Energy efficiency, safety and comfort with DALI lighting management

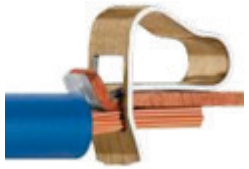
Speaker

DALI Summit 2019

Dirk Dronia

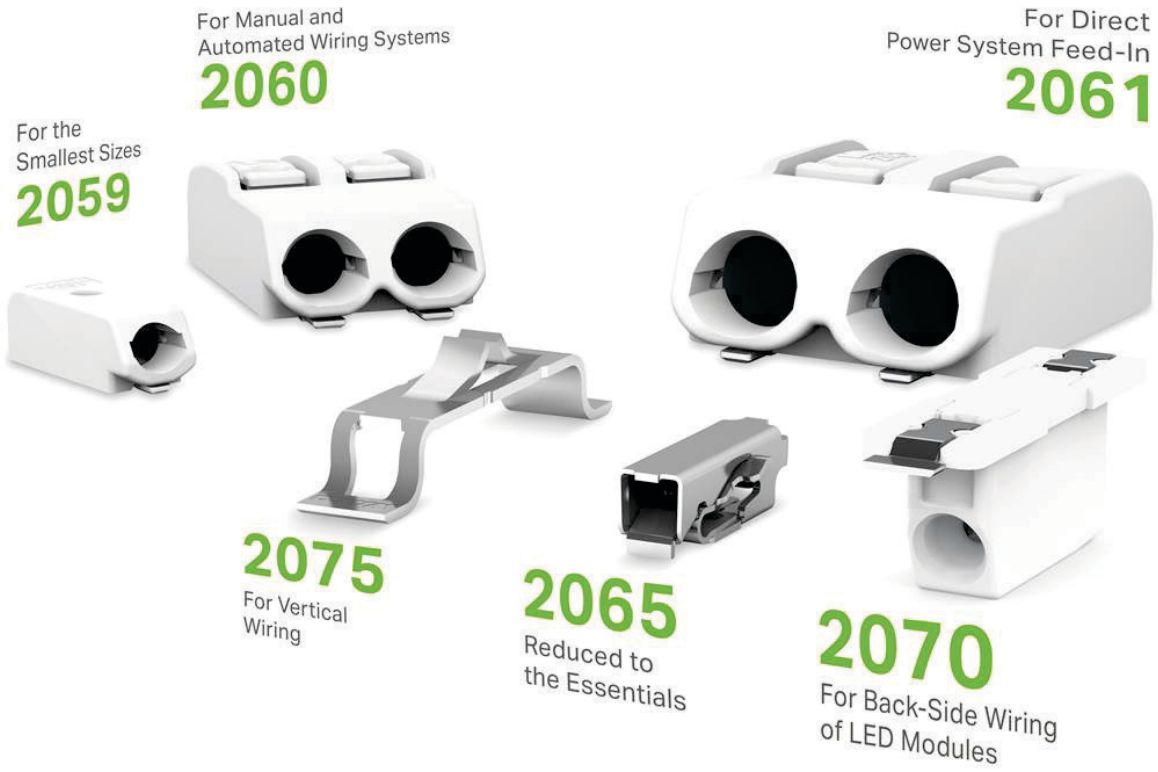
Market Management Building Automation

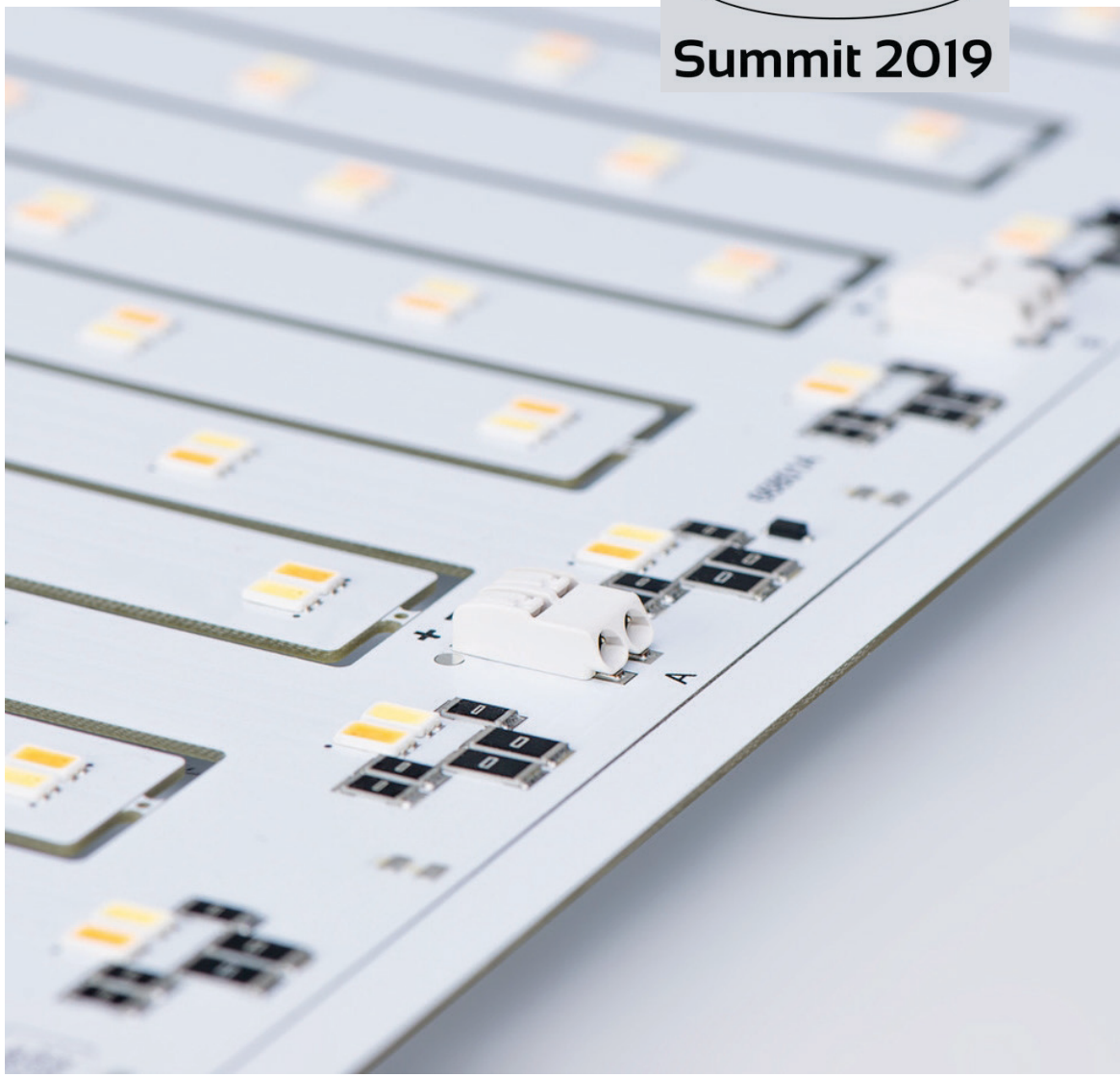
WAGO Kontakttechnik GmbH (Minden, D)



We connect your light

SMD terminal blocks for LED modules



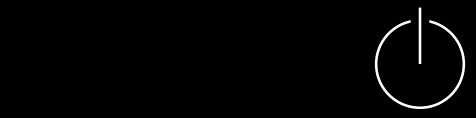


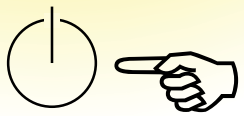
DALI Summit 2019

We manage your light

DALI Light Management

DALI Summit 2019





Light - The influencer

DALI Summit 2019

Light intensity and light color

- have an impact on wellbeing, health and performance
- have psychological effects
- ensures security i.e. for crime prevention
- ensures safety i.e. for accident prevention

Light – Different Tasks

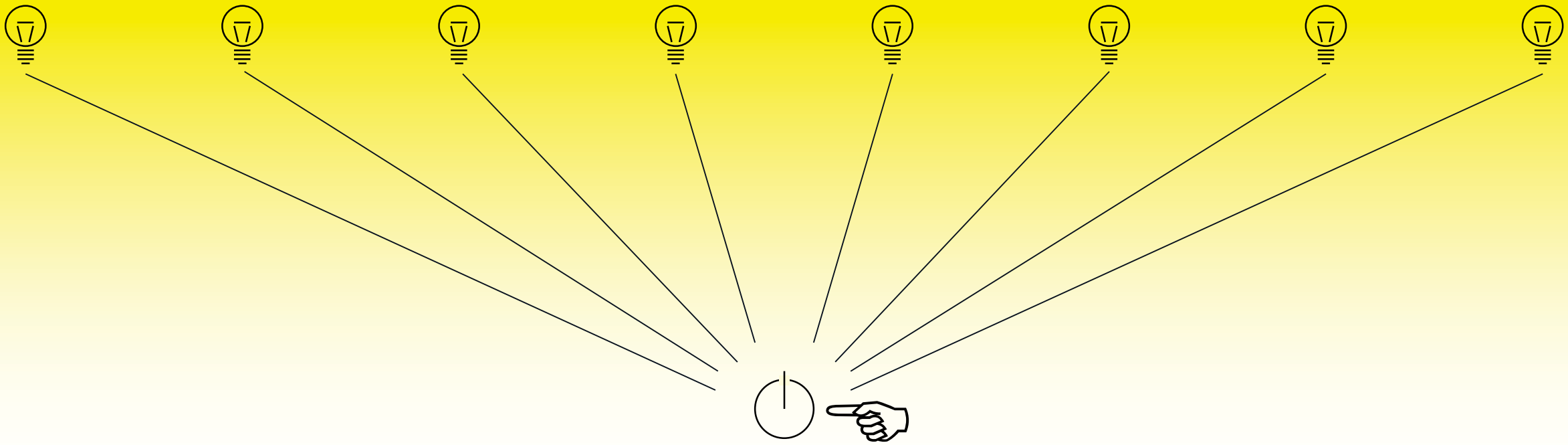
Summit 2019

Different needs for different buildings and user groups

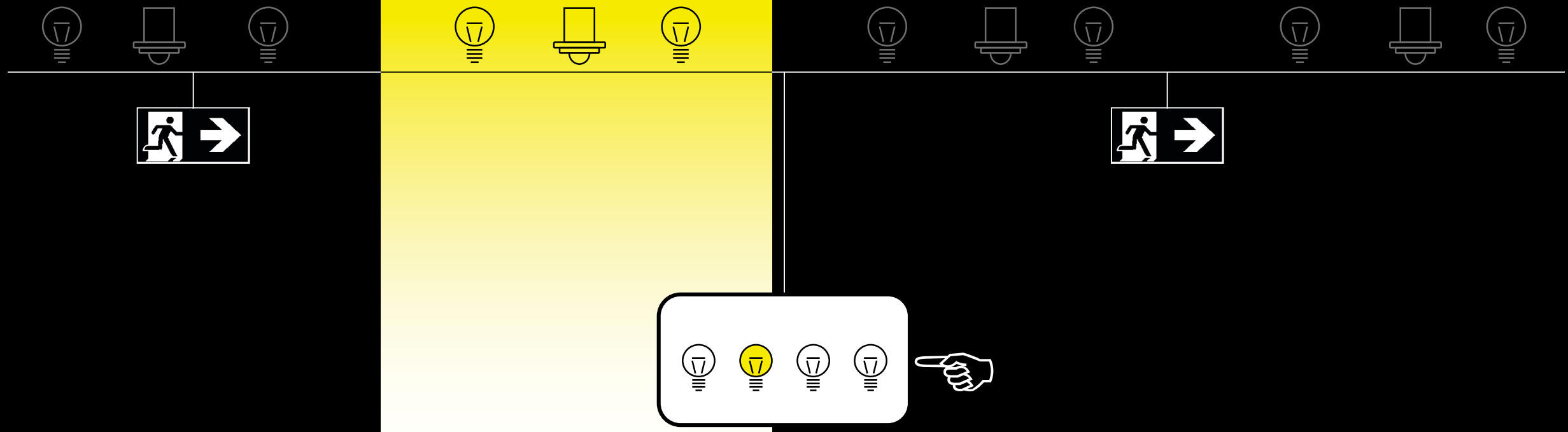
- Industrial Buildings
- Office Buildings
- Retail
- Hospitals
- Schools
- …

Manual On/Off
does not meet the different requirements

Manual On/Off
does not meet the different requirements



DALI-2
Flexibility and efficiency through networking



DALI-2
in a connected world ensures …

DALI Summit 2019

- Interoperability through certified products based on IEC 62386
  - DALI Ballast
  - DALI Sensor
  - DALI Master
- Flexibility, as requirements change
- Cost-effectiveness through easy commissioning, predictive maintenance and active service support
- Integration of emergency lighting for maintenance tasks
- Energy consumption measurement
- Easy mapping to other communication protocols

Possible functions through DALI-2

DALI Summit 2019

Switching
- Power on/off (with and without watchdog)
- Latching relays
- Staircase feature
- Automatic light (motion detector)
- Twilight control

Dimming
- Automatic dimming
- Dimming with presence sensors

Lighting Control
- Constant light control
- Human-centric lighting (HCL)
- Daylight control:
  - Switching function
  - Staircase function
  - Advanced functions

Simple project documentation by mouse click

Time Functions
- Weekly
- Vacation
- Special switching programs
- Holidays

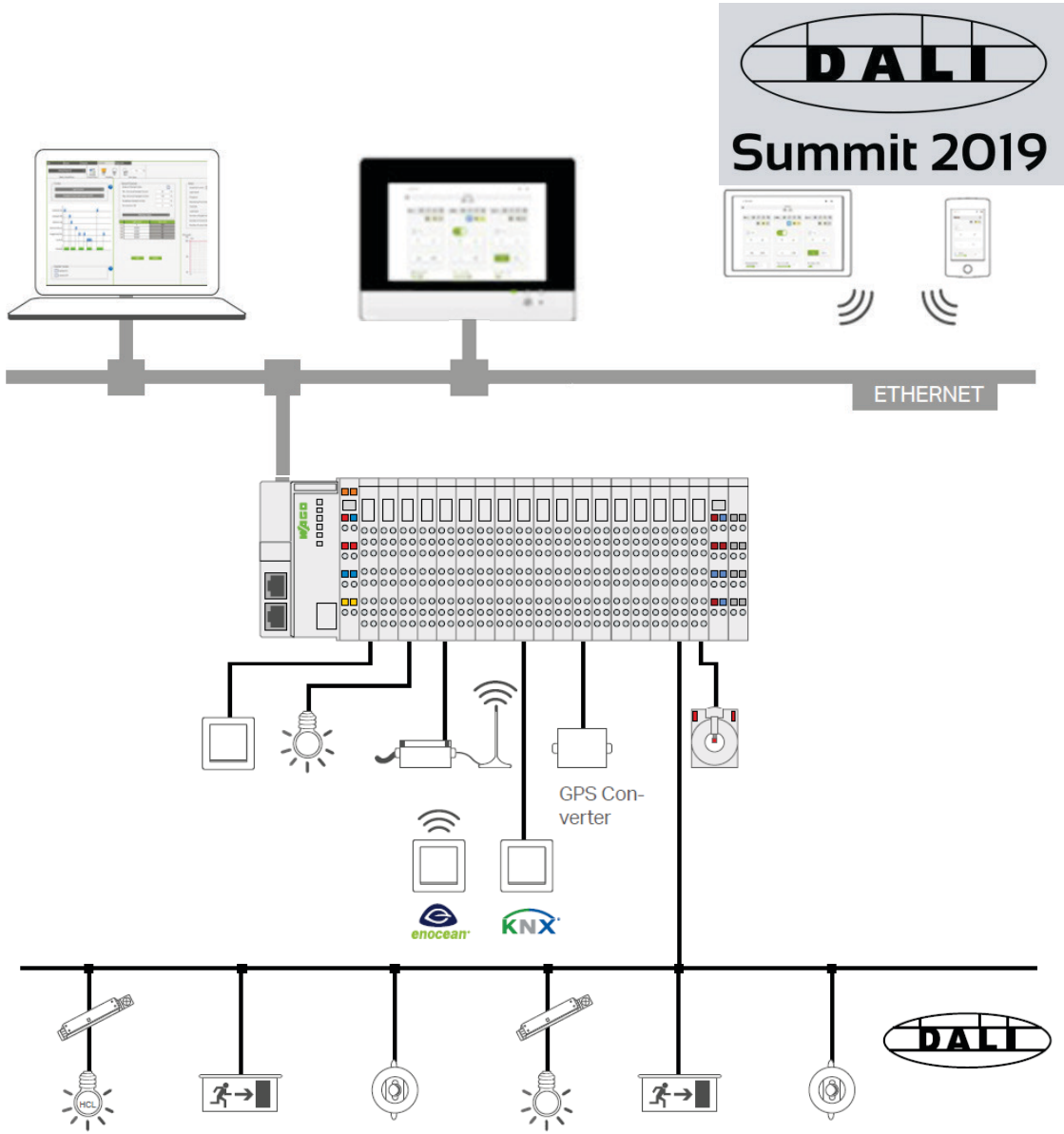
Slave Function
- Cross-communication between diffusers
- External virtual room
- External dimming value

Safety Lighting
- Single battery
- Central battery

- Precise energy consumption measurement
- Calculation of energy consumption for virtual room (VR)
- Measurement of total power; calculation per virtual room

System Architecture

- DALI-Channel: Interoperability through certified products based on IEC 62386
- Automation Level:
  - Interaction with sensors and actors supporting different communication protocols
  - Mapping to IP-Bases protocols



User Interface

- DALI Standard allows the design of user friendly interfaces for operation and maintenance
  - Controlling ballasts
  - Receiving status
  - Setting parameter

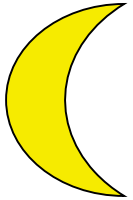
DALI-2, for sure the perfect base for light management in an industrial building ….

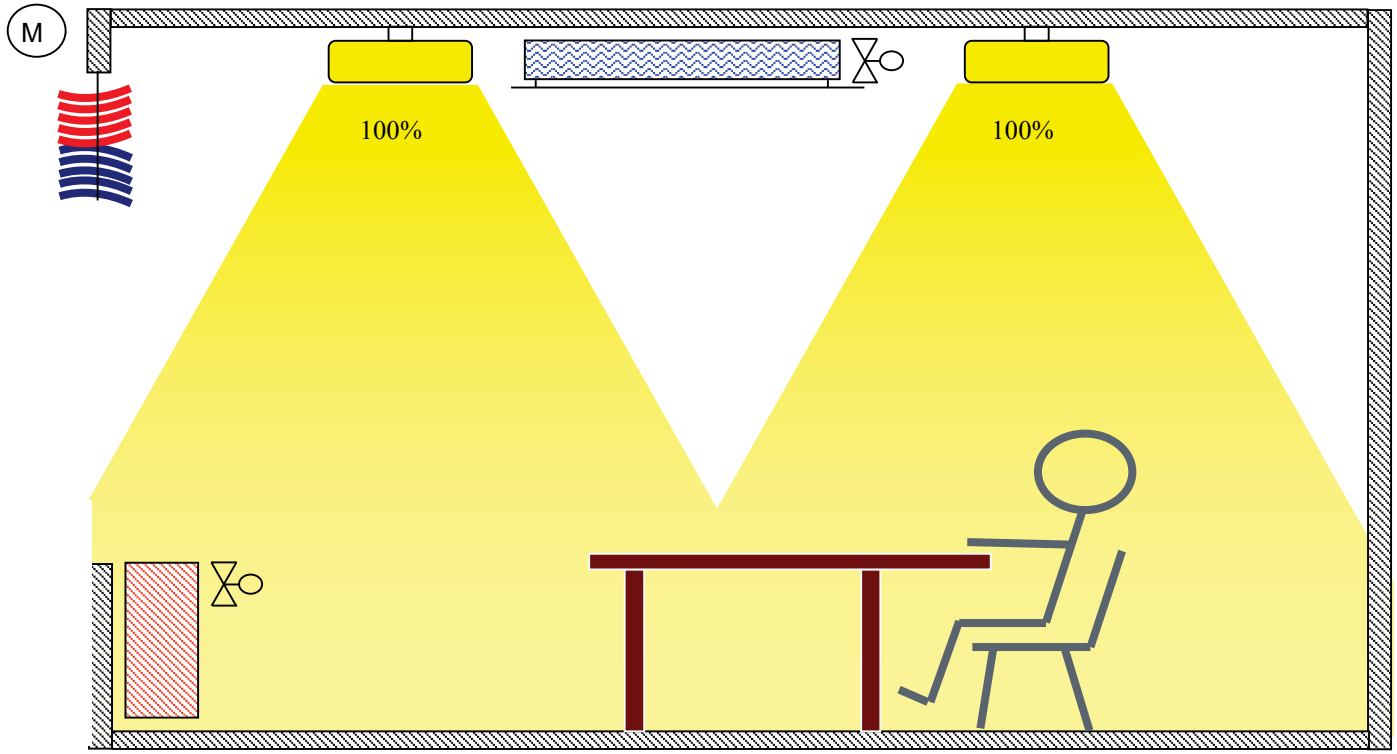
and ….

…what about an Office Building?

Room Automation and Control

DALI Summit 2019



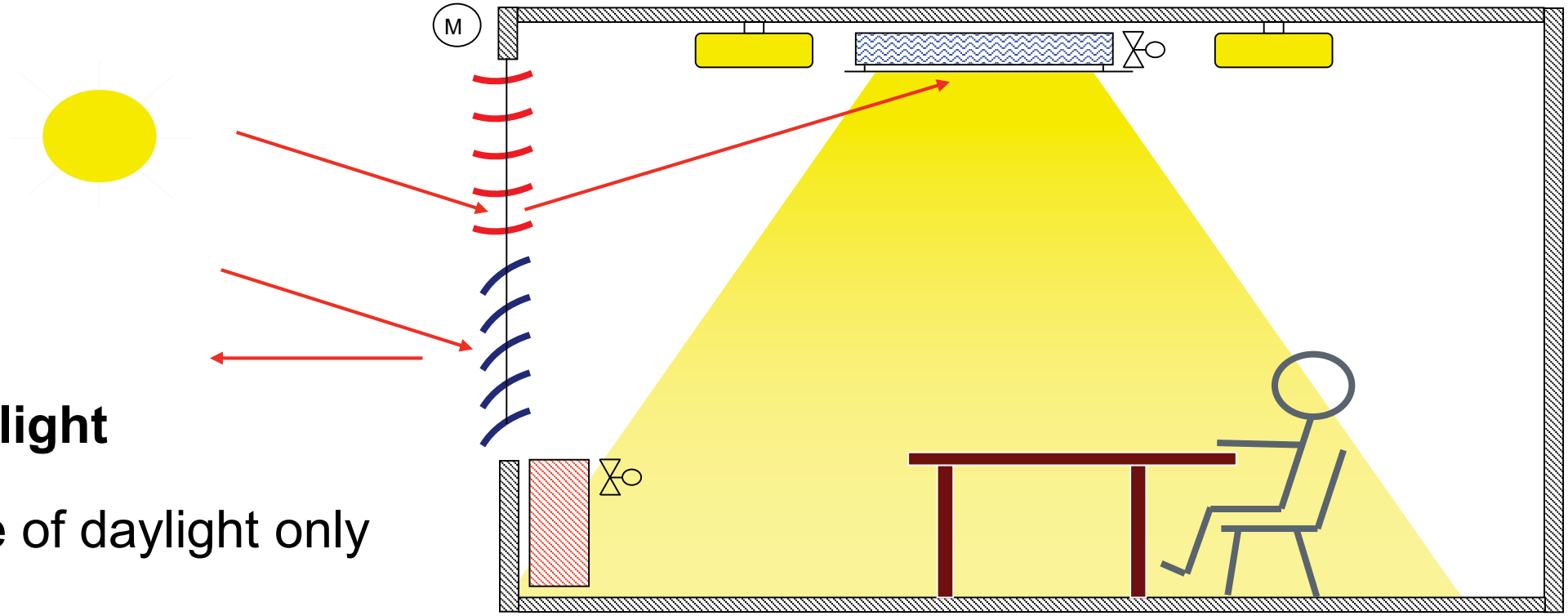


Night

Artificial lighting

Room Automation and Control

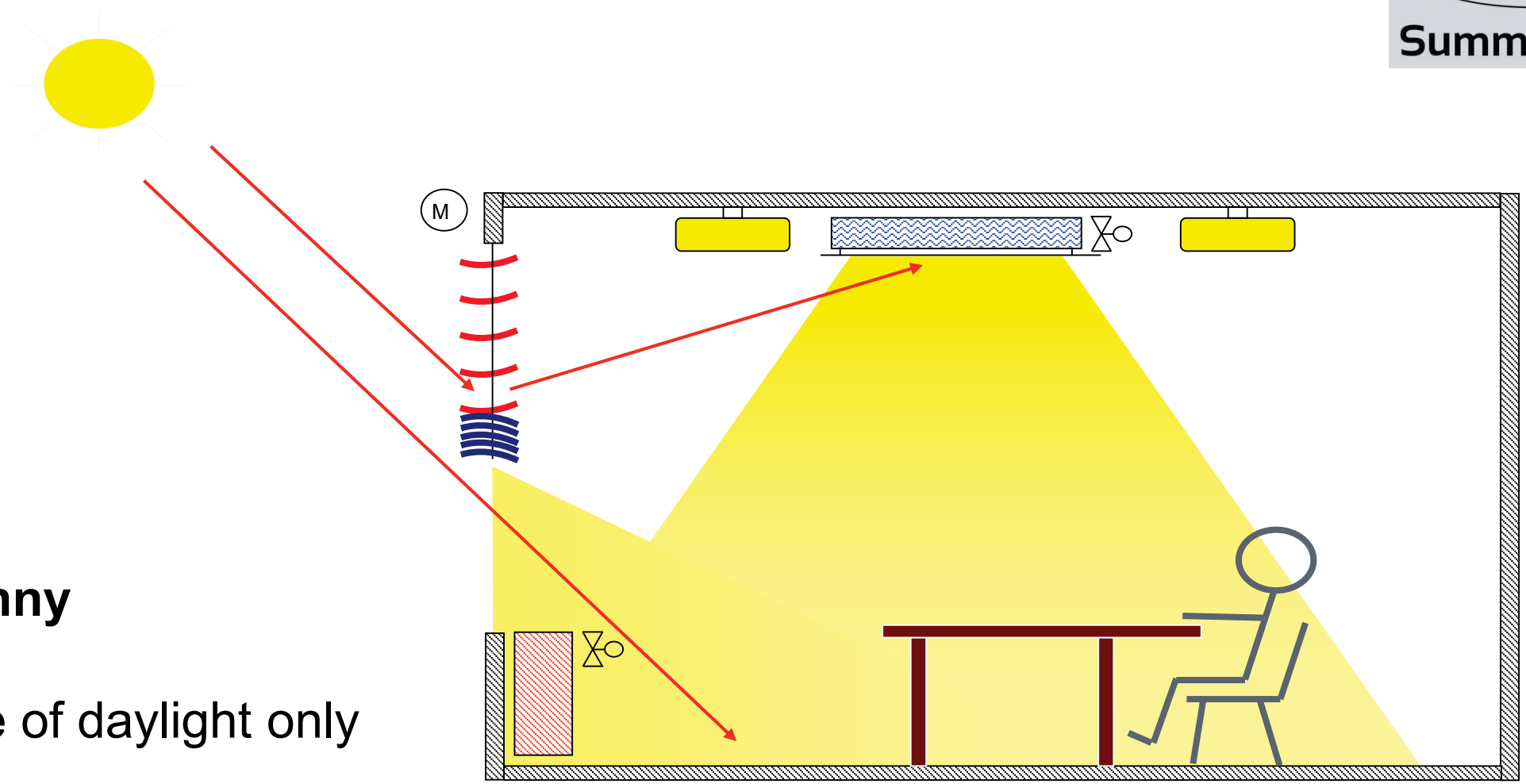
DALI Summit 2019



Twilight

Use of daylight only

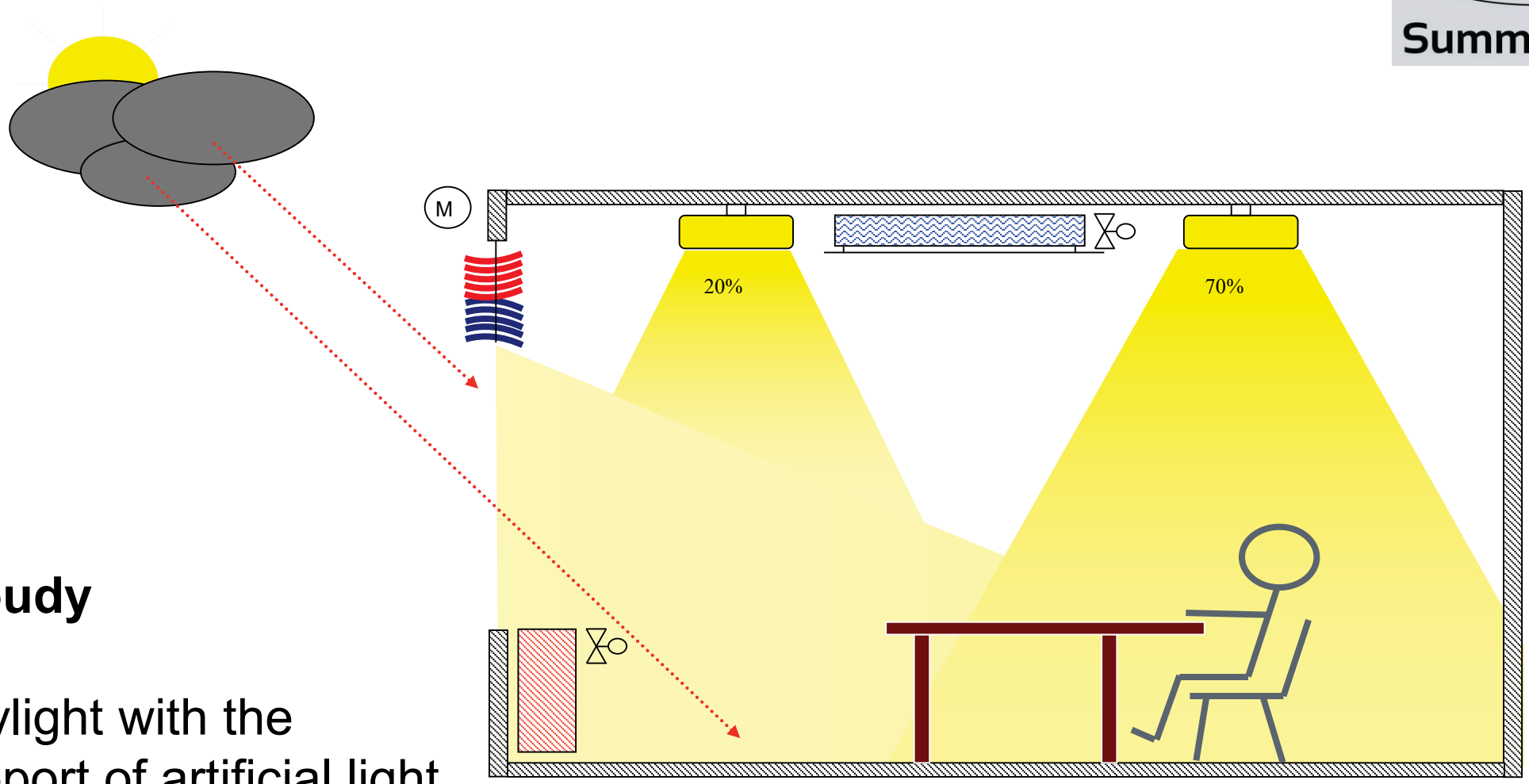
Room Automation and Control



Sunny

Use of daylight only

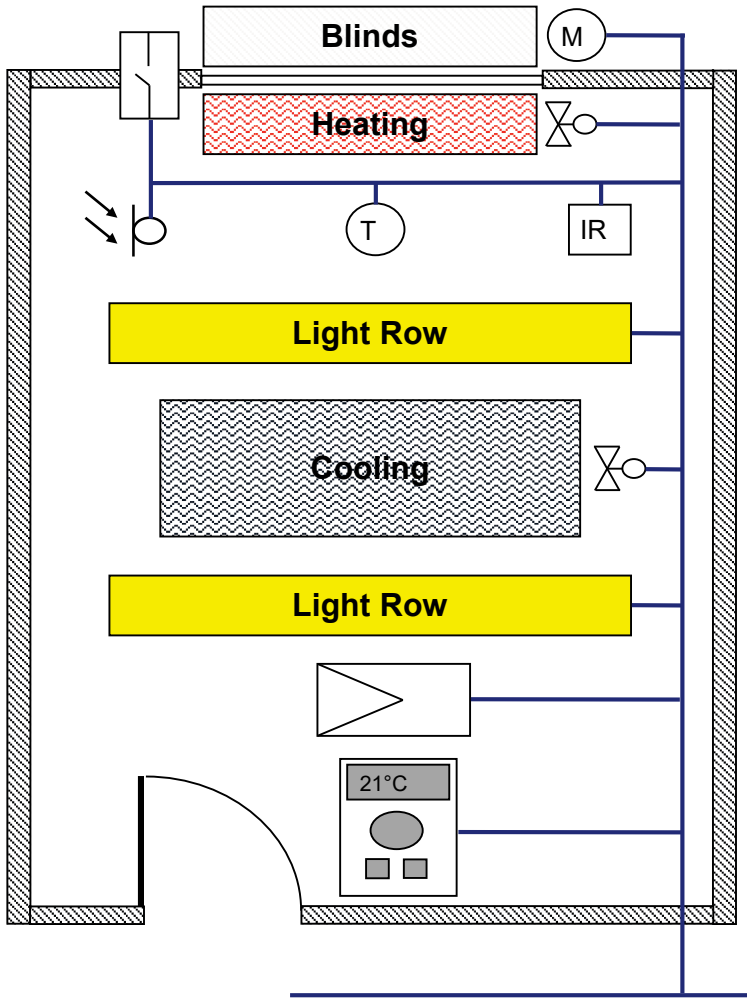
Room Automation and Control



Cloudy

Daylight with the support of artificial light

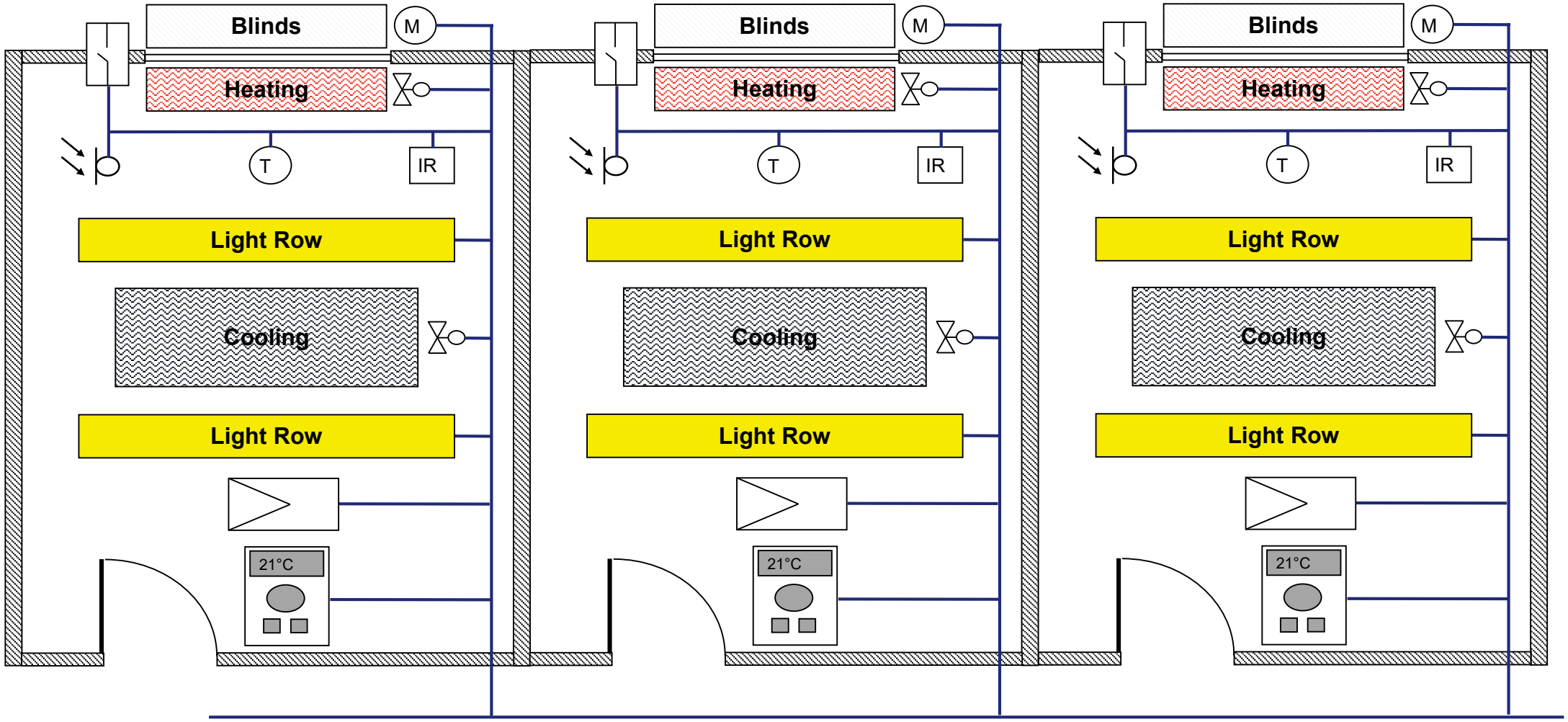
Room Automation and Control



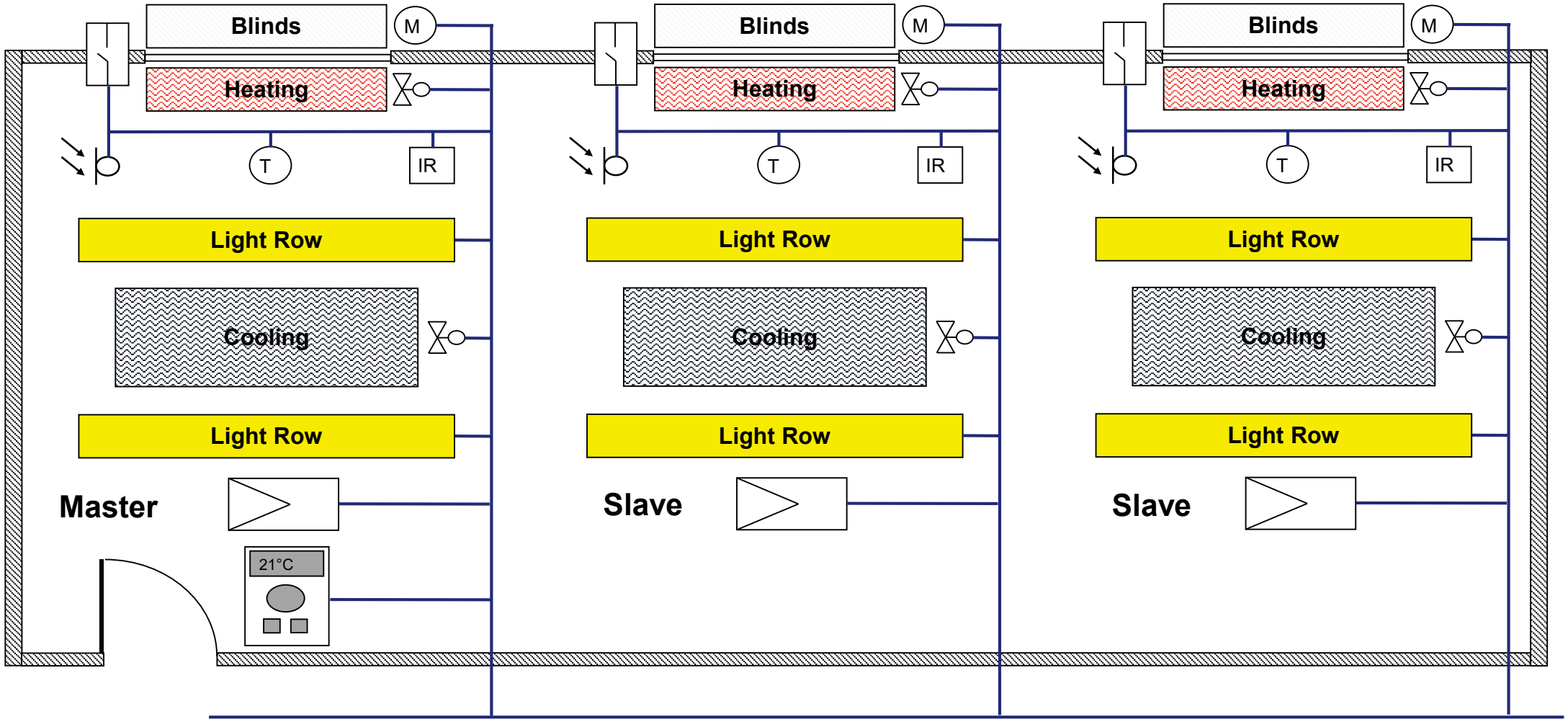
Sensors	HVAC	Light	Blinds	Security
Lux-Level		X	X	
Room Temperature	X			
Presence detection	X	X	X	X
Room Operation Unit	X	X	X	
Wondows Contact	X		X	X
Wind / Rain			X	
Outdoor Temperature	X		X	
Solar Radiation		X	X	

Room Automation and Control

DALI Summit 2019



Room Automation and Control

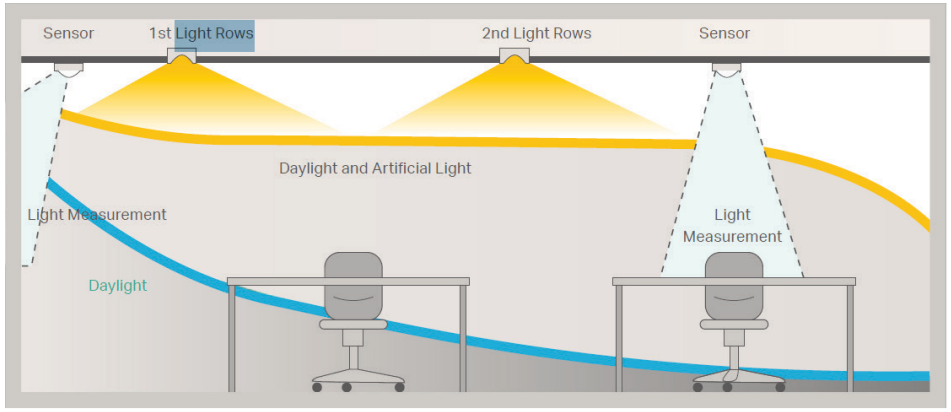


The Room Automation slides before are more than a decade old!

Room Automation and Control

DALI Summit 2019

- Technologies have changed but not the concept!



Example: Light Incidence from Outdoors

- A lighting system can not be viewed in isolation!

EPBD
(Energy Performance of Buildings Directive)

DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 30 May 2018
amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

(15) **It is important to ensure that measures to improve the energy performance of buildings do not focus only on the building envelope, but include** all relevant elements and technical systems in a building, such as passive elements that participate in passive techniques aiming to reduce the energy needs for heating or cooling, **the energy use for lighting** and for ventilation and hence **improve** thermal and visual **comfort**.

Article 3
Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 10 March 2020. They shall immediately communicate the text of those measures to the Commission.

EPBD
(Energy Performance of Buildings Directive

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 19 May 2010
on the energy performance of buildings
(recast)

Article 3

Adoption of a methodology for calculating the energy performance of buildings

Member States shall apply a methodology for calculating the energy performance of buildings in accordance with the common general framework set out in Annex I.

This methodology shall be adopted at national or regional level.

EPBD
(Energy Performance of Buildings Directive

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 19 May 2010
on the energy performance of buildings
(recast)

ANNEX I
Common general framework for the calculation of energy performance of buildings
(referred to in Article 3)

3. The methodology shall be laid down taking into consideration at least the following aspects:

…
(e) built-in lighting installation (mainly in the non-residential sector);
…
(h) indoor climatic conditions, including the designed indoor climate;
…

https://eur-lex.europa.eu/homepage.html?locale=en

EPBD
(Energy Performance of Buildings Directive

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 19 May 2010
on the energy performance of buildings
(recast)

ANNEX I
Common general framework for the calculation of energy performance of buildings
(referred to in Article 3)

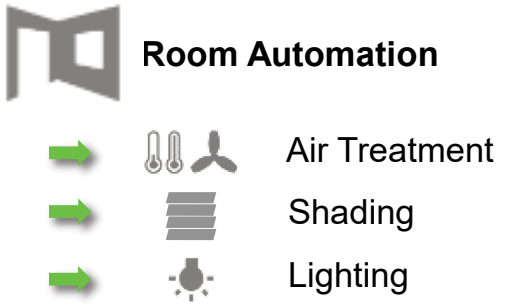
4. The positive influence of the following aspects shall, where relevant in the calculation, be taken into account:
(a) local solar exposure conditions, active solar systems and other heating and electricity systems based on energy from renewable sources;
(b) electricity produced by cogeneration;
(c) district or block heating and cooling systems;
(d) **natural lighting.**

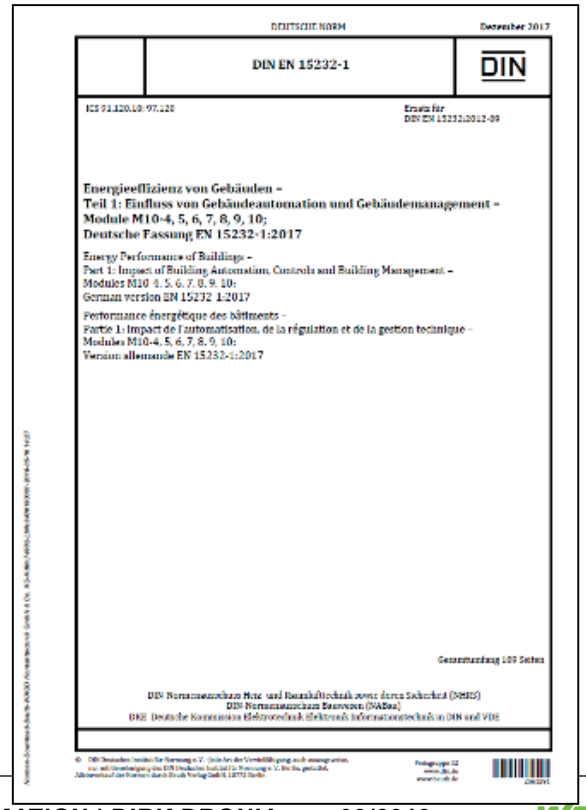
https://eur-lex.europa.eu/homepage.html?locale=en

EN 15232:2017 (SIA 386.110:2017)

This European Standard specifies:

- Europen Standard describing how Building Automation is influencing the energy performance of buildings
- The standard states that the lighting must be considered in the context of shading and indoor climate control.
- There is no BAC efficiency classes A without a combined light, sun blind, and HVAC control




DEUTSCHE NORM

DIN EN 15232-1

DIN

Energieeffizienz von Gebäuden –
Teil 1: Einfluss von Gebäudeautomation und Gebäudemanagement –
Module M10-4, 5, 6, 7, 8, 9, 10;
Deutsche Fassung EN 15232-1:2017

Energy Performance of Buildings –
Part 1: Impact of Building Automation, Controls and Building Management –
Modules M10-4, 5, 6, 7, 8, 9, 10;
German version EN 15232-1:2017

Performance énergétique des bâtiments –
Partie 1: Impact de l'automatisation, de la régulation et de la gestion technique –
Modules M10-4, 5, 6, 7, 8, 9, 10;
Version allemande EN 15232-1:2017

EN 15232:2017 (SIA 386.110:2017)

Energy Performance of Buildings

– Part 1: Impact of Building Automation, Controls and Building Management

- Definition of BA classes

AUTOMATIC CONTROL			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
1	**HEATING CONTROL**									
1.1	Emission control									
		The control function is applied to the heat emitter (radiators, unde room level; for type 1 one function can control several rooms								
	0	No automatic control								
	1	Central automatic control								
	2	Individual room control								
	3	Individual room control with communication								
	4	Individual room control with communication and occupancy detection (not applied to slow reacting heating emission systems, e.g. floor heating)								
	a	In case of slow reacting heat (and cool) emission systems, e.g. floor heating, wall heating, etc. functions 1.1.3 (and 3.1.3) are allocated to BAC class A.								
5	**LIGHTING CONTROL**									
5.1	Occupancy control									
	0	Manual on/off switch								
	1	Manual on/off switch + additional sweeping extinction signal								
	2	Automatic detection (auto on)								
	3	Automatic detection (manual on)								
5.2	Light level / Daylight control									
	0	Manual (central)								
	1	Manual (per room/zone)								
	2	Automatic switching								
	3	Automatic dimming								
6	**BLIND CONTROL**									
	0	Manual operation								
	1	Motorized operation with manual control								
	2	Motorized operation with automatic control								
	3	Combined light/blind/HVAC control								

BAC efficiency classes

EN 15232:2017

Classes	Heating / Cooling control (3)	Ventilation /Air conditioning control (4)	Lighting Control (5)	Blind Control (6)
A	▪ Individual room control with communication and occupancy detection ▪ Total interlock between heating and cooling control ▪ Demand based control of distribution water ▪ Variable speed pump control of distribution pumps in networks	▪ Demand-based room air temp. control (all-air systems) ▪ Supply air flow control at the room level by occupancy detection ▪ Variable set point with load dependent compensation for supply air temperature control ▪ H,x- directed free mechanical cooling control ▪ Direct humidity control	▪ Automatic detection (manual on) for occupancy control ▪ Light level / Daylight control via automatic dimming	▪ **Combined light/blind/HVAC control**
B	▪ Individual room control with communication between controllers ▪ Partial interlock (dependent on HVAC system) ▪ Outside temperature compensated distribution water ▪ On/Off control of distribution pumps in networks	▪ Demand-based room air temp. control (all-air systems) ▪ Supply air flow control at the room level by by time scheduling ▪ Variable set point with outside temperatur compensation for supply air temperature control ▪ Free mechanical cooling ▪ Direct humidity control	▪ Automatic detection (auto on) for occupancy control ▪ Light level / Daylight control via automatic switching	▪ **Combined light/blind/HVAC control**
C	▪ Individual room control ▪ Outside temperature compensated control ▪ Partial interlock (dependent on HVAC system) ▪ Demand based control of distribution water ▪ Multi-State control of distribution pumps in networks	▪ Variable room air temp. control (all-air systems) ▪ Supply air flow control at the room level by by time scheduling ▪ Constant set point for supply air temperature control ▪ Free mechanical night cooling ▪ Dewpoint control of humidity	▪ Manual on/off switch + additional sweeping extinction signal for occupancy control ▪ Light level / Daylight control manual per room/zone	▪ Motorized operation with automatic blind control
D	▪ No automatic control or Central automatic control ▪ No interlock between heating and cooling control ▪ No automatic control of distribution water ▪ No automatic control of distribution pumps in networks	▪ On/Off room air temp. control (all-air systems) ▪ No automatic supply air flow control at the room level ▪ No automatic supply air temperature control ▪ No automatic control of mechanical control ▪ No automatic humidity control	▪ Manual on/off switch instead of occupancy control ▪ Central light level / Daylight control	▪ Motorized operation with manual blind control ▪ Manual operation for sun blinds

EN 15232:2017 (SIA 386.110:2017)

Energy Performance of Buildings

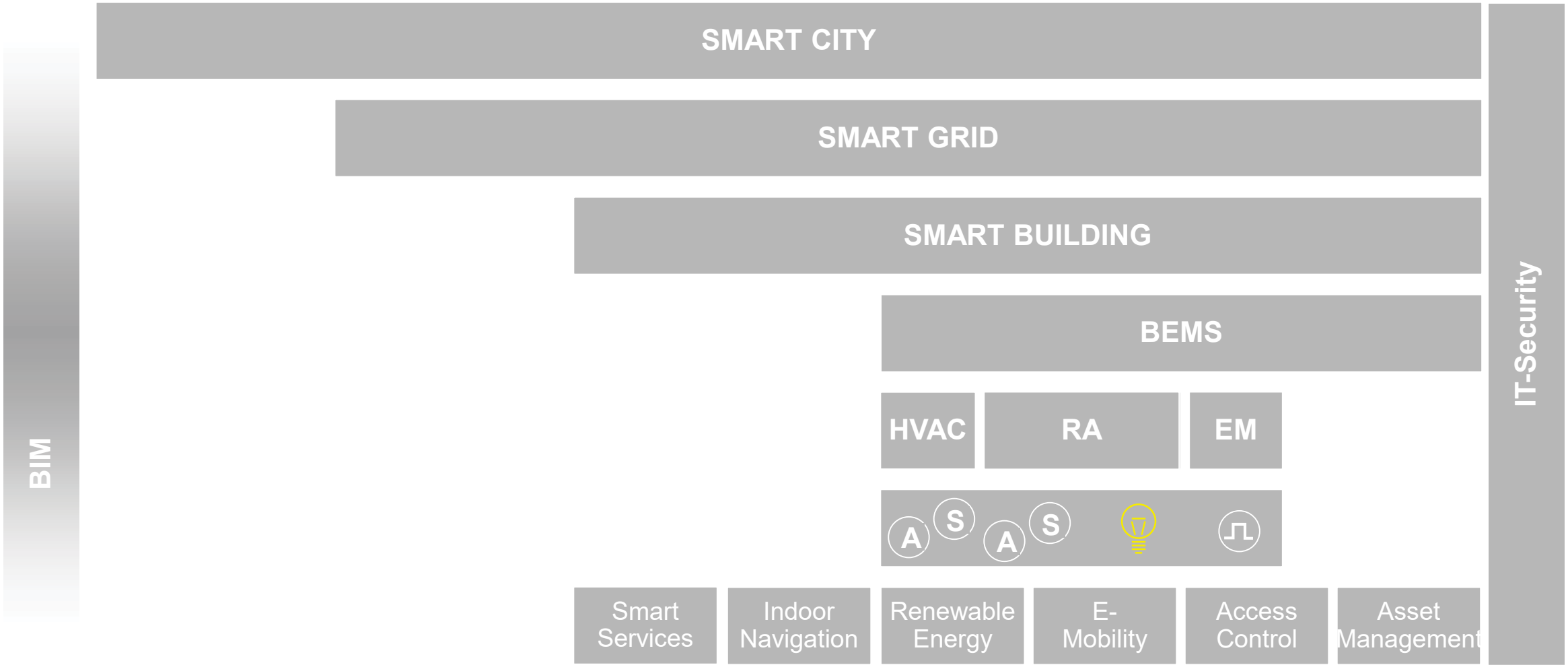
– Part 1: Impact of Building Automation, Controls and Building Management

- Lighting in Building Automation must be seen in context with other systems and not as an individual system

AUTOMATIC CONTROL			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
5	LIGHTING CONTROL									
5.1	Occupancy control									
	0	Manual on/off switch								
	1	Manual on/off switch + additional sweeping extinction signal								
	2	Automatic detection (auto on)								
	3	Automatic detection (manual on)								X
5.2	Light level / Daylight control									
	0	Manual (central)								
	1	Manual (per room/zone)								
	2	Automatic switching								
	3	Automatic dimming								X
6	BLIND CONTROL									
	0	Manual operation								
	1	Motorized operation with manual control								
	2	Motorized operation with automatic control								
	3	Combined light/blind/HVAC control								X

AUTOMATIC CONTROL										
1	HEATING CONTROL									
1.1	Emission control									
		The control function is applied to the heat emitter (radiators, unde room level; for type 1 one function can control several rooms								
	0	No automatic control								
	1	Central automatic control								
	2	Individual room control								
	3	Individual room control with communication								
	4	Individual room control with communication and occupancy detection (not applied to slow reacting heating emission systems, e.g. floor heating)								X
	a	In case of slow reacting heat (and cool) emission systems, e.g. floor heating, wall heating, etc. functions 1.1.3 (and 3.1.3) are allocated to BAC class A.								

“Light” in a connected world



Summary

- DALI allows
  - interoperability through certified products based on IEC 62386
  - flexibility, as requirements change
  - cost-effectiveness through easy commissioning, predictive maintenance and active service support
  - integration of emergency lighting for maintenance tasks Energy consumption measurement
  - easy mapping to other communication protocols
  - designing user interfaces for easy commissioning and maintenance

Summary

- Especially in office buildings lighting can not be considered in isolation
- “Technical Building Systems“ including lighting are in European directives and standards

Thank you

See you at the LpS 2019 Expo (C13/D14)


WAGO