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Smart Buildings Webinar SRI

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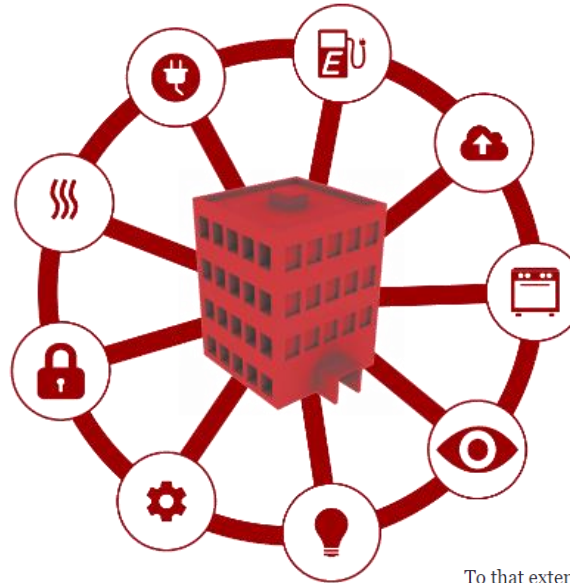
25/06/2020



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What is a smart building?

Leveraging cutting-edge technologies, such as the Internet of Things, Big Data and intelligent software, smart buildings enhance the experience of occupants, and create more attractive and desirable places to work. In a smart building, building systems sustain optimal levels of performance, helping to make them highly energy efficient; the experience of building users is personalised to their individual preferences; and real-time data is captured on the performance of the building and its work spaces.



The term 'Smart Building' describes a building, which contains interconnected technologies that make the building more responsive to its environment and the people inside it; with the goal of providing greater insight and control of overall 'performance'.

What constitutes 'improving performance' will differ for different buildings in different industries but broadly a smart building should deliver better economic, social and environmental conditions for the building owner and its occupants.



To that extent, a smart building can be thought of as an ecosystem, a dynamic entity with many devices of varying age that "talk to" and depend on one another, sharing data and responding to various needs. Key to this complex interaction of software and hardware is the human element, the overriding "voice," if you will, of guidance and direction that points all other systems toward those goals.



“ *Smartness of a building refers to the ability of a building or its systems to sense, interpret, communicate and actively respond in an efficient manner to changing conditions in relation to the operation of technical building systems or the external environment (including energy grids) and to demands from building occupants.* ”



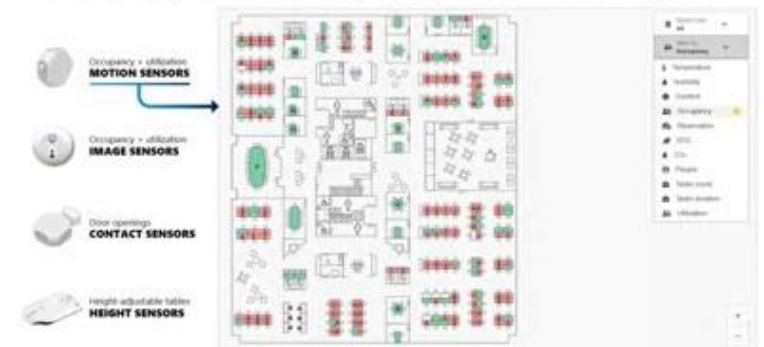
What is a smart building?



Parking Management



Example: Space monitoring using different sensor types



Building management

Energy efficiency

User comfort

Smart Readiness Indicator - SRI

- SRI = Tool voor inschatten 'level of Smartness', ontwikkeld in opdracht van de Europese commissie.
- DOEL:
 - Bewustmaking vh (gebrek aan) potentieel
 - Stimulans voor innovatie
- STARTING POINTS
 - **Comfort & Convenience:** mogelijkheid om te reageren op een vraag van de gebruiker
 - **Energy efficiency performance&operation:** Intelligent beheer en gebruik van energie en middelen
 - **Energy flexibility:** De mate waarin de energievraag gestuurd kan worden en er energieopslag mogelijk is..
- Checklist met focus op technisch, energetisch vlak

MEASURE THE TECHNOLOGICAL READINESS OF YOUR BUILDING



1 Readiness to
adapt in response
to the needs of the
occupant

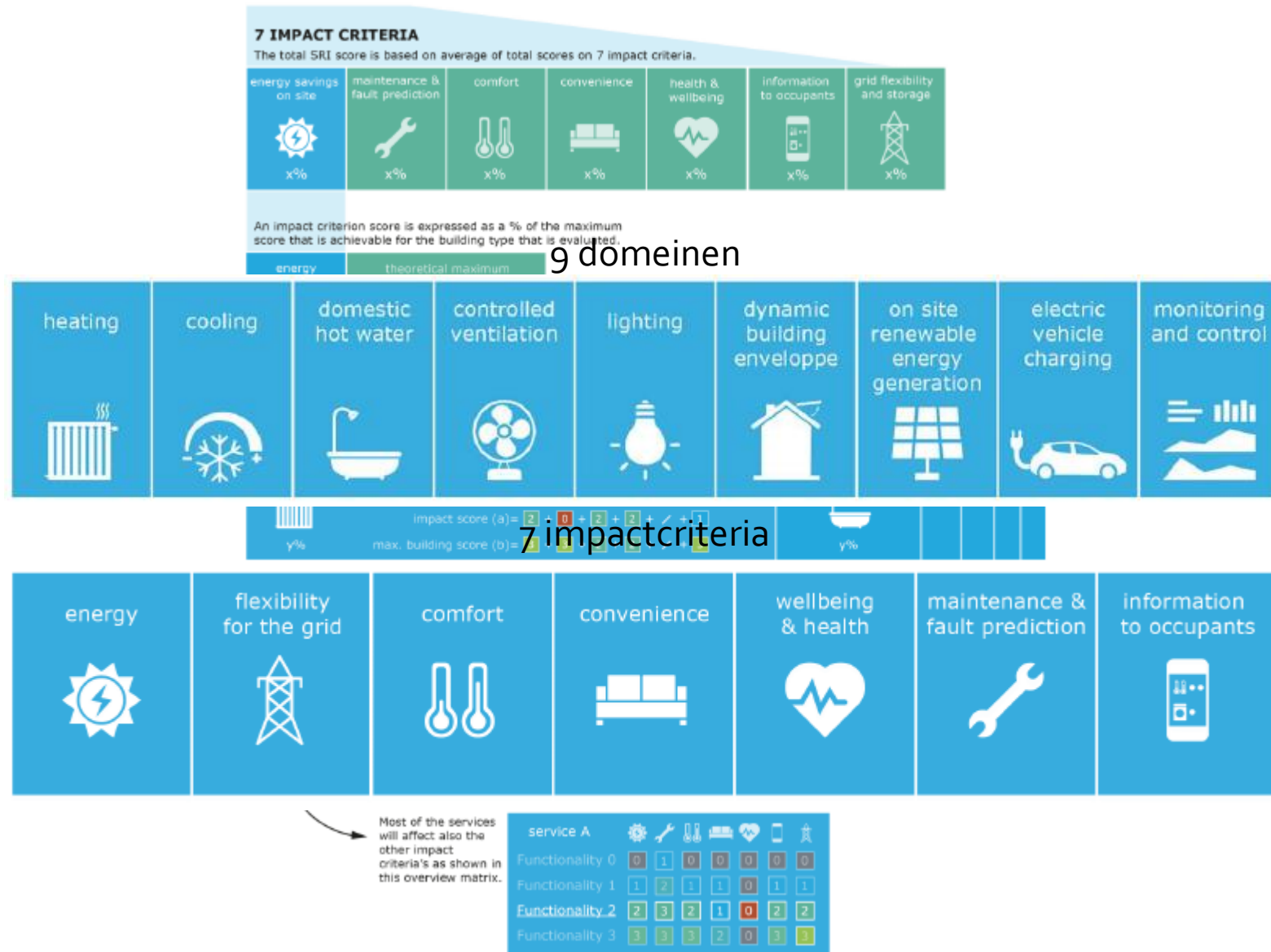


2 Readiness to
facilitate main-
tenance and
efficient operation



3 Readiness to
adapt in response
to the situation of
the energy grid

Smart Readiness Indicator - SRI



Smart Readiness Indicator - SRI

Code	Service category				Code	Service category							
Heating-1	Heat control - demand side				DHW-1	Control DHW production facilities							
Heating-2	Control heat production facilities				DHW-3	Information to occupants and facility managers							
Heating-3	Information to occupants and facility managers	Category 3 service	Functionality level 0 (non-smart default)		DHW-4	DSM control of equipment	Functionality level 2						
Heating-4	DSM control of equipment												
Cooling	Heating-1a	Heat control - demand side	Heat emission control	No automatic control	Central automatic control (e.g. central thermostat)	Individual room control (e.g. thermostatic valves, or electronic controller)	Individual room control with communication between controllers and to BACS	Individual room control with communication and presence control				2/4	
Cooling													
Cooling													
Cooling													
Ventilat	Heating-2b	Control heat production facilities	Heat generator control (for heat pumps)	On/Off-control of heat generator	Multi-stage control of heat generator capacity depending on the load or demand (e.g. on/off of several compressors)	Variable control of heat generator capacity depending on the load or demand (e.g. hot gas bypass, inverter frequency control)	Variable control of heat generator capacity depending on the load AND external signals from grid				1/3		
Ventilat													
Ventilat													
Ventilat													
electrici													
electrici	Heating-3	Information to occupants and facility managers	Report information regarding HEATING system performance	None	Indication of actual values (e.g. temperatures, submetering energy usage)	Actual values and historical data	Performance evaluation including forecasting and/or benchmarking	Performance evaluation including forecasting and/or benchmarking; also including predictive management and fault detection				3/4	
electrici													
electrici													
electricity-5	DER - Generation Control				Lighting-2	power based on daylight levels							

• DER = Distributed Energy Source

n:
 Domestic Hot Water
 Electric Vehicles
 Domestic building Envelope
 Monitoring & control
 Building & control systems

Smart Readiness Indicator - SRI



A Simplified method	B Expert SRI assessment	C In-use smart building performance
Checklist approach with limited, simplified services list	Checklist approach, covering full catalogue of smart services	<i>Measured / metered data (potentially restricted set of domains)</i>
Online self-assessment by end-user (no certification) OR On-site inspection by third-party qualified expert (formal certification)	Online self-assessment by technical expert (no certification) OR On-site inspection by third-party qualified expert (formal certification)	<i>In-use buildings, metered data Part of the commissioning? TBS self-reporting their actual performance</i>
Up to one hour	½ day to 1 day, depending on the complexity	<i>Gather data over a long period (e.g. 1 year)</i>
Residential buildings and small non-residential building (net surface floor area < 500m ²)	Non-residential buildings (and residential buildings if desired)	<i>Residential and non-residential Restricted to occupied buildings (not in design phase)</i>

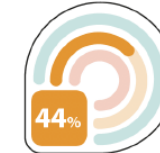
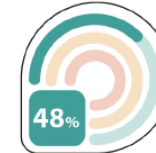
Smart Readiness Indicator - SRI



- Kwantificeren van *smartness* adhv technische checklist als kapstok
- Gebouwpotentieel aangeven
 - Informatieve functie – wat kan beter en hoe?
 - Wettelijke component?
- Focus op technische installaties en energieverbruik



- Pure comforttoepassing vallen buiten de scope
bv. wayfinding, reservatiesysteem lokalen, lunchplatform...



	Energy efficiency	Maintenance and fault protection	Comfort	Convenience	Health and well-being	Information to occupants	Energy flexibility & storage	SRI
Total	39%	18%	60%	71%	48%	59%	51%	46%
Heating	32%	18%	62%	55%	24%	74%	100%	
Sanitary hot water	17%	0%	45%	70%	67%	83%	0%	
Cooling	65%	51%	78%	72%	61%	55%	0%	
Controlled ventilation	41%	0%	55%	60%	34%	44%	-	
Lighting	85%	14%	90%	100%	83%	15%	-	
Dynamic building envelope	10%	0%	31%	56%	22%	46%	-	
Electricity	10%	0%	-	-	-	68%	0%	
Electric vehicle charging	-	38%	-	82%	-	84%	25%	
Monitoring and control	52%	43%	62%	72%	45%	64%	14%	

DOMAINS

SRI – Case Study



- Kantoorgebouw jaren '60
- 18 verdiepingen (14 bovengronds, incl. technische verdieping)
- 32.260 m² kantoren en circulatie;
- Grondige renovatie 2000 – 2001
- Beperkte renovatie 2019 – 2020

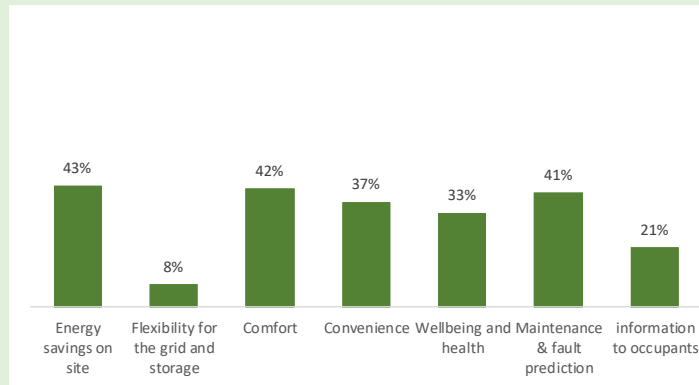
SRI – Case Study

Smart Readiness Indicator for Buildings

TOTAL SRI SCORE 33%

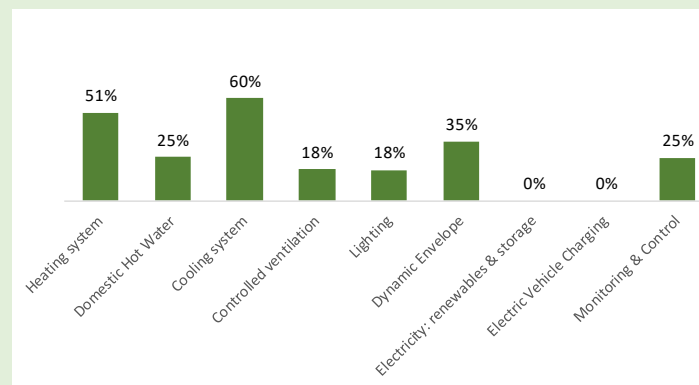
IMPACT SCORES

Energy savings on site	43%
Flexibility for the grid and storage	8%
Comfort	42%
Convenience	37%
Wellbeing and health	33%
Maintenance & fault prediction	41%
information to occupants	21%



DOMAIN SCORES

Heating system	51%
Domestic Hot Water	25%
Cooling system	60%
Controlled ventilation	18%
Lighting	18%
Dynamic Envelope	35%
Electricity: renewables & storage	0%
Electric Vehicle Charging	NVT
Monitoring & Control	25%



- Heating system & cooling system: regeling via GBS geeft >50%; nog beter is predictief (door energy monitoring system die model maakt en anticipeert)
- Domestic hot water: scheduled charging door alles warm te houden zonder te kijken naar verbruik; geen forecasting of historische gegevens
- Controlled ventilation: CO₂ sturing geeft optimalisatie (vraaggestuurd) en VAV systeem (gekoppeld op aanwezigheid en CO₂ detectie)
- Lighting: verlichtingsturing via afwezigheidsdetectoren (t.o.v. vroeger alles aan of uit), plateaus via GBS maar met daglichtdetectie en lokale derogatie
- Dynamic envelope: sturing zonnewering i.f.v. al dan niet koeling (i.p.v. weerstation); volgende stap is predictief
- Electricity renewables and storage: geen rapportering energieproductie renewables; ook totaal geen storage
- Electric vehicle charging: bij laadpalen dan de oplaadcapaciteit (15/260 parkeerplaatsen = medium) en geen vehicle to grid toepassing; ook geen bericht indien auto volgeladen is
- Monitoring&Control : vast tijdschema en setpoints met centrale indicatie van fouten en alarmen; verbetering d.m.v. variabele setpoints (ontbreekt nu in regelbeschrijving; ook niet na te gaan of ventilatie afvalt bij afwezigheid);

SRI – Case Study

- Domein: Ventilation + monitoring & control

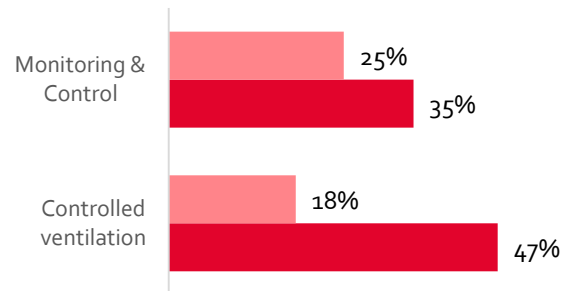
- Monitoring luchtkwaliteit -> Ventilatie vraaggestuurd via CO₂-detectie
- Informatie rapportering IAQ (aan gebruikers)
- + Nachtkoeling

- Gebouwimpact:

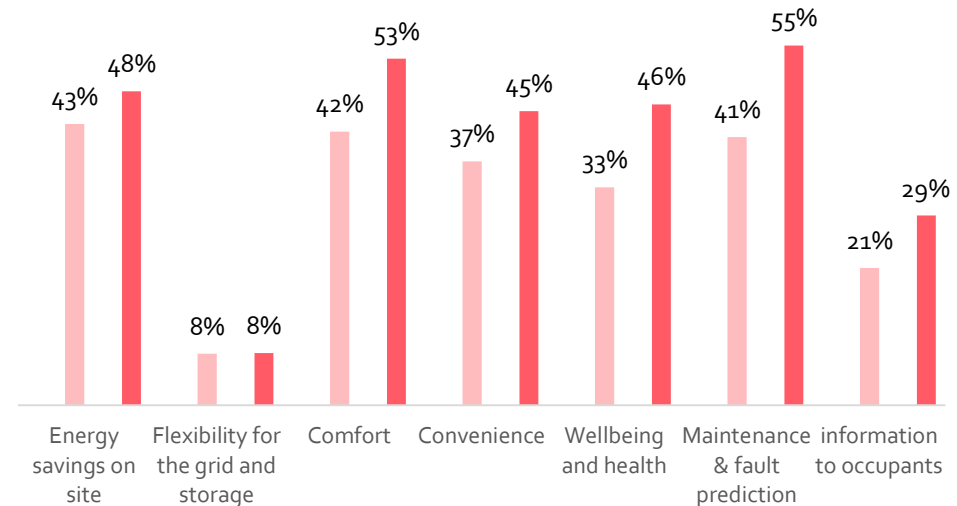
- Comfort en health
- Betere opvolging en inspraak gebruikers
- Impact op huidige installatie?

- Kostprijs:

- Ruwe inschatting 2.000-3.000€/niveau



SRI impact - IAQ monitoring





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Smart Buildings Webinar IoT & datanetwerken

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25/06/2020



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IoT & datanetwerken

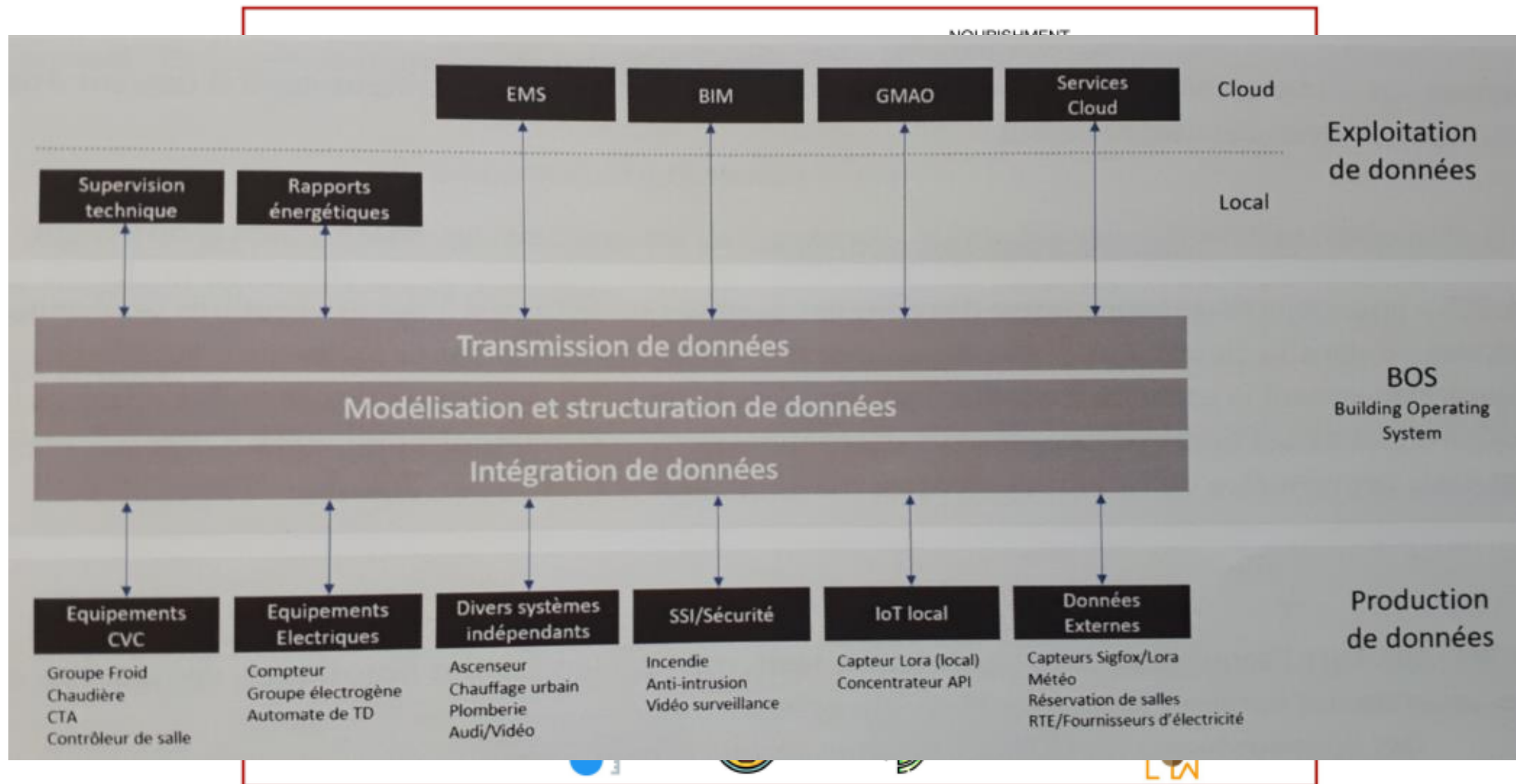


Internet of Things (IoT) = Geheel van fysische objecten uitgerust met intelligentie (processoren, data opslag, software, etc.) **en** verbonden met andere objecten over het internet.

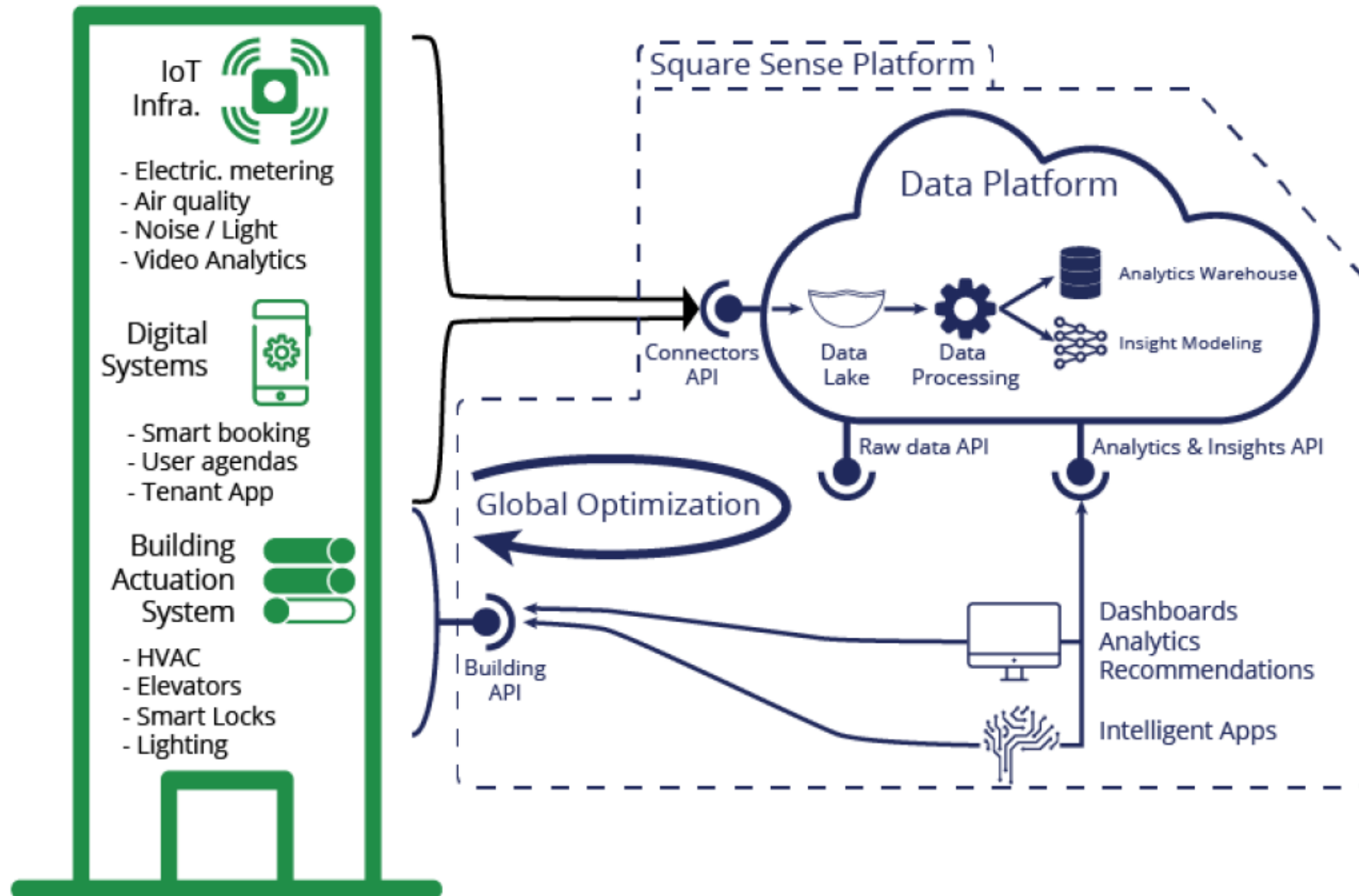
Keywords:

- Connectivity
- Data

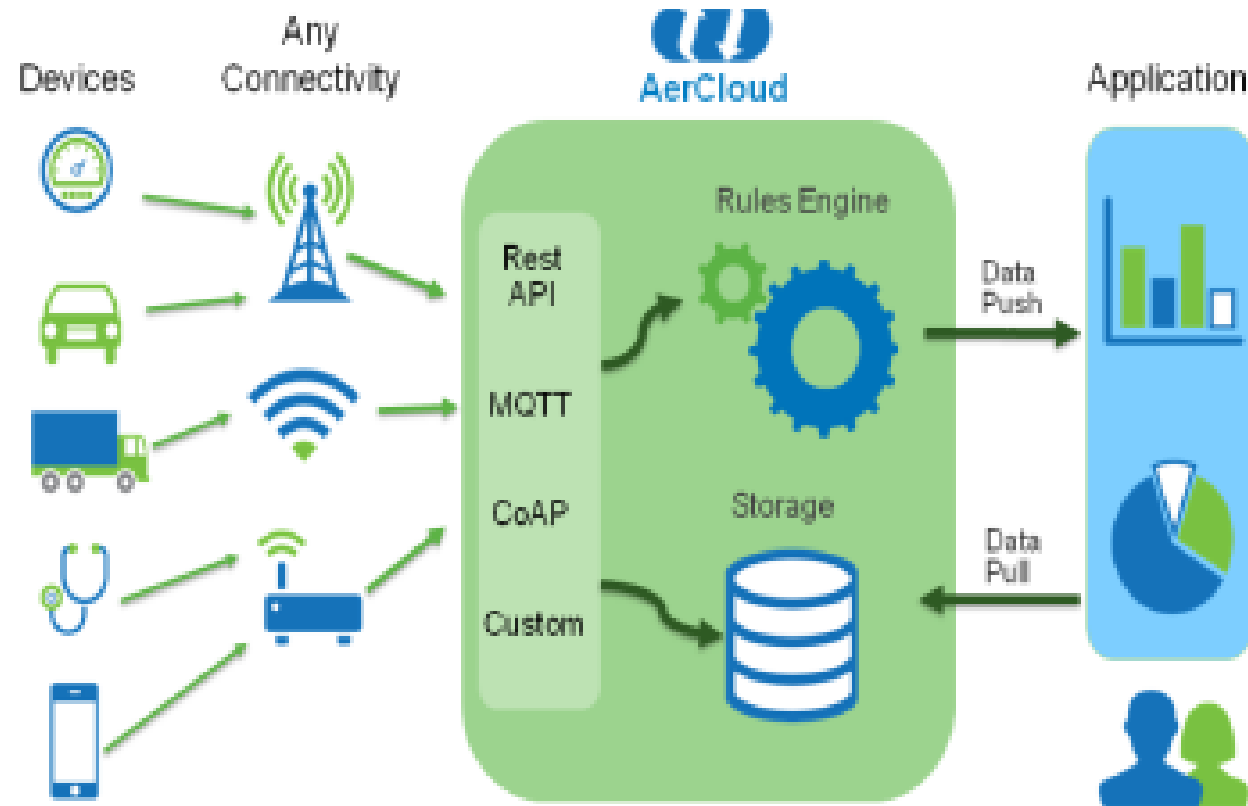
IoT & datanetwerken



IoT & datanetwerken



IoT & datanetwerken



IoT & datanetwerken

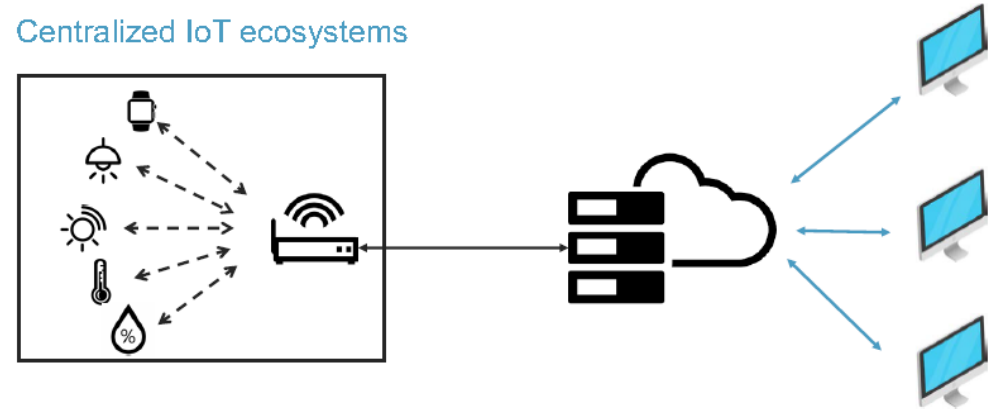
- Infrastructuur

- Smart grid = netwerk van datapunten
- Flexibel en uitbreidbaar
- Datastream:
 - Sensor/actuator -> (hub ->) gateway -> rack -> cloud -> API/user

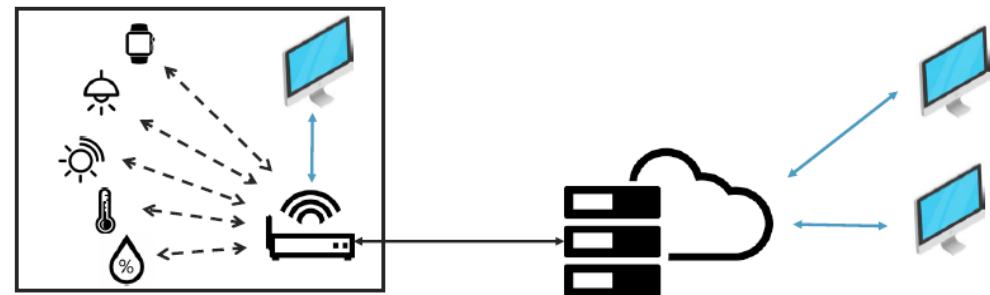
- Gebouwimpact:

- Meten = weten
- Automatisering
- Bekabeld vs. Draadloos
 - (Beacons (LAN): WIFI, 4G, BLE... vs. Mesh (DAN): Zigbee, BLE,...)

Centralized IoT ecosystems



Edge-oriented IoT ecosystems



Case study – Indoor positioning

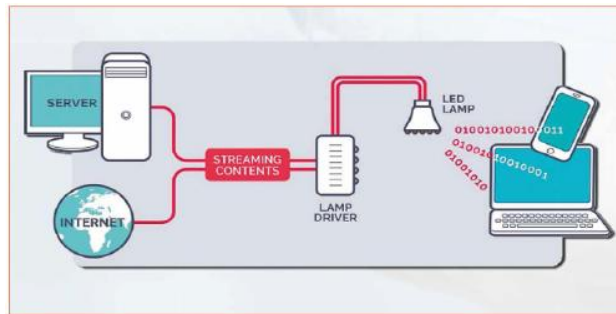
comparison of different technologies for client-based indoor positioning

Technology	Indoor / Outdoor	Accuracy	Range
GPS		 5-20 m	 global
Wi-Fi		 5-15 m	 < 150 m
BLE		 1-3 m	 < 30 m
Li-Fi (VLC)		 < 50 cm	 < 8 m



Case Study – VLC (LiFi)

- VLC $\longleftrightarrow$ PoE
 - Data verpakt als variaties in lichtintensiteit
 - Visible light spectrum, >2-3kHz
 - LiFi $\longleftrightarrow$ WiFi
 - Toepassing *weak output*: indoor GPS
 - Unieke barcode per armatuur
 - Ontvangst via frontcamera
 - Registreren van locatie 10-20cm
 - Toepassing *strong output*: netwerk
 - Volwaardige vervanger WiFi maar *dongle* nodig
 - Verkeersinformatie
 - ...



Downstream: zichtbaar licht
Upstream: IR



Bedankt!