

Digitisation Technologies for the FM Industry

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Michael May

1972-1976	Technical University of Magdeburg, Germany (mathematics)
1976-1990	German Academy of Sciences Berlin
1981	Ph.D. (mathematics)
1990	Habilitation (information technology)
1991-1992	German Ministry of Research and Technology
1992-1994	IIEF Institute Berlin, Head of FM Research Department
since 1994	Univ. of Applied Sciences Berlin (HTW) Berlin, Professor of IT and FM
1995	Establishment of the first FM program at a German university Member of GEFMA (German Facility Management Association)
Since 2001	Head of GEFMA's SIG on Digitization (formerly CAFM), Member of EuroFM
2002-2010	Head of Competence Centre FM at HTW Berlin
Since 2003	Board member of GEFMA (IT/FM and international relations)
Since 2007	Member of IFMA, joint research with IFMA's ITC Editor and author of several books e.g. the "CAFM Handbook", "The Facility Manager's Guide to Information Technology"
2015	Founding Member of BIM Competence Centre at HTW and
2016	BIM Cluster Berlin
2018	EuroFM Ambassador to Germany



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- Digitisation – What is it?
- Digital economy
- Indoor digitisation
- Some digitisation trends relevant to FM
 - CAFM/IWMS
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 - Simulation

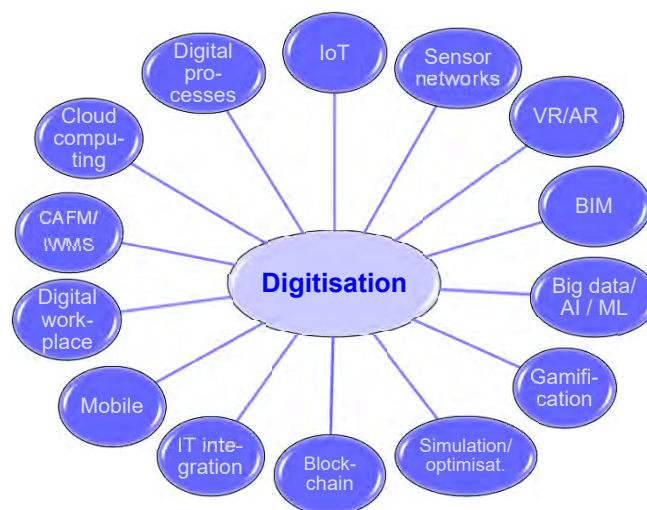
Digitisation – What is it?

- The process of **converting analogue data** or information (like text, images or voices/sounds) of any form into a digital (binary) format that can be understood by computer systems or electronic devices
- The phenomenon that information is provided and processes are executed using **digital computing**
- **Migration of traditional analogue approaches** to customers, products, and operating models to an
 - always-on,
 - real-time, and
 - information-richmarketplace (**digital business**)

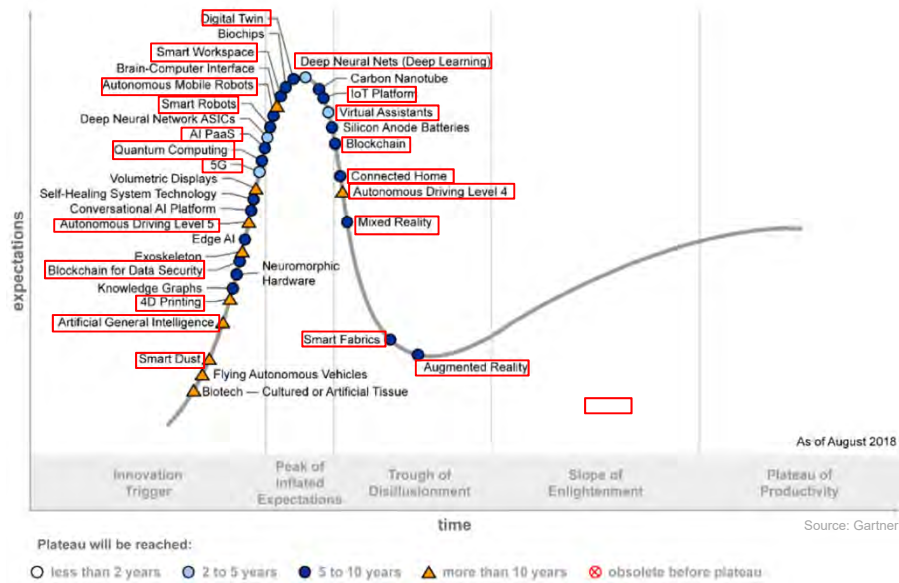
Opportunities

- US\$ 2 trillion of additional economic output by 2020
- Digital economy represents 22.5% of the world economy.
Source: Accenture
- Ability of digitisation to unlock value is far from being fully exploited (particularly in FM/RE).

Digitisation – related technologies



Hype cycle for emerging technologies, 2018



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Digitisation in FM

Digitisation

- Challenging
- Promising
- Disruptive
- Transformation process
- Digital Natives
- Prerequisite:
 - Digital Data (capture and maintenance)

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Digitisation in FM

Indoor space digitisation

- **Outdoor** space is digitally captured and easily available on all our devices today.
- Economically even more valuable **indoor** space is still a digital wasteland.
- Estimated floor space of about **m² 220 bn** globally is waiting to be digitised.

Scan to CAD/BIM



Trolley

- Map complete buildings (up to 2.000 m² per hour)
- Panoramic images + 3D point clouds



IndoorViewer

- Access digital buildings from anywhere via a browser-based IndoorViewer
- Interact with points of interest and connect them to real-world objects
- Measure distances and volumes



Navigation App

- Get your location – meter-accurate
- Route to any location in the building
- Without the need for new infrastructure
- Computer vision based technology



CAFM/IWMS Integration

- Link IWMS POIs in IndoorViewer
- Make changes in IndoorViewer that apply directly to the CAFM/IWMS database

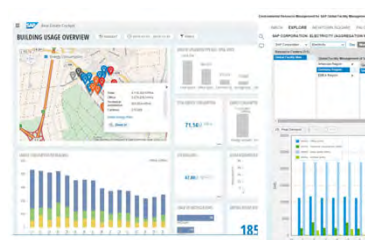
1. CAFM/IWMS systems

- Enterprise platforms that support the planning, design and management of an organisation's physical asset base
- IT-based, FM process-oriented information systems
- Capture, store, process, analyse and present data occurring during the entire lifecycle of the built environment
- Allow the integration of different IT systems which handle FM-relevant data
- Tools for implementing and controlling FM processes efficiently
- Assist in optimising the use and administration of workplace resources
- Proven, reliable and beneficial tools for FM

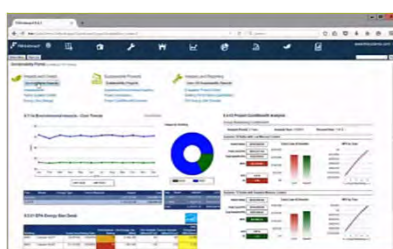
CAFM/IWMS – proven IT tools for FM



Source: Planon



Source: SAP



Source: FM:Systems

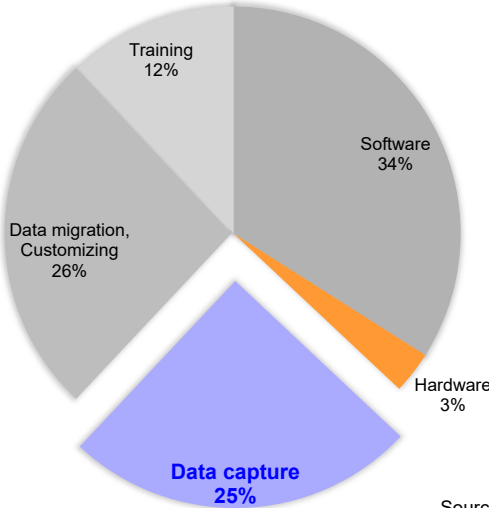


Source: Archibus



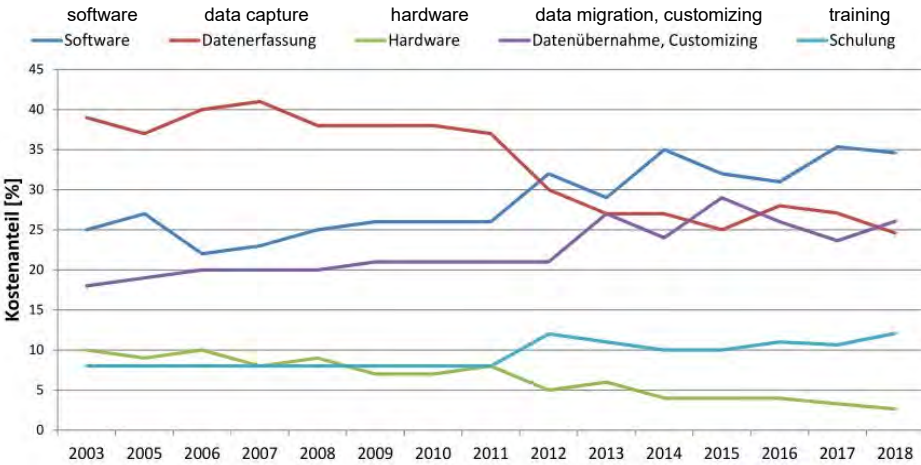
Source: Trimble Manhattan

Cost distribution of a CAFM/IWMS implementation (without preparatory consulting)



Source: CAFM Market Survey, GEFMA 940, 2018

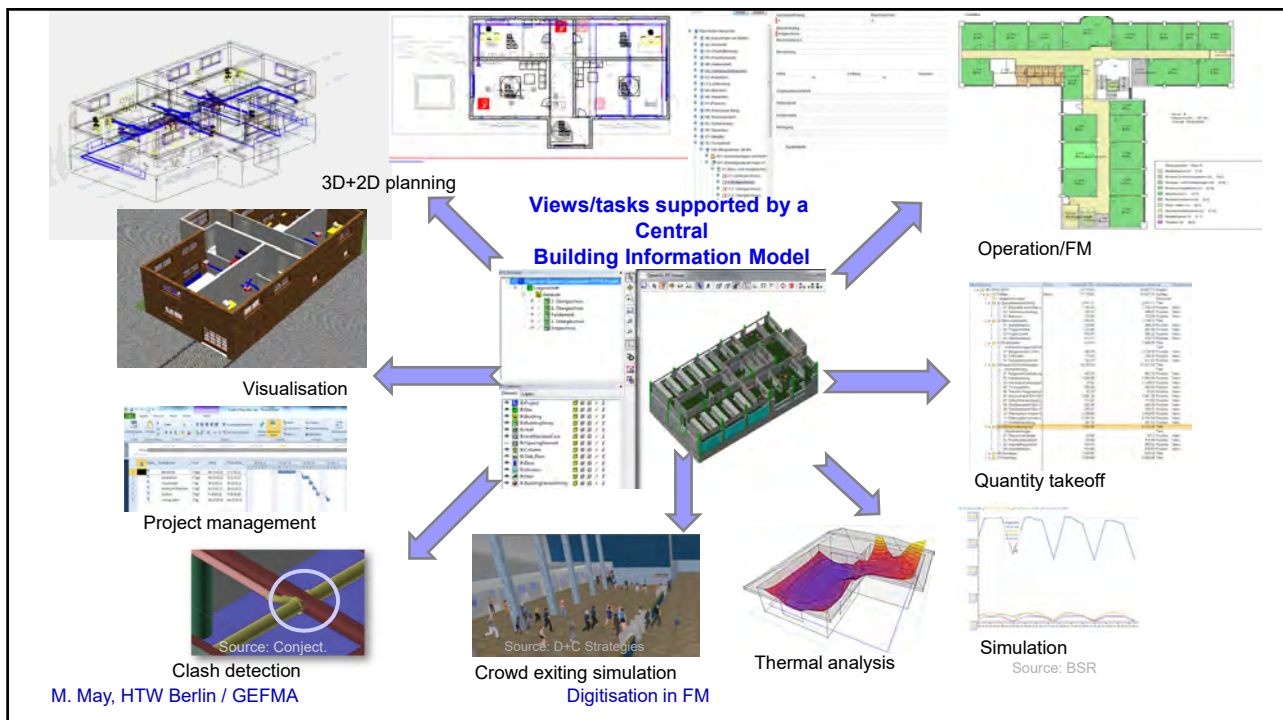
Cost distribution of a CAFM/IWMS implementation (% of total cost)



2. Building Information Modelling (BIM)

- A set of interacting policies, processes and technologies generating a **methodology** to manage the essential building design and project data in digital format throughout the building's **lifecycle**
- A **software technology** gaining rapid acceptance throughout the Architecture, Engineering, Construction (AEC) and Operation industry
- Provides a visually and dimensionally accurate **3D digital representation** of a building
- Also a **database**, offering the capability to track data attributes for the components that comprise the building model
- All objects have unique **identity** and various **attributes**

Challenge: Extend BIM to the **operating phase / FM**



3. Internet of Things (IoT)

- A system of **interrelated** computing devices, mechanical and digital machines, objects, animals or people that are provided with unique **identifiers** and the ability to transfer data over a **network** without requiring human-to-human or human-to-computer interaction
- Provides **undisputable data** that describes how things actually behave
- Allows to **measure** and **control** performance of (smart) buildings and cities
- Needs **sensors** / sensor networks to capture (big) data and analytics methods to take informed decisions

Wireless sensors

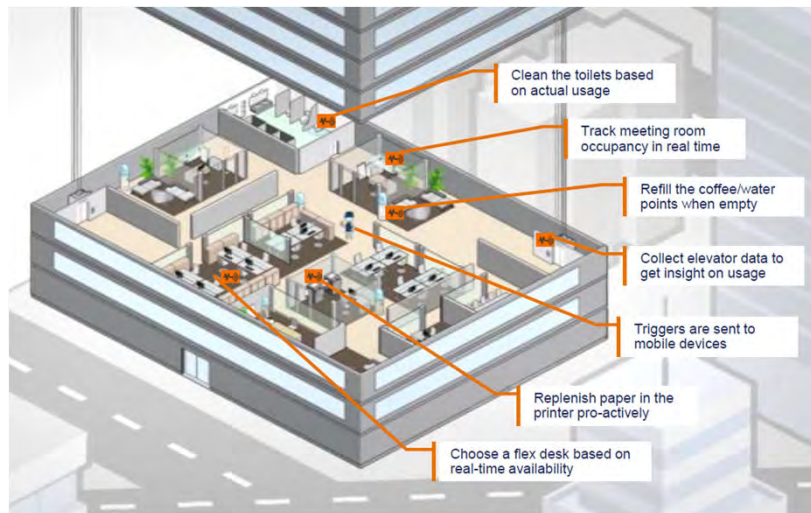
- Affordable
- Easy to deploy
- Low implementation cost



Source: MCS

- Meters
- Occupational sensors
- Cameras
- Measuring devices
- ...

IoT scenarios in FM



Source: MCS

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Digitisation in FM

4. Big Data

- Data sets (structured and unstructured) that are too large or complex to be treated by traditional software approaches
- High-volume, high-velocity and/or high-variety information assets that demand cost-effective, **innovative forms of information processing** that enable enhanced insight, decision making, and process automation
- Show huge potential for the better understanding of various phenomena and events through **data mining** and **machine learning** technologies, e.g. predictive data analytics
- Often **Artificial Neural Networks** are used to emulate the way neurons work in the human brain to find patterns in data representing sounds, images, ... (**deep learning**)



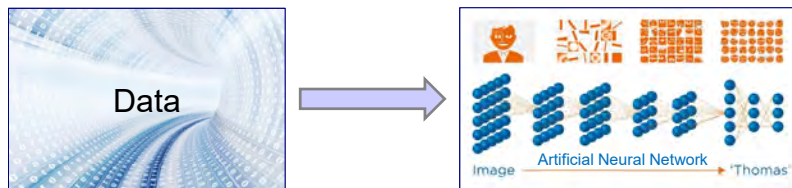
Source: siliconangle.com

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Big Data and Machine Learning (AI)

- Accumulate and combine diverse data to discover
 - Correlations,
 - Predict and
 - Prescribe responses



Source: Planon

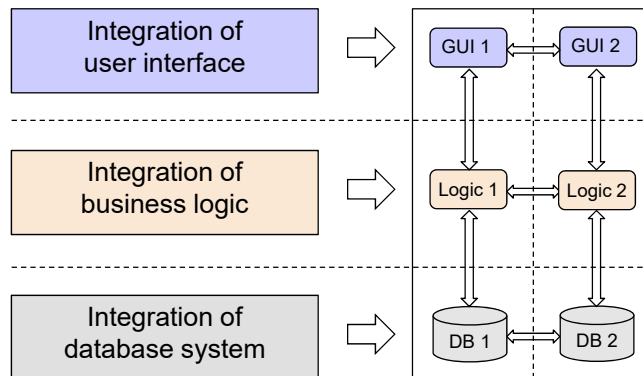
- Some experts argue: When you don't know what you are looking for you can't expect adequate results.
- **Challenge:** Select useful data already when it is generated

5. IT Integration

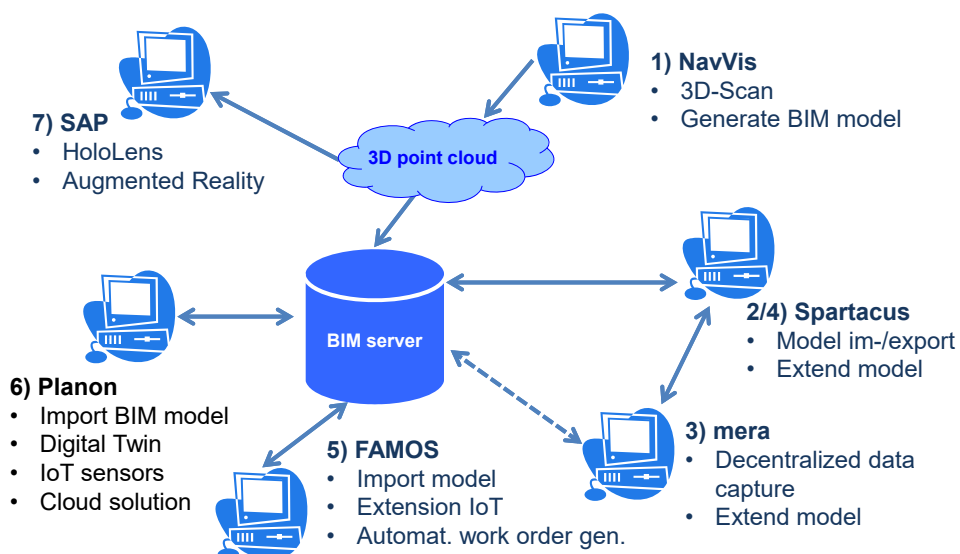
- A process that aims to **interconnect** different, often disparate, **subsystems** and **data sources**
- Creates **added value** because of automated interactions between the various subsystems
 - Prevent redundant work
 - Reduce failure
 - Enhanced information (by analysing data from different sources)
 - Faster processes
 - More reliable decisions

Types of integration

- Offline (txt, csv, xls, ...)
- Online (database, middleware, web service, ...)
- Direction
 - Unidirectional
 - Bidirectional
- Frequency
 - Once
 - Periodical
 - Real time



Future Lab – IT integration based on BIM



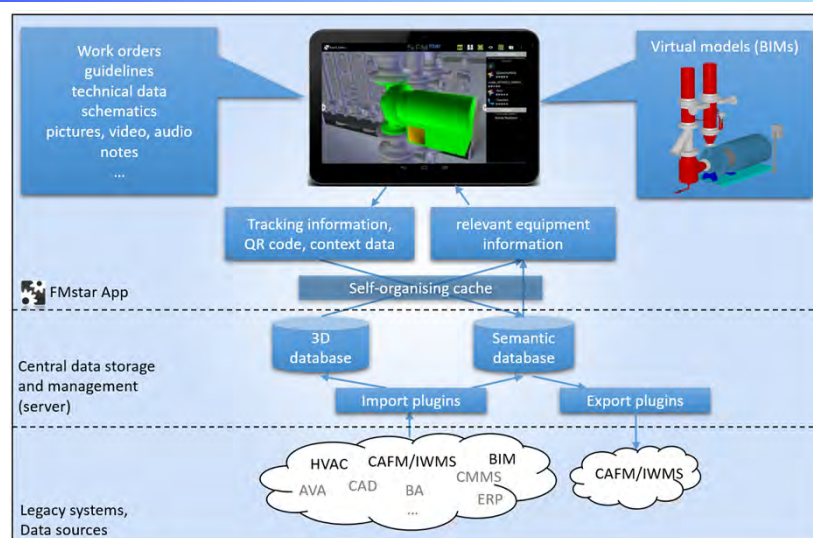
6. Augmented Reality (AR)

- In VR the user is completely immersed in the **virtual environment** without being able to interact with the real world
- AR rather **supplements** reality than replacing it
- Keeps the user in the **real world** while enhancing it

- **Challenges**
 - Interaction in real-time
 - Recognition and tracking of objects and positioning (rendering) of virtual objects in a real environment
 - Matching (registration) of real objects with their virtual counterparts

FM supported by AR and Semantic Technologies (FMstar)

- Objects in the real world are located (e.g. by QR code) and overlaid by virtual objects (BIM models/IFC)
- Work orders are processed on the mobile device
- Context-based data is provided and captured on site



7. Simulation

- **Imitation** of the operation of real-world systems or processes over time
- Requires a (mathematical) **model** representing the key characteristics or behaviour of the physical or abstract system or process under consideration
- **Algorithms** and related computer programmes simulate representative **scenarios** for a model
- Often used in **building simulation**, e.g.
 - Indoor climate
 - Energy consumption and retrofit
 - Thermal analysis
 - Crowd exiting
 - Space utilisation
 - Education and training of FM's incl. (serious) computer-gaming

7.1 Example: FM simulation game



Goals:

- Develop a **Serious Computer Game** for **know-how transfer** in FM
- Various **scenarios**, **target groups** and game types to be considered
- **Flexible** architecture
(new scenarios to be implemented with acceptable effort)

Example playFM



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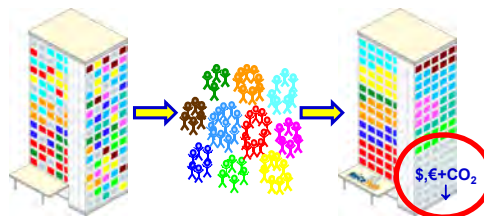
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7.2 Example: Space Utilization Simulation



Goal:

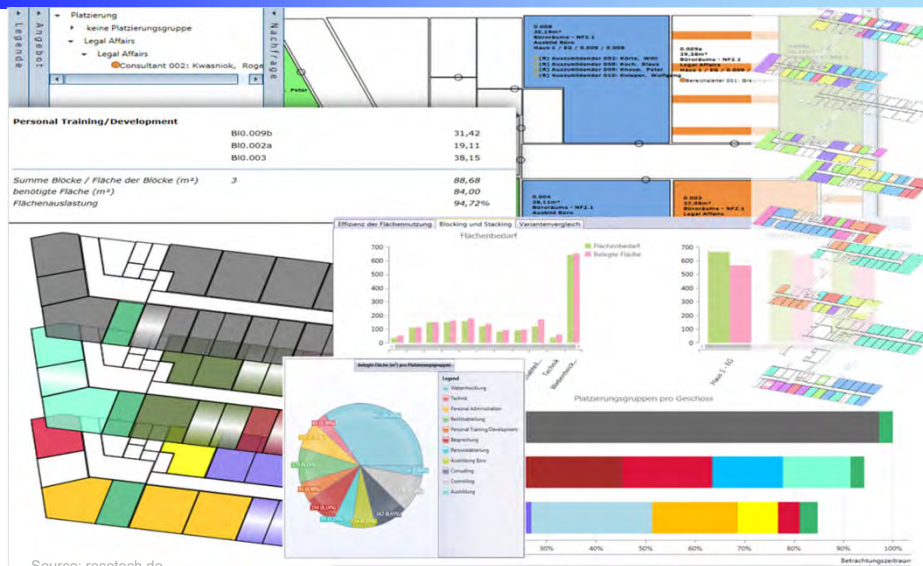
- To solve the extremely **complex** (mathematical) problem of **space allocation** in large organisations **automatically** in a (close to) **optimum** manner
- To run on a standard PC/notebook in acceptable **time**
- To use **available data** from tools like CAD/BIM, IWMS/CAFM, Excel, ERP, ... as much as possible
- True **decision support** in space allocation process
- Add **value / benefits** (space, cost and carbon reductions)



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Graphical and textual simulation results



Source: recotech.de

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Recent Publications of GEFMA's SIG Digitisation

Systematic textbooks on
Digitisation in FM

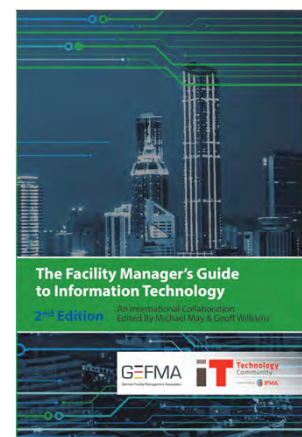


<https://www.springer.com/de/book/9783658213565>

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Topics:

- Relationship Between FM and IT
- Technologies & Their Impact on FM
- IT Basics for Facility Managers
- FM and CAFM/IWMS
- FM Application Fields
- Economic Benefits of a CAFM
- FM Processes & Their IT Implement.
- Mobile Technologies & IT Interfaces
- IT Security for Facility Managers
- Data Capture and Data Exchange
- Selection of CAFM Software
- Implementation Strategies for CAFM
- Strategic Space Optimization in FM
- Security for Building Control Systems
- Building Information Modeling
- Internet of Things around Buildings
- Data-Driven FM
- Big Data and AI/ML
- Information System Strategies in FM
- Trends and Outlook
- Case Studies of Successful CAFM/IWMS/BIM projects



Since 2019 also available as
Kindl ed.

<https://www.amazon.com/Facility-Managers-Guide-Information-Technology/dp/1938780000>

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