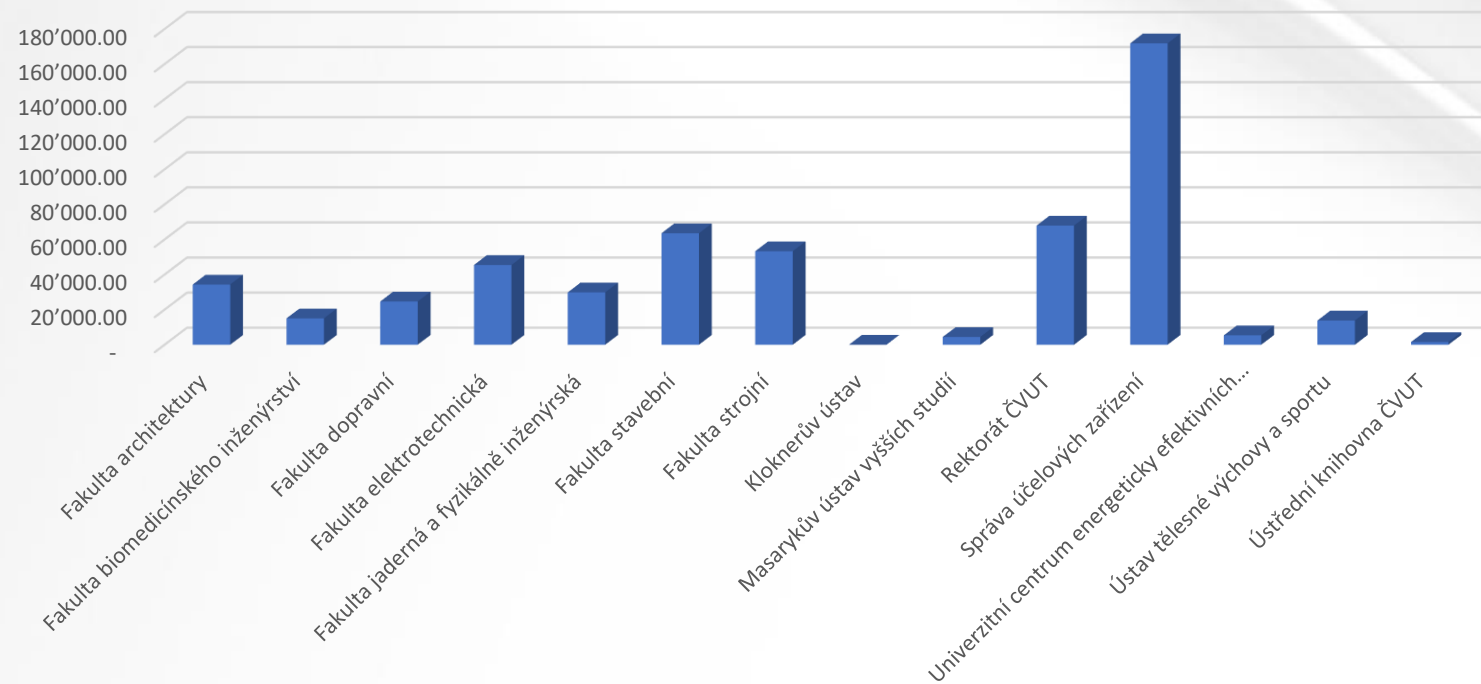
8,2%

Inaccuracies in room naming/descriptions

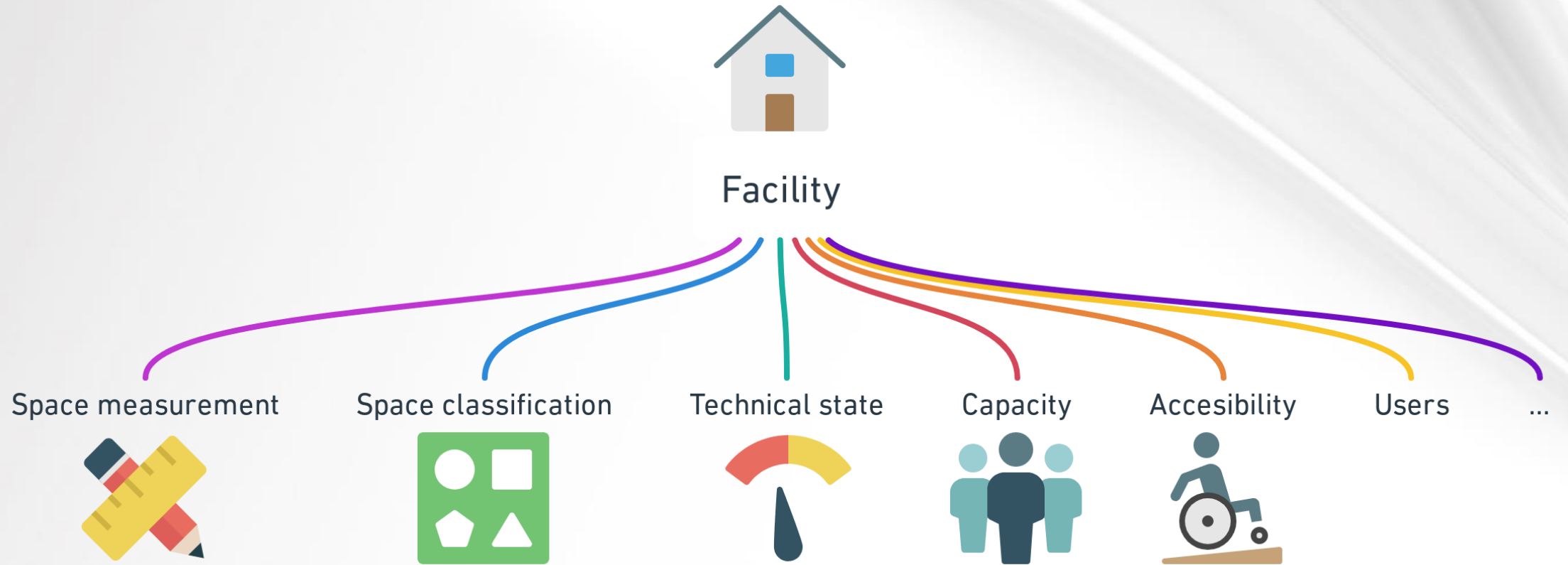


CTU in Prague – areas according to faculties

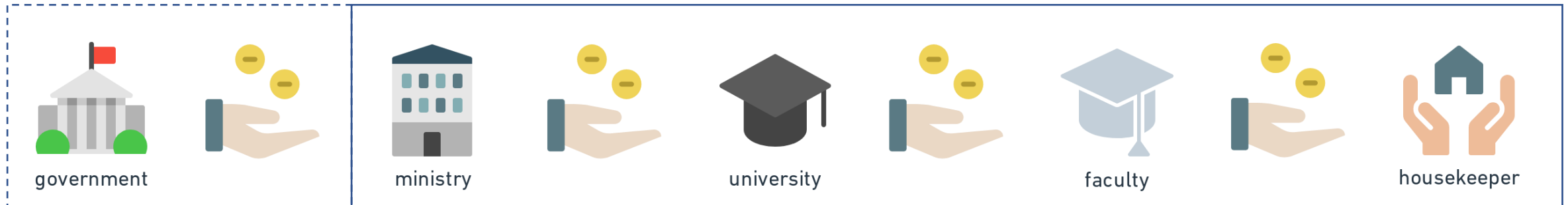
Total m2: 531 032 m2



Areas addressed



Users addressed



Users addressed

Analyses

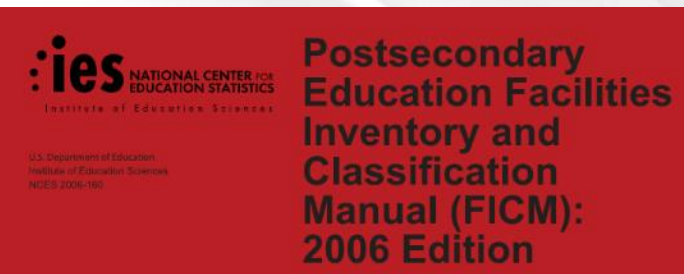
Analysis of existing methodologies for measuring and classifying spaces

Analysis of current portfolio technologies

Pre-selection of methodologies for assessment

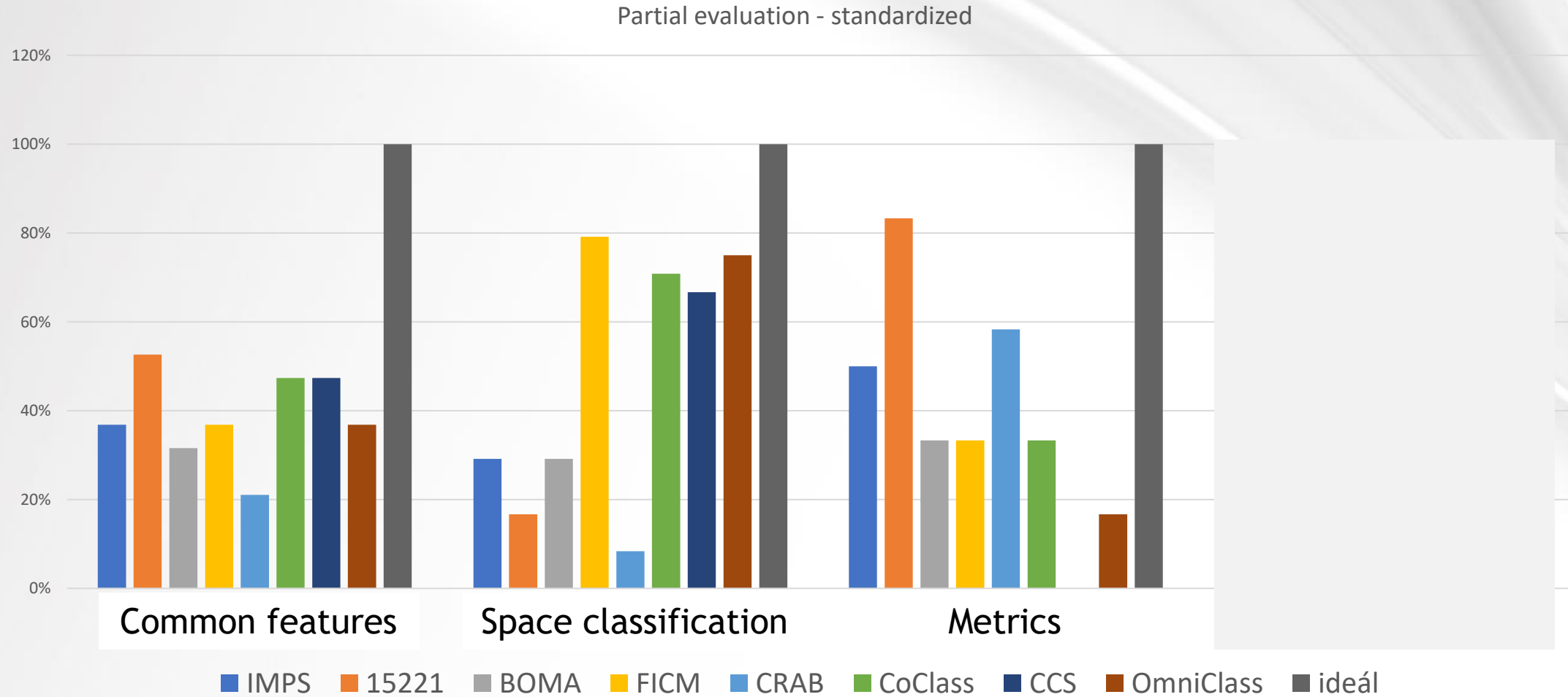


EN 15221-6
Space standard

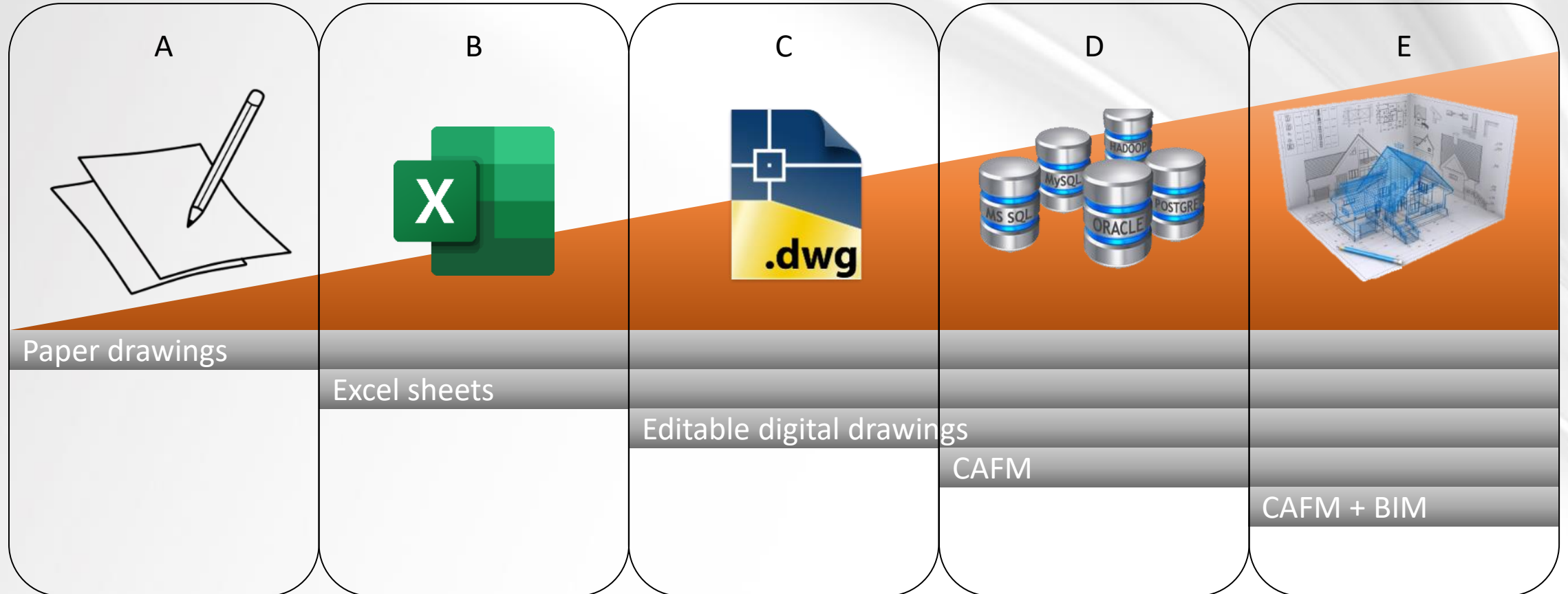


Note: in Switzerland also the [SIA 416](#) can be involved in assessment

Evaluation



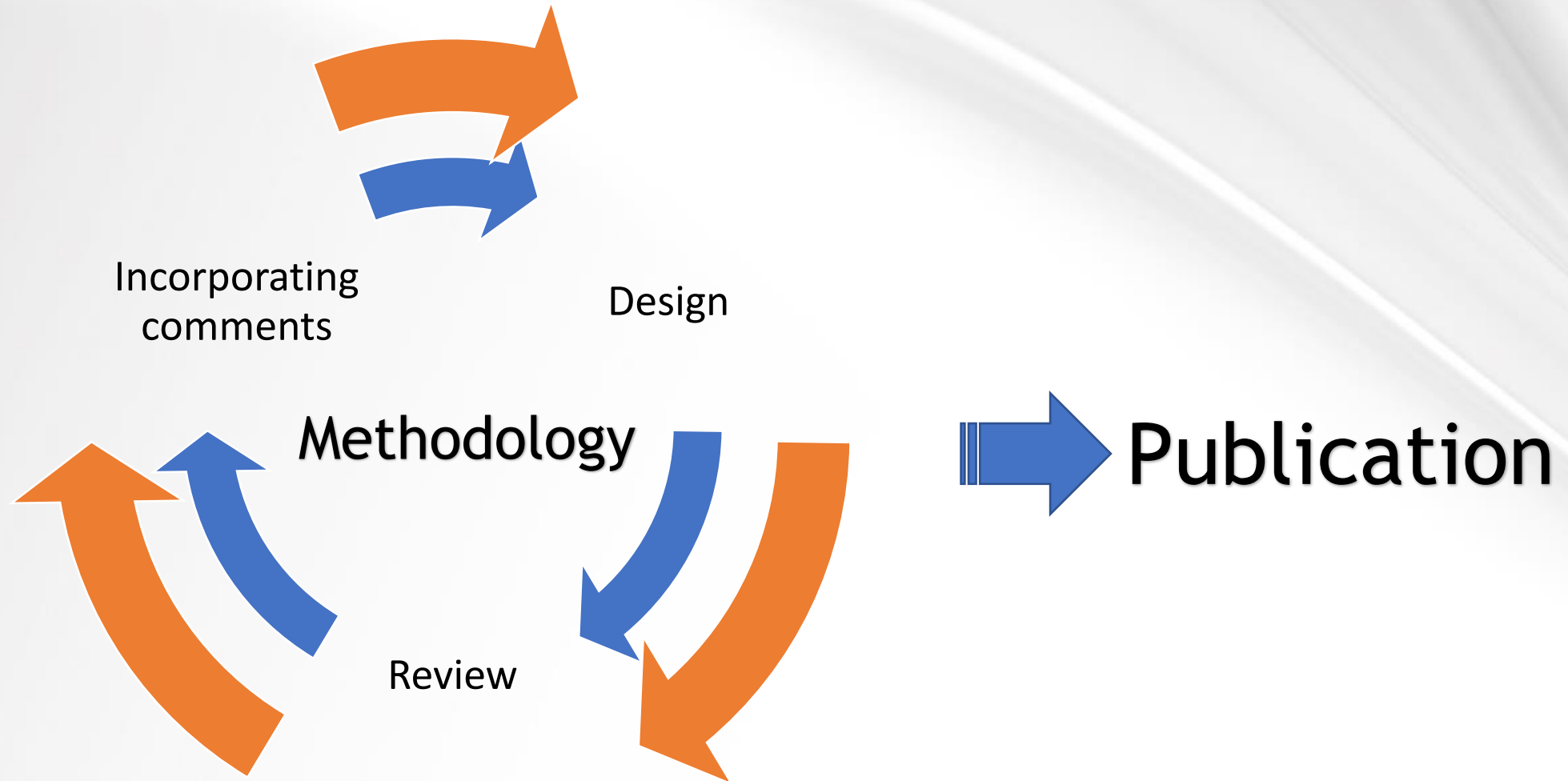
Real estate portfolio technology



Standard development and implementation

implementation at universities in the Czech Republic

Implementation process



All universities consensus



Building condition assesment

- More than 3000 building janitors on all universities
- Each year assesment
- Balance between:

simplicity and precision



Building condition assessment

Var.1		long-term durability elements												
		without the need for reconstruction				need for partial reconstruction				need for complete reconstruction				
		found ation	horizontal support system	horizontal support system	roof	found ation	horizontal support system	horizontal support system	roof	found ation	horizontal support system	horizontal support system	roof	
short-term durability elements	without the need for reconstruction	roof covering	category 1/2 1 - building up to 10 years old 2- building over 10 years old				category 3/4 3 - max. 2 long-term durability elements types for partial reconstruction 4 - min. 3 long-term durability elements types for partial reconstruction				category 5			
		facade												
		fillings (doors/windows)												
		HVAC												
	need for partial reconstruction	surfaces	category 2/3 2 - max. 2 short-term durability elements types for partial reconstruction 3 - min. 3 short-term durability elements types for partial reconstruction				category 4				category 5/6 5 - max. 2 long-term durability elements types for complete reconstruction 6 - min. 3 long-term durability elements types for complete reconstruction			
		roof covering												
		facade												
		fillings (doors/windows)												
	need for complete reconstruction	HVAC	category 3				category 4/5 4 - max. 2 long-term durability elements types for partial reconstruction 5 - min. 3 long-term durability elements types for partial reconstruction				category 6			
		surfaces												
		roof covering												
		facade												
fillings (doors/windows)														
HVAC														
surfaces														

Building condition assessment

Var.1		long-term durability elements											
		without the need for reconstruction				need for partial reconstruction				need for complete reconstruction			
		found	horizontal	horizontal	roof	found	horizontal	horizontal	roof	found	horizontal	horizontal	roof
		ation	support	support		ation	support	support		ation	support	support	
		system	system			system	system			system	system		
short-term durability elements	without the need for reconstruction	roof covering	category 1/2 1 - building up to 10 years old 2- building over 10 years old										
	facade												
	fillings (doors/windows)												
	HVAC												
	surfaces												
	need for partial reconstruction	roof covering	category 2/3 2 - max. 2 short-term durability elements types for partial reconstruction 3 - min. 3 short-term durability elements types for partial reconstruction										
	facade												
	fillings (doors/windows)												
	HVAC												
surfaces													
need for complete reconstruction	roof covering	category 3											
facade													
fillings (doors/windows)													
HVAC													
surfaces													
		category 3/4 3 - max. 2 long-term durability elements types for partial reconstruction 4 - min. 3 long-term durability elements types for partial reconstruction				category 5							
		category 4/5 4 - max. 2 long-term durability elements types for partial reconstruction 5 - min. 3 long-term durability elements types for partial reconstruction				category 4							
		category 4/5 4 - max. 2 long-term durability elements types for partial reconstruction 5 - min. 3 long-term durability elements types for partial reconstruction				category 5/6 5 - max. 2 long-term durability elements types for complete reconstruction 6 - min. 3 long-term durability elements types for complete reconstruction							
		category 4/5 4 - max. 2 long-term durability elements types for partial reconstruction 5 - min. 3 long-term durability elements types for partial reconstruction				category 6							

Space classification



15221-6 + further development (2 years)

amenity (v-xxx)
external additional space (v-900)



primary (p-xxx)
administrative (p-3xx)
non-academic (p-320)



circulation (k-xxx)
vertical (k-2xx)
staircase (k-210)

amenity (v-xxx)
parking (v-2xx)
parking stacker (k-210)



primary (p-xxx)
administrative (p-3xx)
meeting room (p-330)



amenity (v-xxx)
hygiene (v-1xx)
toilet (v-130)



circulation (k-xxx)
horizontal (k-1xx)
transit (k-120)



technical (t-xxx)
technology (t-1xx)
other (t-190)
stacker technology (t-190-9)



Space classification

**Code:**

p-210

Name:

teaching laboratory

Definition:

Teaching laboratories are specialized spaces used primarily for regularly scheduled teaching, used for activities that are linked to a specific topic or scientific discipline. Planned teaching typically means regularly repeated lessons according to schedules, regular courses, etc.

Description:

Laboratories are characterized by a special purpose (equipment, surfaces, conditions) or a specific arrangement (disposition, configuration or mutual arrangement) of the space, which limit the teaching activity to a certain discipline or a closely related group of disciplines. These activities can be individual or group in nature, supervised or unsupervised. Teaching laboratories can further be divided into six basic categories according to the FORD classification - Fields of Research and Development - Structure of scientific fields according to OECD (Organization for Economic Co-operation and Development) http://www.vyzkum.cz/storage/att/E6EF7938F0E854BAE520AC119FB22E8D/Prevodnik_oboru_Frascati.pdf

is recorded **The capacity** .

Limitations:

These are not **teaching spaces (p-100)** , the use of which is not tied to a specific topic or scientific discipline. These are not **R&D laboratories (p-220)** , in which research and development activities mostly take place.

Synonyms:

study, laboratory, laboratory, workshop

Examples:

Space measurement I – elevator vs shaft



circulation (k-xxx)
horizontal (k-1xx)
corridor (k-110)

circulation (k-xxx)
vertical (k-2xx)
lifting device (k-240)

technical (t-xxx)
technology (t-1xx)
other (t-190)

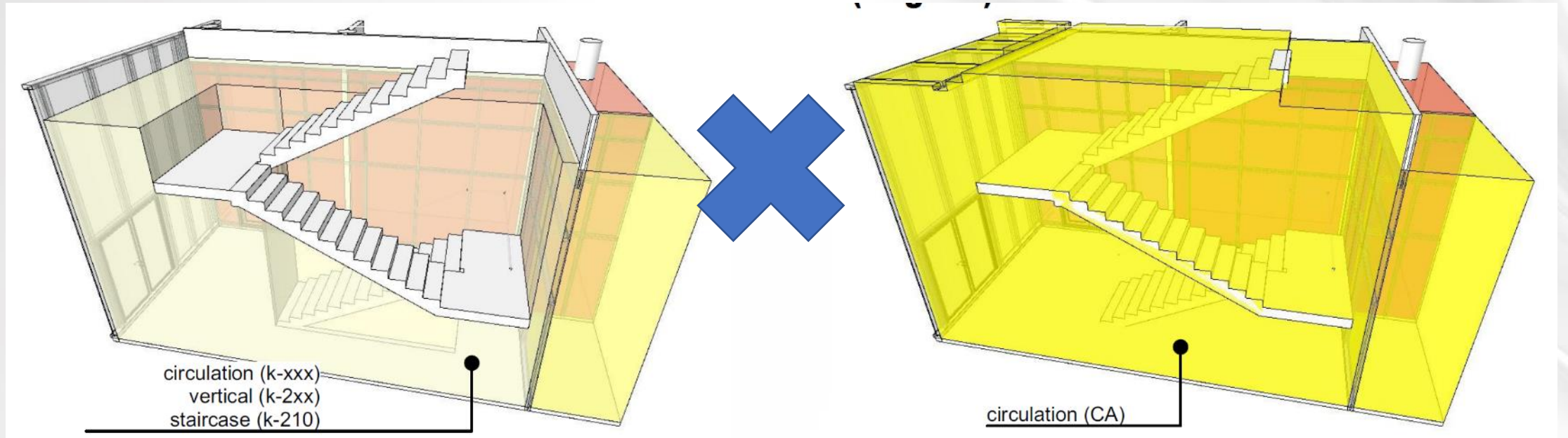


circulation (CA)

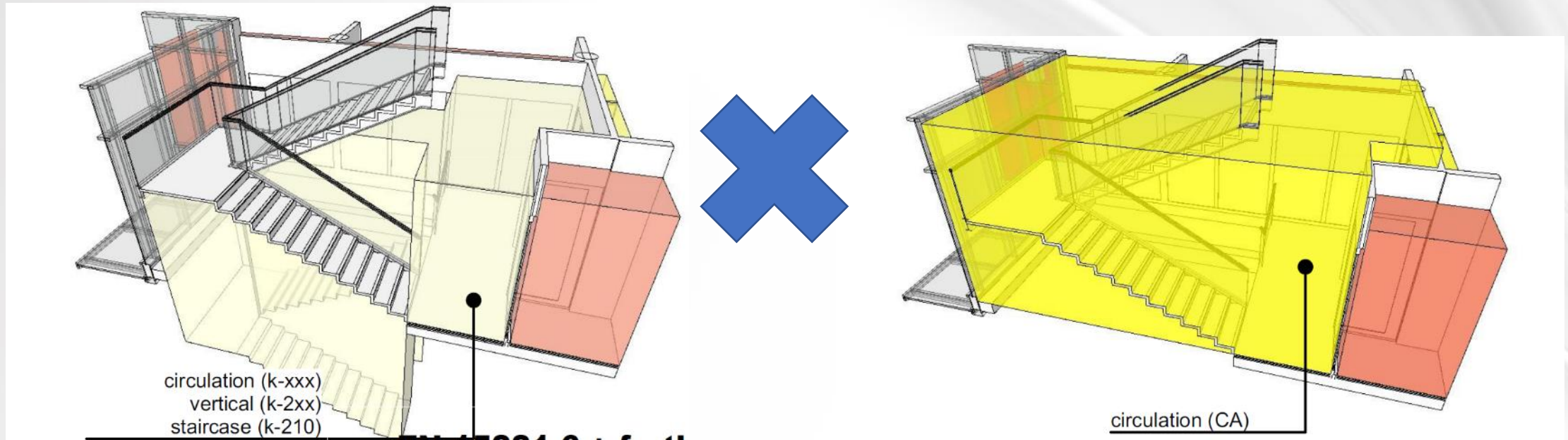
circulation (CA)

circulation (CA)

Space measurement II – staircase 1st floor



Space measurement II – staircase 2nd floor



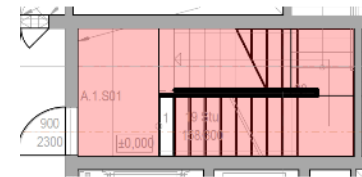
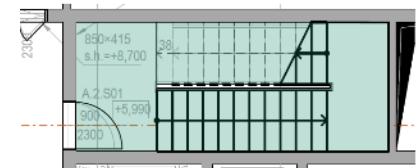
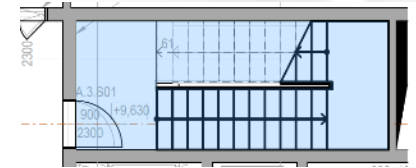
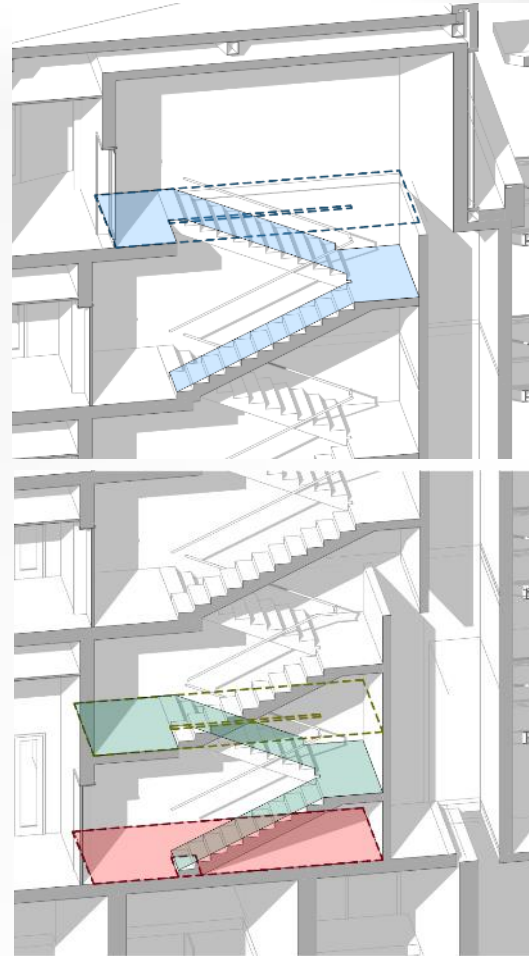
Staircase

The area of the staircase is calculated as the projection of the staircase onto the horizontal surface.

The area of the staircase underneath is added to the given level.

The area of the stair mirror is not included.

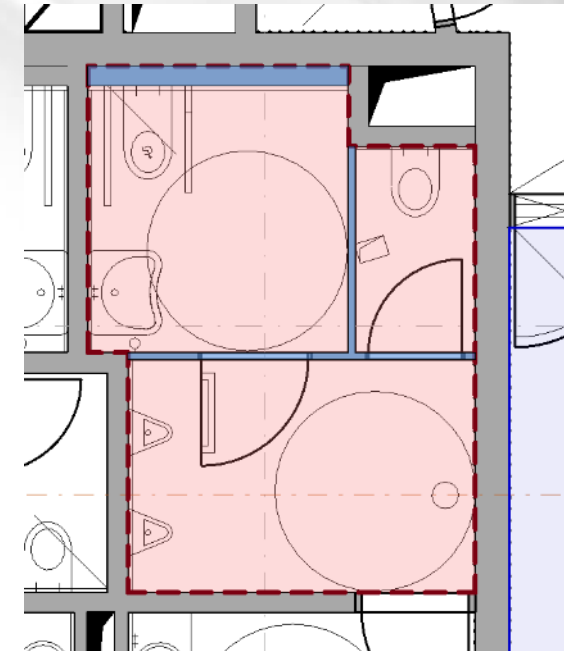
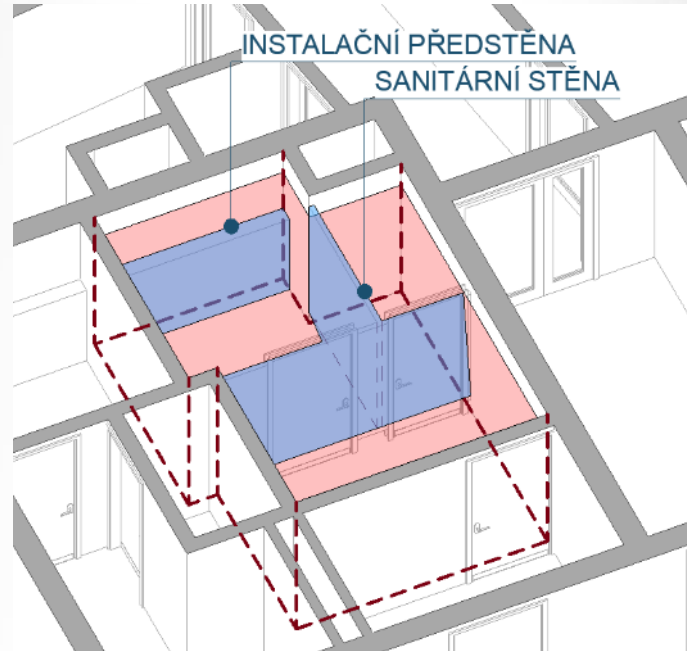
On the lowest floor, all floor area at floor level is counted.



Sanitary area

Installation partitions up to a height of 1.2 meters count towards the floor area.

Sanitary walls (not over the full height of the room) count towards the floor area.



www.bim.cvut.cz/msmt

Call for further development

- Translate to other languages
- Adapt to other country norm
 - FM space benchmark accross universities

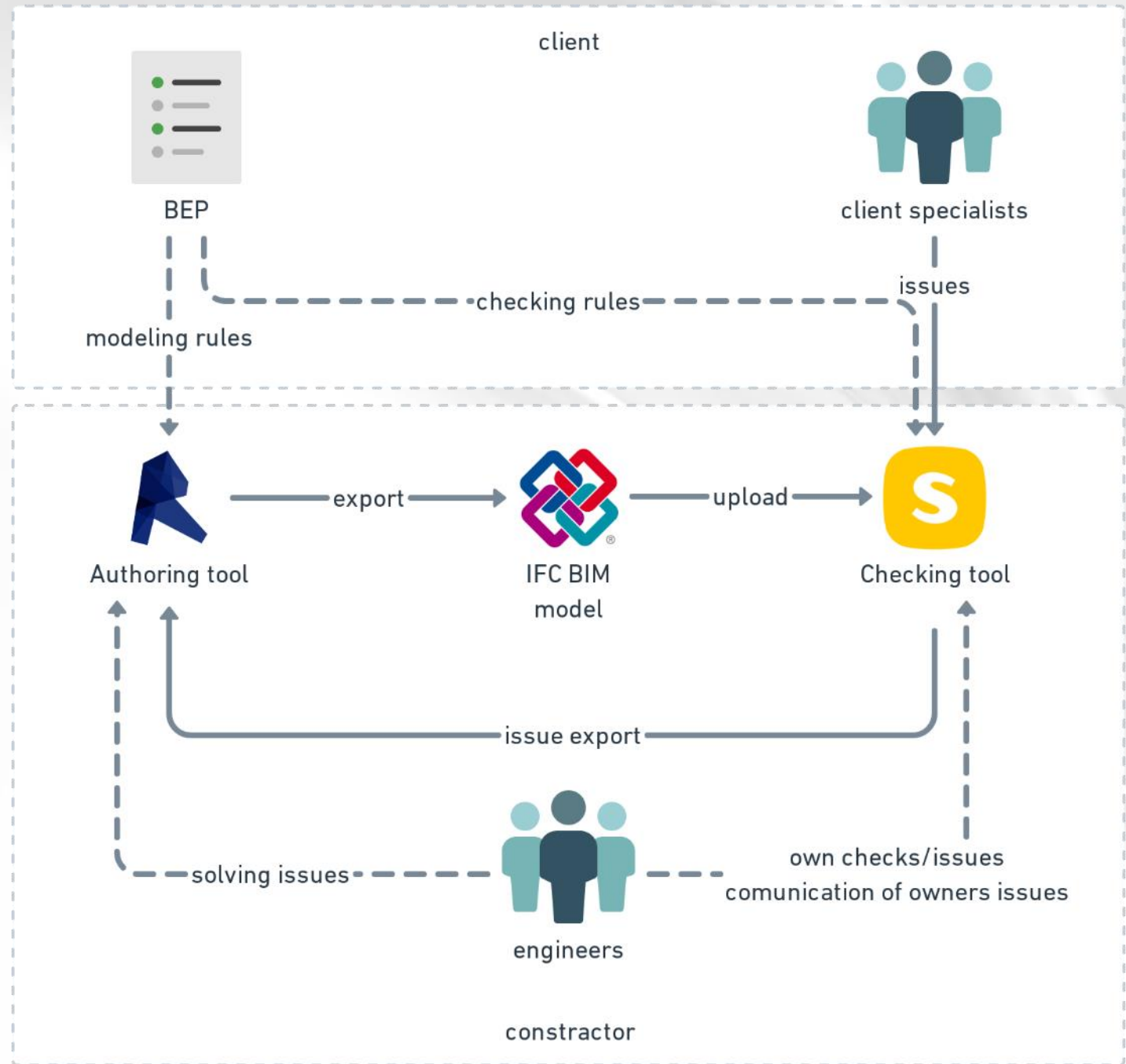
Standard implementation example
BIM project
Campus Albertov (325 mil. Euro)



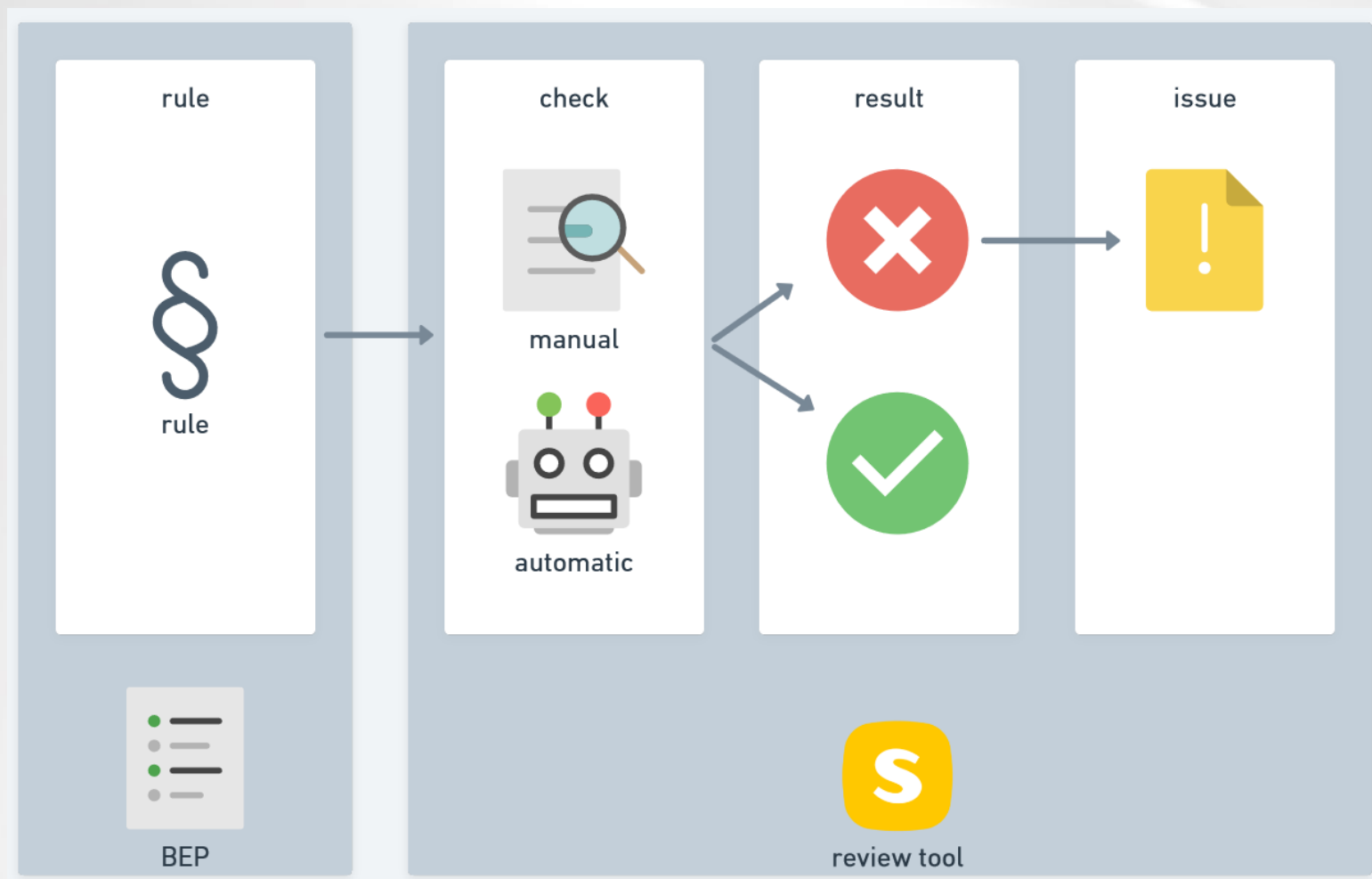
Need of..

- Consistent and fast space QTO
- Clear classified spaces according the Standards

QC/AC process



Rules (BEP) vs check in the tools (smc)



Check of project information

Manual 2D

Manual 3D

Semi-automatic

- Use of filters, coloured views, classification, QTOs, etc.

Automatic

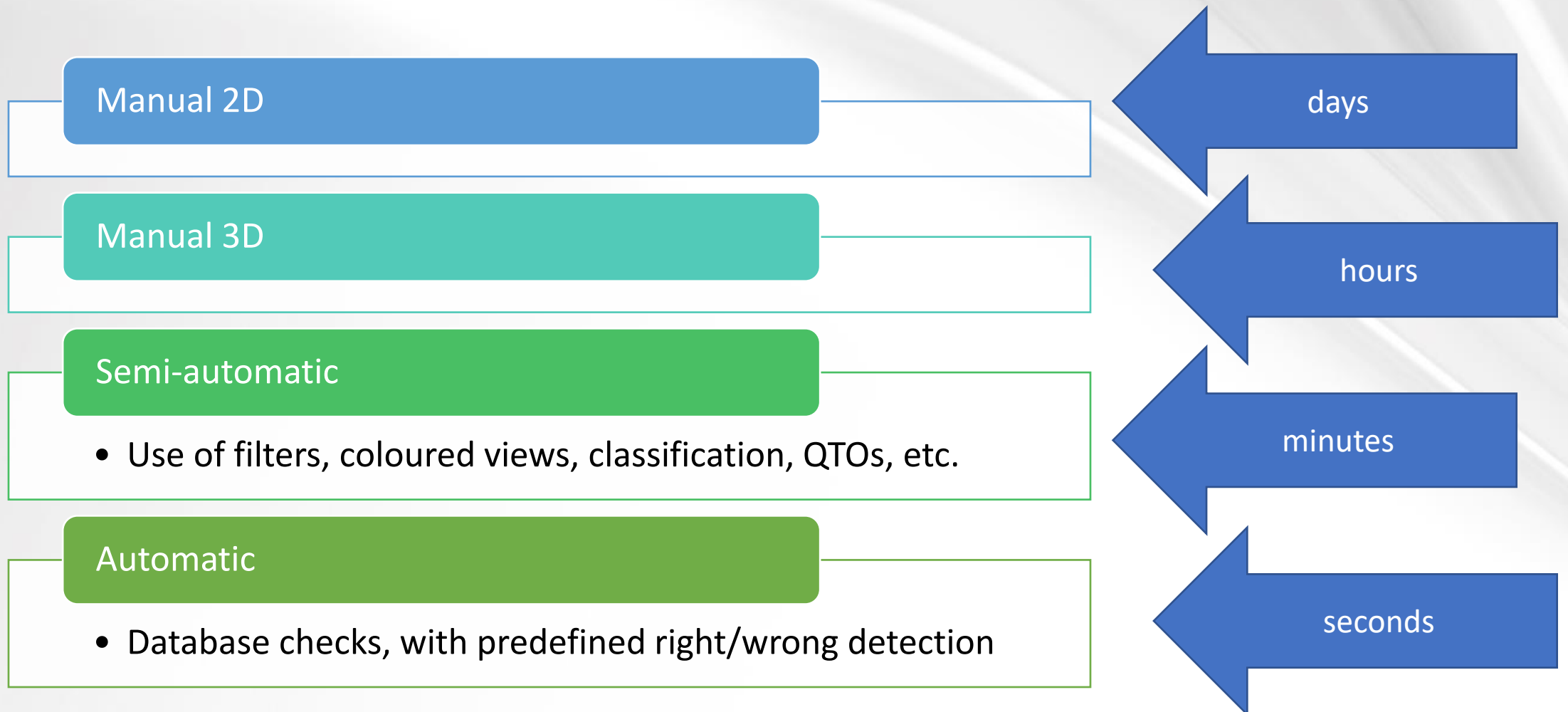
- Database checks, with predefined right/wrong detection

More advanced method

higher data reliability

fewer non-value-added tasks

Check of project information



Example of automatic check

Solibri Office - 20210204_modelISS

FILE MODEL CHECKING COMMUNICATION INFORMATION TAKEOFF +

TO-DO (2/8) VIEWS

CHECKING

TOOLS

INFO

Unallocated Area

Description Hyperlinks

CLASSIFICATION

Building Elements - Ge

IfcCovering:Predefined

nosneXnenosné_V2

otevírání dveří

PredefinedType

SNIM

Space Grouping

Space Usage

stávajícíXnověXbouran

REPORT

RESULT SUMMARY

	△	▲	▲	×	✓
Issue Count	2	1	1	4	0
Issue Density	0.17	0.087	0.087	0.35	0

RESULTS

No Filtering Automatic

Results

- Unallocated Area [4/4]
 - Unallocated Area in (A) 1PP (14.07 m2) [2/2]
 - Unallocated Area (12.88 m2)
 - Unallocated Area (1.19 m2)
 - Unallocated Area in (A) 3NP (8.02 m2) [1/1]
 - Unallocated Area in (A) 1NP (3.40 m2) [1/1]

Role: Architectural Checking Selected: 0

(A) Střecha

Example of poloautomatic checks



findCAFM.com

Tool to find the best fit CAFM solution

Assesment of cca 400 CAFM features

Cca 10 hours of features checking/per CAFM -> recorded for further confirmation

Real Estate Software Guide

Swiss Edition 2018

Klaus Treff
Thomas Steiner



PFM Portfolio Management	BIM Building Information Modeling	BAU Bau und Baumanagement
CAFM Computer Aided Facility Management	SMB Smart Building	KGM Kaufmännisches Gebäudemanagement
ERP Enterprise Resource Planning	CRM Customer Relationship Management	SER Digital Services



conrealis



Marktübersicht CAFM-Software

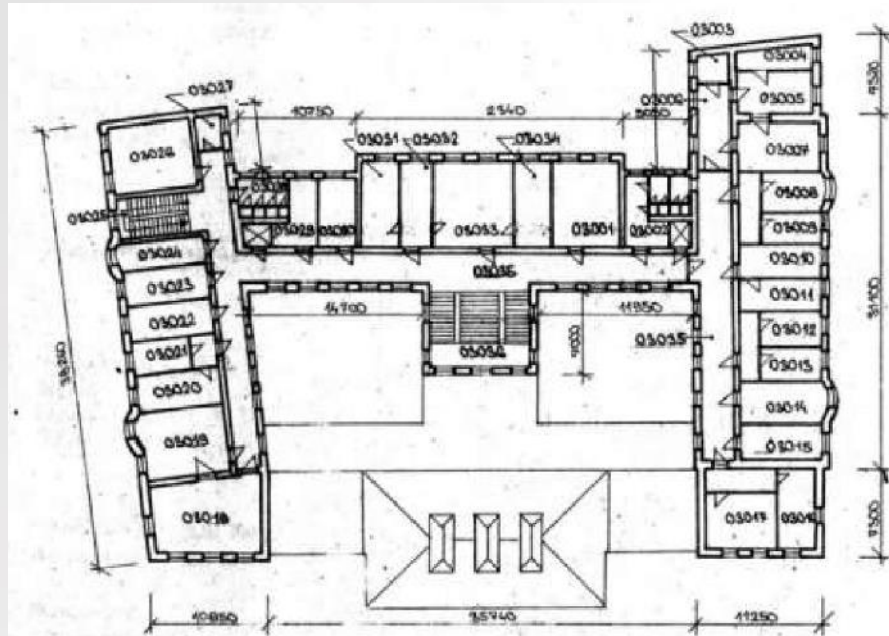
2022

GEFMA 940

Implementierung und Datenerfassung

NEWS

Need for proper tool



1. Místnost č.	2. Název místnosti	3. Plocha v m ²	4. Š. v. m	5. H. v. m	Funkční soubor				Kapacita		Uživatel		Využití	Jiný druh
					5.2.FS	7.PFS	8.FSK	9.FSTV	10. kód	11. kód	12. kód	13. kód		
02001	LABORATOŘ KAT. FYZIKY	42,20	4,30	4,30							03032	2144	3	
02002	KANCELARĚ ASIS* KF	8,00	4,30	4,30							03032	2144	3	
02003	LABORATOŘ KF	9,20	4,30	4,30							03032	2144	3	
02004	SCHODIŠTĚ	10,27	4,30	4,30							03032	2144	3	
02005	KANCELARĚ LADOR AS. KF	37,10	4,30	4,30							03032	2144	3	
02006	KANCELARĚ AS KF	20,00	4,30	4,30							03032	2144	3	
02007	KANCELARĚ AS CF	18,00	4,30	4,30							03032	2144	3	
02008	LABORATOŘ KF	18,00	4,30	4,30							03032	2144	3	
02009	LABORATOŘ KF	35,50	4,30	4,30							03032	2144	3	
02010	LABORATOŘ KF	62,40	4,30	4,30							03032	2144	3	
02011	LABORATOŘ KF	50,25	4,30	4,30							03032	2144	3	
02012	POSLUCHATELNA	165,00	4,30	4,30							03032	2144	3	
02013	POKLADNA	20,00	4,30	4,30							03032	2144	3	
02014	ÚČTARNA	29,40	4,30	4,30							03032	2144	3	
02015	ODDĚL VĚDY A VÝZK - KANCEL	24,20	4,30	4,30							03032	2144	3	
02016	KANCELARĚ DE CALVA TAK	44,85	4,30	4,30							03032	2144	3	
02017	KANCELARĚ SECRET	25,10	4,30	4,30							03032	2144	3	
02018	KANCELARĚ KANCELARSKA PAL	20,75	4,30	4,30							03032	2144	3	
02019	HOSPOD. ODDĚL - KANCEL	16,00	4,30	4,30							03032	2144	3	
02020	HOSPOD. ODDĚL - KANCEL	16,00	4,30	4,30							03032	2144	3	
02021	PŘEDSÍVNÍ	7,60	4,30	4,30							03032	2144	3	
02022	ÚČTARNA	19,10	4,30	4,30							03032	2144	3	
02023	KANCEL. ODDĚL	19,10	4,30	4,30							03032	2144	3	
02024	ZASEDACÍ MÍSTNOST	66,00	4,30	4,30							03032	2144	3	
02025	STUDIJNÍ ODDĚLENI	43,20	4,30	4,30							03032	2144	3	
02026	STUDIJNÍ ODDĚLENI	10,00	4,30	4,30							03032	2144	3	
02027	WC	28,80	4,30	4,30							03032	2144	3	
02028	POSLUCHATELNA	40,00	4,30	4,30							03032	2144	3	
02029	POSLUCHATELNA	61,10	4,30	4,30							03032	2144	3	
02030	KADROVÉ A PERS. ODDĚL	19,50	4,30	4,30							03032	2144	3	
02031	KADROVÉ A PERS. ODDĚL	19,50	4,30	4,30							03032	2144	3	
02032	ZVLÁŠTNÍ ODDĚLENI	16,00	4,30	4,30							03032	2144	3	
02033	DÍLNA - KAT. FYZIKY	16,50	4,30	4,30							03032	2144	3	
02034	WC	28,80	4,30	4,30							03032	2144	3	
02035	CHODBA	544,73	4,30	4,30							03032	2144	3	
	CELKEM	1704,65												

31 01 04 05

31 01 04 05



ZAMĚŘENÝ STAV	VYPRACOVAL	KODAT	DATUM 12/87
	ZAMĚŘIL		FORMÁT 2A4
VYSOKÁ ŠKOLA : ČVUT	STŘEDISKO 31-PRAHA	CENTRUM 01 PRAHA	
FAKULTA : FJFI	AREÁL : 04 - JOSEFOV	ZAK Č. 8004/81	
OBJEKT Č. 05	KAT. ÚZEMÍ	PARC. Č.	
NÁZEV OBJ. F4 - BŘEMOVA	OBSAH 3. NADZEM. POOL		

Need for proper tool

The screenshot displays the GTSolution CVUT-2.10.5 (CVUT_PRO) - rudovzde - [Místnosti] application. The interface includes a menu bar (Uživatelé, Okna, Nastavení, nápověda, Helpdesk ČVUT), a toolbar, and a sidebar with navigation options like Stavby, Podlaží, Místnosti, and Vchody. The main window is titled "Místnosti" and contains a table with 12 columns: Kód místnosti, Č. místnosti, Kód podlaží, Č. výkresu, Plocha (m2), Kód stavby, Název stavby, Zvykový název, Kapacita, Obec, and Ulice. The table lists various rooms, with B-731 highlighted in blue. Below the table, a floor plan view shows the layout of rooms B-730, B-730a, B-731a, and B-731. Room B-731 is highlighted with a red hatched pattern. The interface also shows a total area of 525130,56 m2 and a "Přidání uživatele" button.

Kód místnosti	Č. místnosti	Kód podlaží	Č. výkresu	Plocha (m2)	Kód stavby	Název stavby	Zvykový název	Kapacita	Obec	Ulice
068--n01---21-	21	068--n01-		22,5	068--	koleje Strahov - blok 1	kancelář		2 Praha	Vaničkova
022D--n02-2044a	D-2044a	022D--n02-		12,3	022--	objekt FSv D	kancelář		Praha	Thákurova
022D--n02-2044b	D-2044b	022D--n02-		11,8	022--	objekt FSv D	laboratoř		Praha	Thákurova
022D--n02-2044d	D-2044d	022D--n02-		4,3	022--	objekt FSv D	laboratoř		Praha	Thákurova
022D--n02-2044c	D-2044c	022D--n02-		4,5	022--	objekt FSv D	chodba		Praha	Thákurova
020--n02--237-	237	020--n02-		5,56	020--	Masarykův ústav vyšších výťah			Praha	Kolejní
103B--n08--730-	B-730	103B--n08-		49,58	103--	objekt FBMI Kladno - Kokc:Počítačová učebna			Kladno	náměstí Sítňá
103B--n08--731-	B-731	103B--n08-		20,2	103--	objekt FBMI Kladno - Kokc:Kancelář			Kladno	náměstí Sítňá
103B--n08--732-	B-732	103B--n08-		20,68	103--	objekt FBMI Kladno - Kokc:Kancelář			Kladno	náměstí Sítňá
103B--n08--733-	B-733	103B--n08-		21,31	103--	objekt FBMI Kladno - Kokc:Kancelář			Kladno	náměstí Sítňá

findCAFM – benchmark of CAFM solutions



OVERVIEW AND COMPARISON OF CAFM SYSTEM FUNCTIONALITIES

The project presents an overview of functionalities and a comparison of the properties of individual CAFM systems. The database has thematically sorted queries about whether a given CAFM system includes the relevant feature or functionality. The database also contains descriptive characteristics that specify the possibilities of implementing CAFM systems. For the objectivity of the review, we verified all data.

[FIND CAFM](#)

[INFORMATION ABOUT CAFM](#)

[ABOUT THE PROJECT](#)

Select CAFM solution

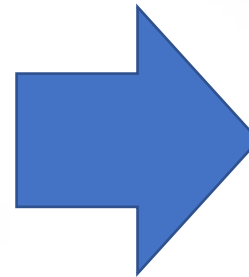
You can select up to 4 CAFM solutions at once

- AFM
- GTFacility
- URBIDO
- twiGIS
- Archibus
- Olify.IO
- pit-FM

Detailed overview

Quick overview

Back



the more solutions
are comming

Scope of benchmark – features in the fields

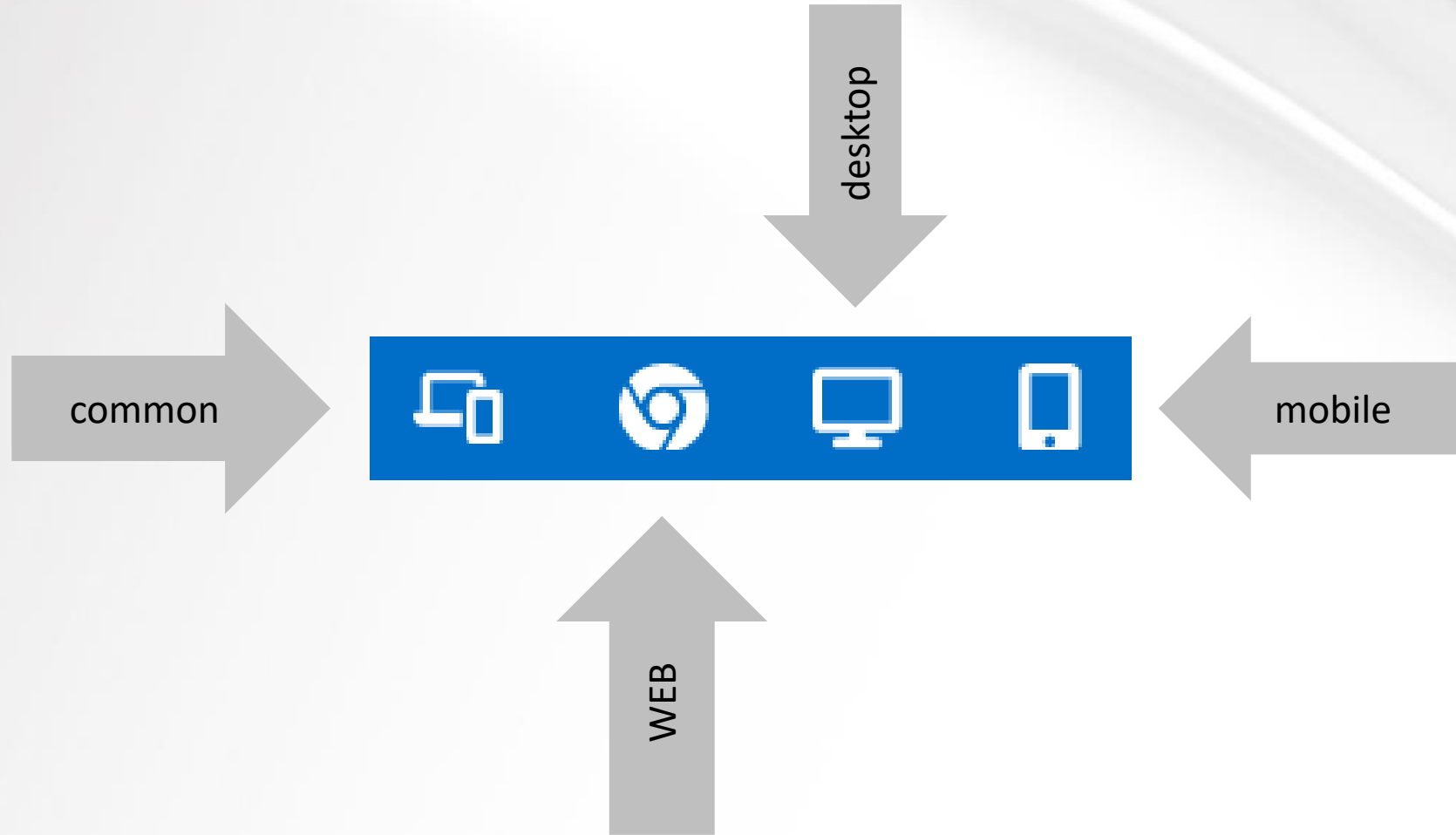
Records System allows...	Graphics System allows...	Processes System allows...	System System allows...
General	BIM	General	Workflow
Properties	CAD	Operation and Maintenance	Environment
Technology	GIS	Energy	Localization
Documents		Car park	Notification
		Economic	Integration
		Contracts	License
		Other processes	Support

Benchmark table

Graphics System allows...	GTFacility				Olify.IO				URBIDO				
▼ BIM													
> Work with the displayed model													
▼ IFC													
import of arbitrary objects from IFC to CAFM	—	×	×	×	—	✓	×	×	—	✓	×	×	
display of the tree structure of the project ('Spatial Structure' concept)	—	×	×	×	—	✓	×	✓	—	✓	×	×	
display of all IFC properties ('Property Sets' concept)	—	×	×	×		✓	×	✓	—	✓	×	×	
add or edit IFC properties and property groups incl. entry into the IFC model (the 'Property Sets' concept)	—	×	×	×	—	×	×	×	—	×	×	×	
display of links of elements to a group/system/zone ('Group Assignment' concept)	—	×	×	×	—	×	×	×	—	✓	×	×	
display of elements according to project type ('Object Typing' concept)	—	×	×	×	—	×	×	×	—	✓	×	×	
display of elements according to project type ('Classification' concept)		×	×	×	—	×	×	×	—	✓	×	×	
display elements by layer (using IfcPresentationLayerAssignment data class)	—	×	×	×	—	×	×	×	—	✓	×	×	
▼ CAD													
▼ General													
direct link to DWG/DXF without intermediate import/export to your own drawing format, for this:	×	—	—	—	✓	—	—	—	✓	—	—	—	
• use of DWF/DXF drawing elements for automated editing of data objects	—	×	×	×	—	✓	×	✓	—	×	×	×	
• writing non-graphical information into a DWG/DXF drawing	—	×	×	×	—	✓	×	✓	—	✓	×	×	



Platform



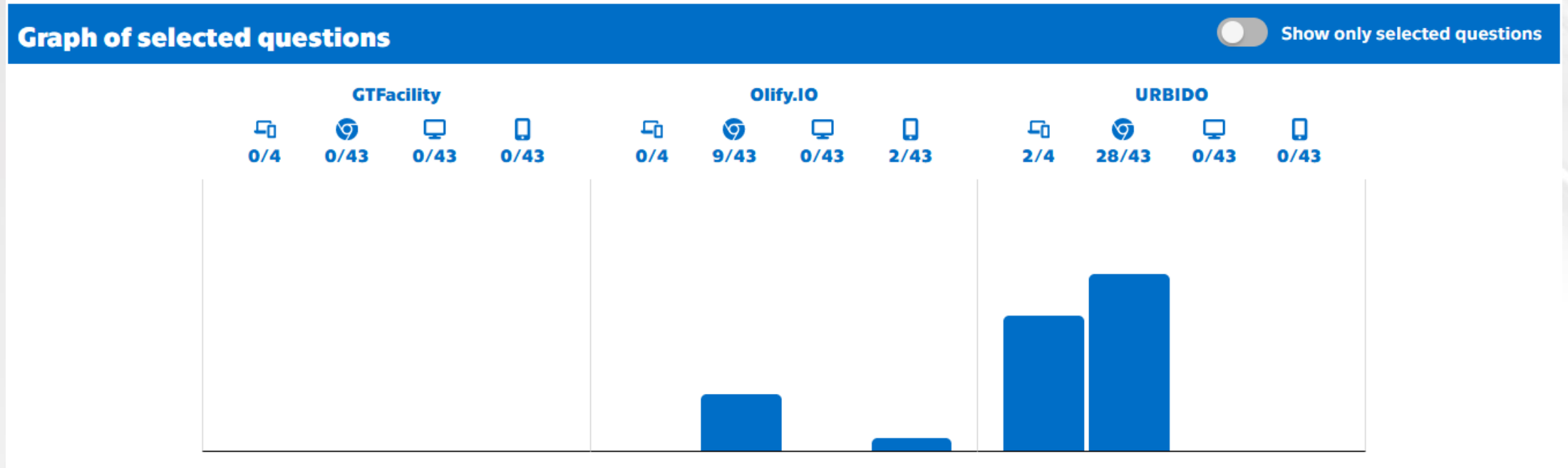
Analytical tools

Graphics
System allows...

GTFacility	Olify.IO	URBIDO	

▼ BIM

> Work with the displayed model



Call for further development

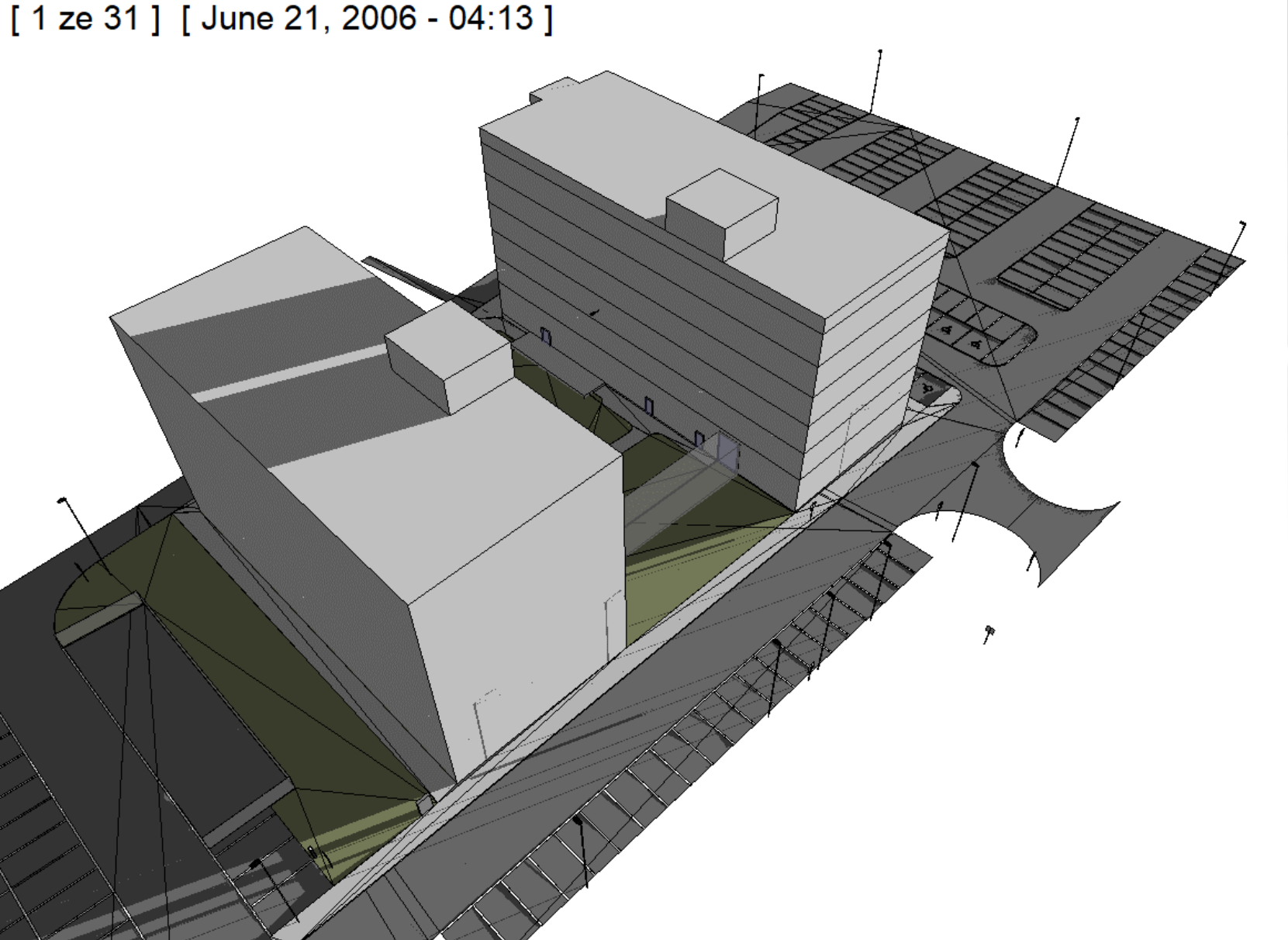
- Translate to other languages (now EN/CZ)
- Benchmark more CAFM solutions
- Turn to international benchmark -> ready to share licence

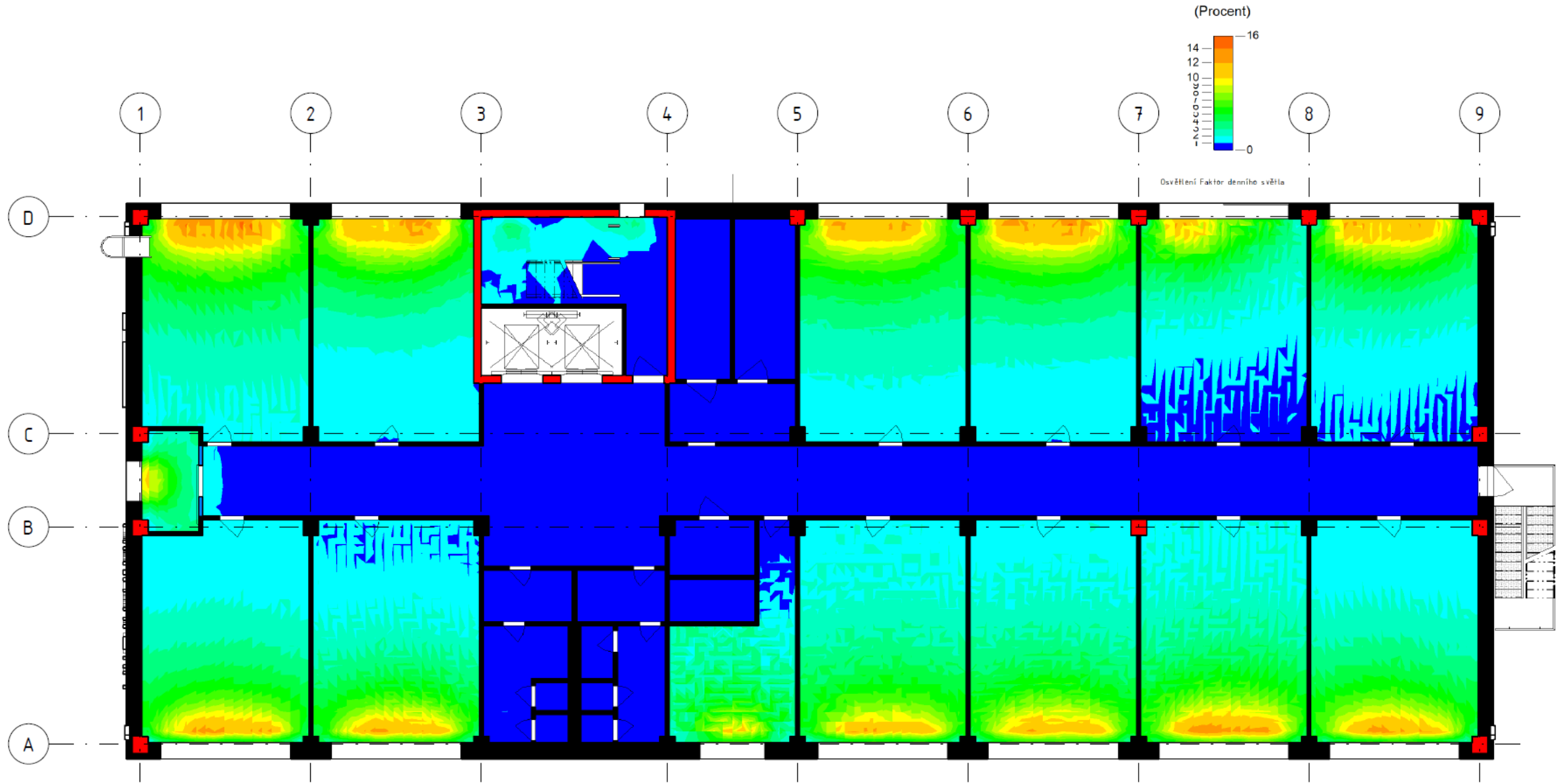
Pilot project BIM vs CAFM

- [Olify.io](https://olify.io)
- [Urbido.cz](https://urbido.cz)

what didn't fit in the FM section

- BIM -> design review during the BIM project CDE vs Check tools
- BIM design analyses
- common





thank you for your attention