

GEE5303 Green and Intelligent Building

<http://ibse.hk/GEE5303/>



Intelligent buildings

Thei

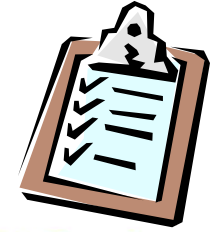
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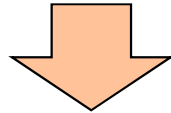
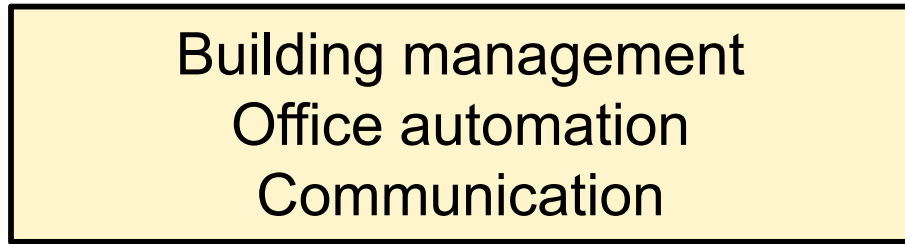


What is intelligent building (IB)?

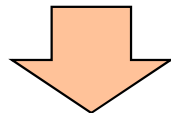
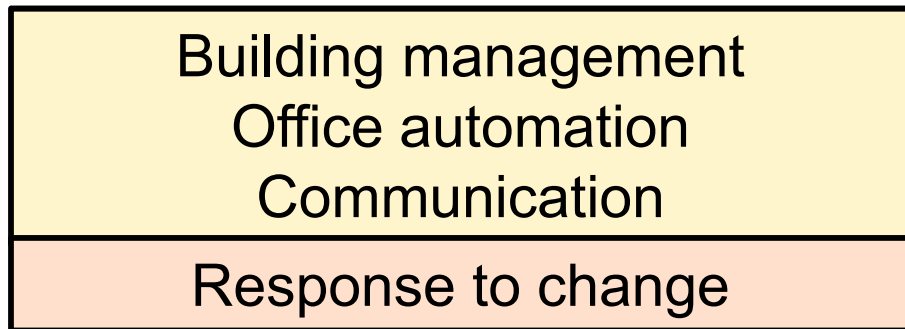
- Intelligent building (IB)
 - First coined in USA in early 1980s; its definition/model is changing/evolving
 - Automated buildings (1981-85)
 - Responsive buildings (1986-91)
 - Effective buildings (1992-)
 - Intelligent and green buildings (2000-)
 - Development of IB
 - Closely linked with computers and information technology (IT); high-tech related
 - But, IB ≠ high-tech building

智慧型大廈
智能建築

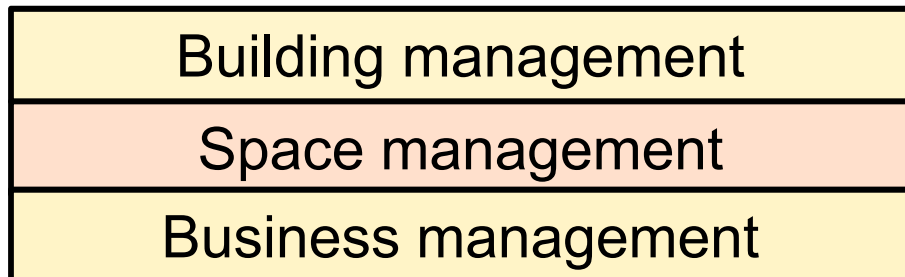
Automated buildings (1981-1985)



Responsive buildings (1986-1991)



Effective buildings (1992-)



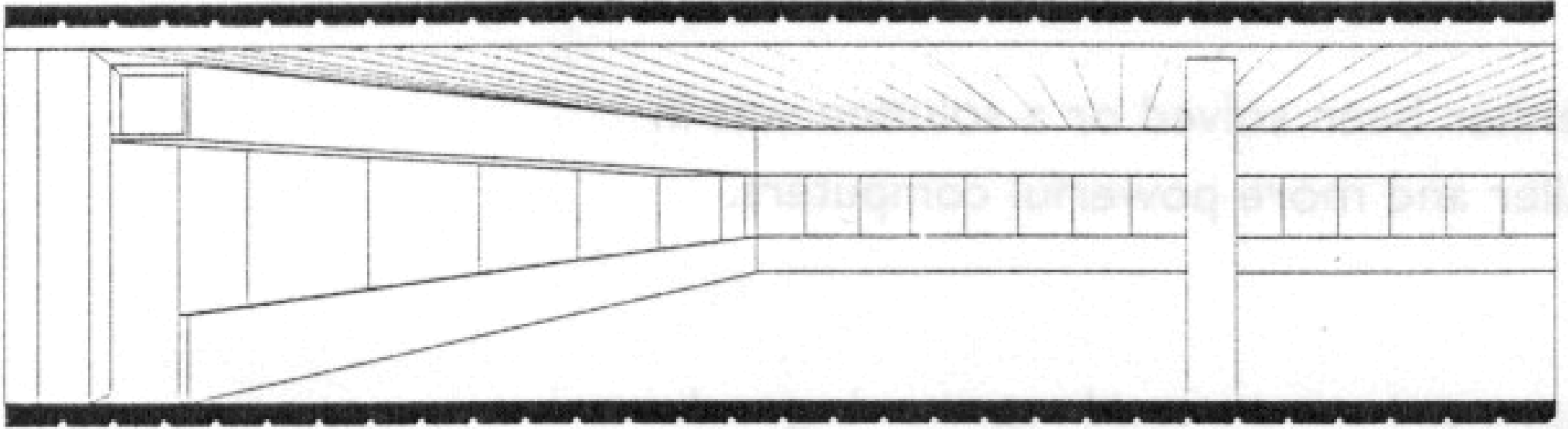
An intelligent building is a collection of innovative technologies

An intelligent building is a collection of technologies able to respond to organizational change over time

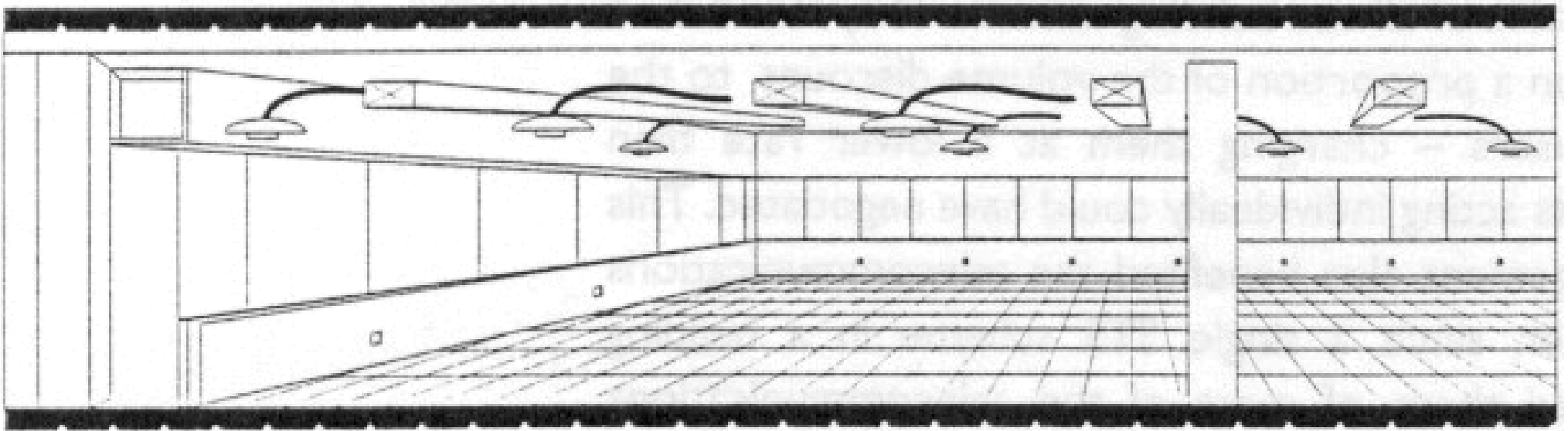
An intelligent building provides a responsive, effective and supportive environment within which the organization can achieve its business objectives. The intelligent building technologies are tool that help this to happen.

What is intelligent building (IB)?

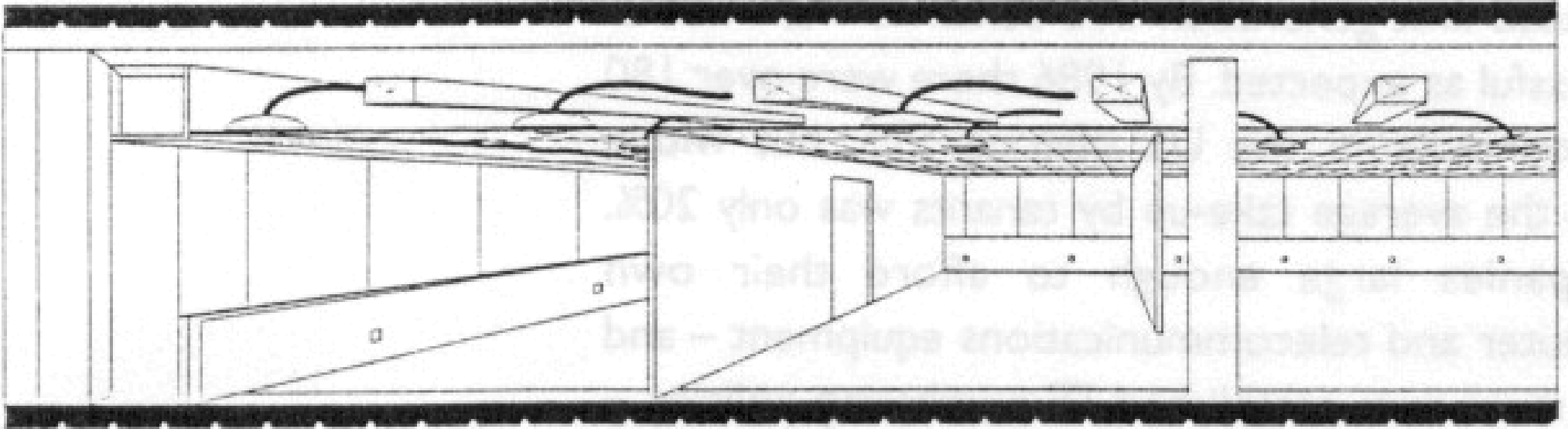
- IB in Europe study (early 1990s)
 - IB “... provides a responsive, effective and supportive intelligent environment within which the organization can achieve its business objectives.” -- DEGW (1992)
- Intelligent Buildings Institute (IBI) study:
 - Optimization of its four basic components - **structure, systems, services and management** - and the interrelationships between them



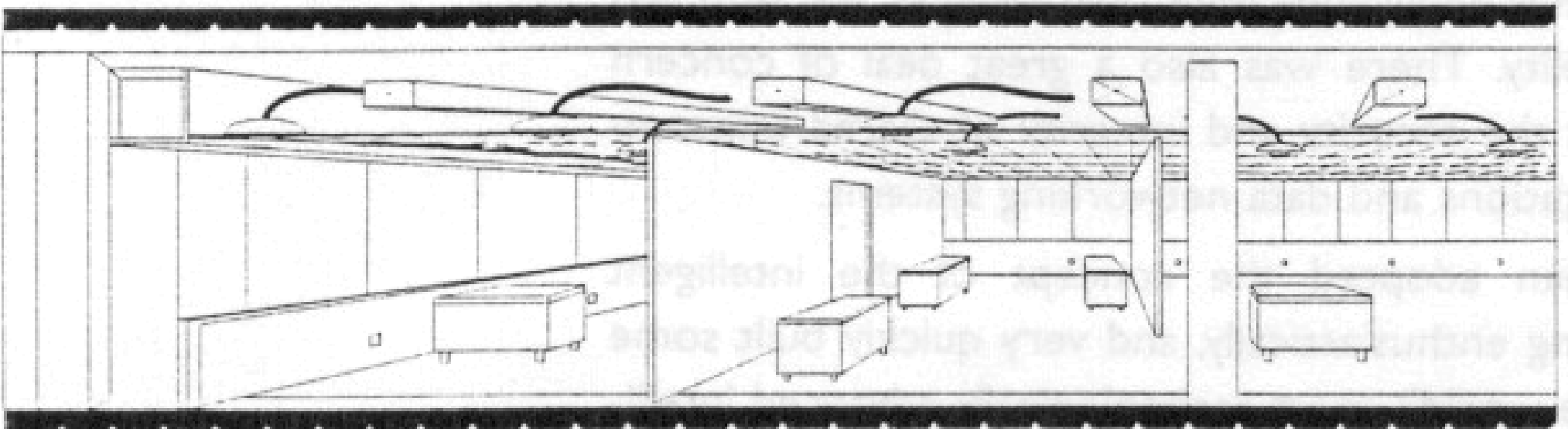
Building shell: 50-75 years (structure cladding)



Building services: 15 years (HVAC, light, power)



Fitting-out elements (scenery): 5 years (fixed interior elements, ceiling, partitions, finishes, IT equipment)



Office furnishings (settings): day-to-day rearrangement

What is intelligent building (IB)?

- Late 1990s and 2000s
 - IB definition: tilted towards **energy efficiency** and **sustainability** with the introduction of green building assessment methods (e.g. BREEAM and LEED)
 - Increasing convergence of intelligence and sustainability: “**Bright Green Buildings**”
 - Buildings that are **both intelligent and green**

What is intelligent building (IB)?

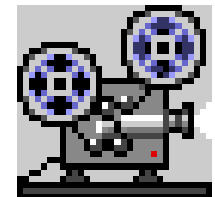
- Current understanding of IB
 - Address both **intelligence** and **sustainability** issues by utilising computer and intelligent technologies to achieve the optimal combinations of overall comfort level and energy consumption
 - Intelligent buildings combine and leverage 5 key aspects of building management:
 - Enhanced financials, operational efficiency, occupant experience, energy conservation, sustainability

Intelligent + Green



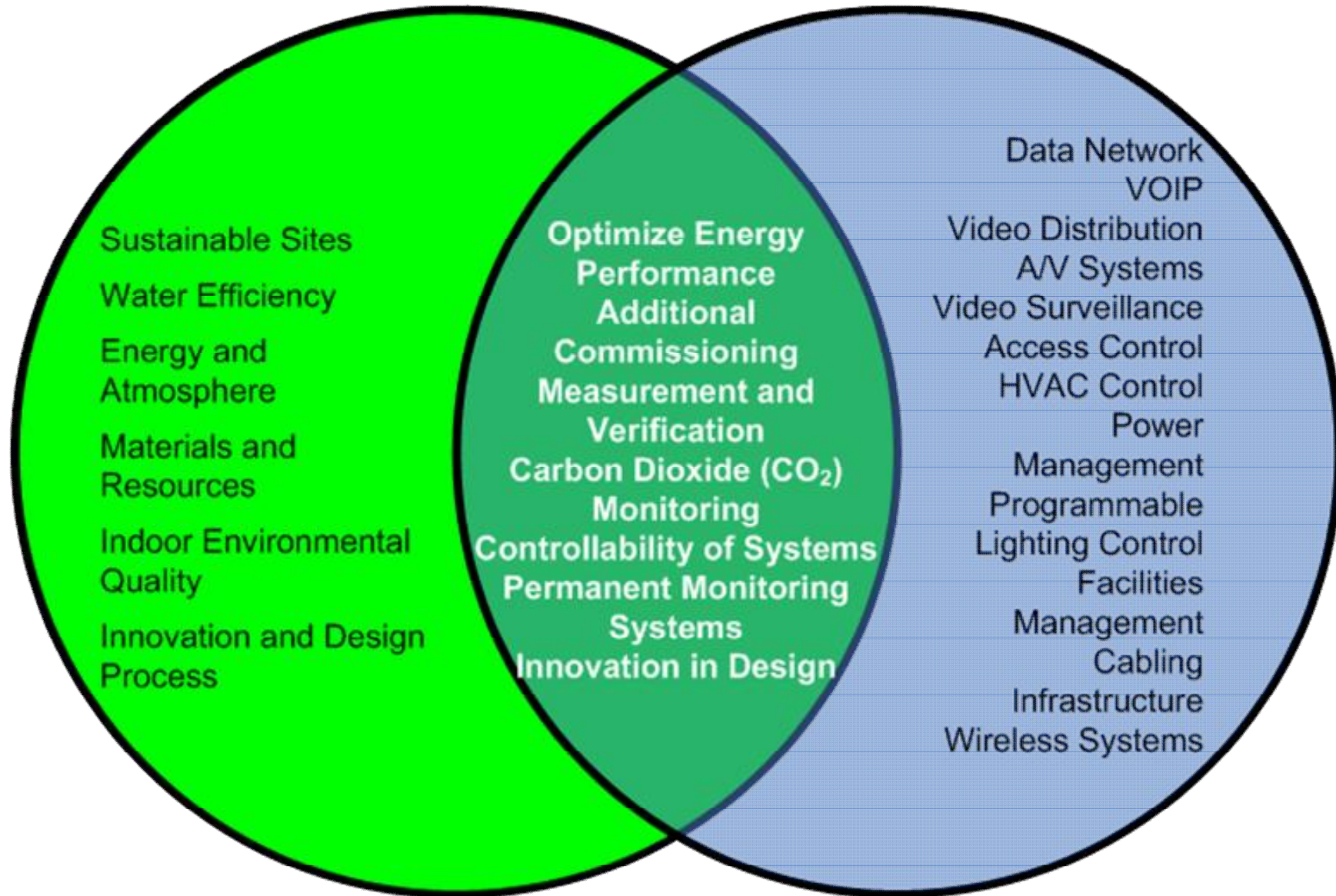
What is intelligent building (IB)?

- Definition of IB by CABA (Continental Automated Buildings Association)
 - An Intelligent Building uses both technology and process to create a facility that is safer and more productive for its occupants and more operationally efficient for its owners
- Video: Intelligent buildings by CommScope (5:22) <http://youtu.be/lgzQ-1WabeE>



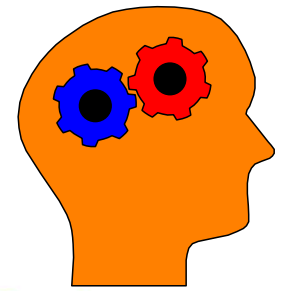
THE COMMONALITY OF SMART AND GREEN BUILDINGS

GREEN BUILDINGS

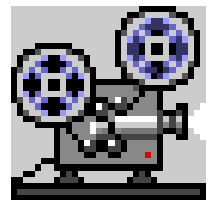


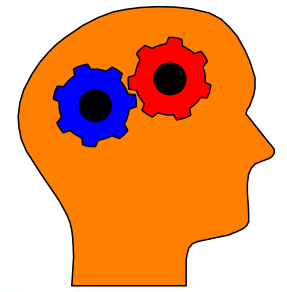
SMART BUILDINGS

Intelligent and Smart



- Smart building technologies can improve buildings' energy efficiency and indoor environmental quality
- Future outlook:
 - Video: Smart buildings - the future of building technology (7:26) <http://youtu.be/gCuPx9shWT0>





Intelligent and Smart

- Intelligent (Smart) buildings are part of an increasingly integrated built environment
 - Smart homes, smart cities, smart electricity grid, intelligent transport



SMART BUILDINGS CONNECTED BY A SMART GRID

Benefits of increased building performance

- cost savings
- comfort optimization
- increased flexibility in energy demand
- CO₂ reduction

Smart Sensors

- humidity
- temperature
- light
- CO₂ level
- occupancy

SMART BUILDING

personal comfort and increased building performance

Room Control

sun blinds
building properties
ventilation

air conditioning
heating
lighting
power consuming devices

combined heat and power system

ev-charging poles

district heating

gas network

water supply

SMART GRID

bi-directional energy and communication flows

thermal (heat and cold) storage

uninterruptible power supply
meters and sub-meters

Building Management System

- real time energy prices
- load occupancy forecasts
- weather forecast anticipation
- demand response signals
- insight in energy usage of devices

electricity storage

electricity grid

solar panels

wind turbine

industrial area

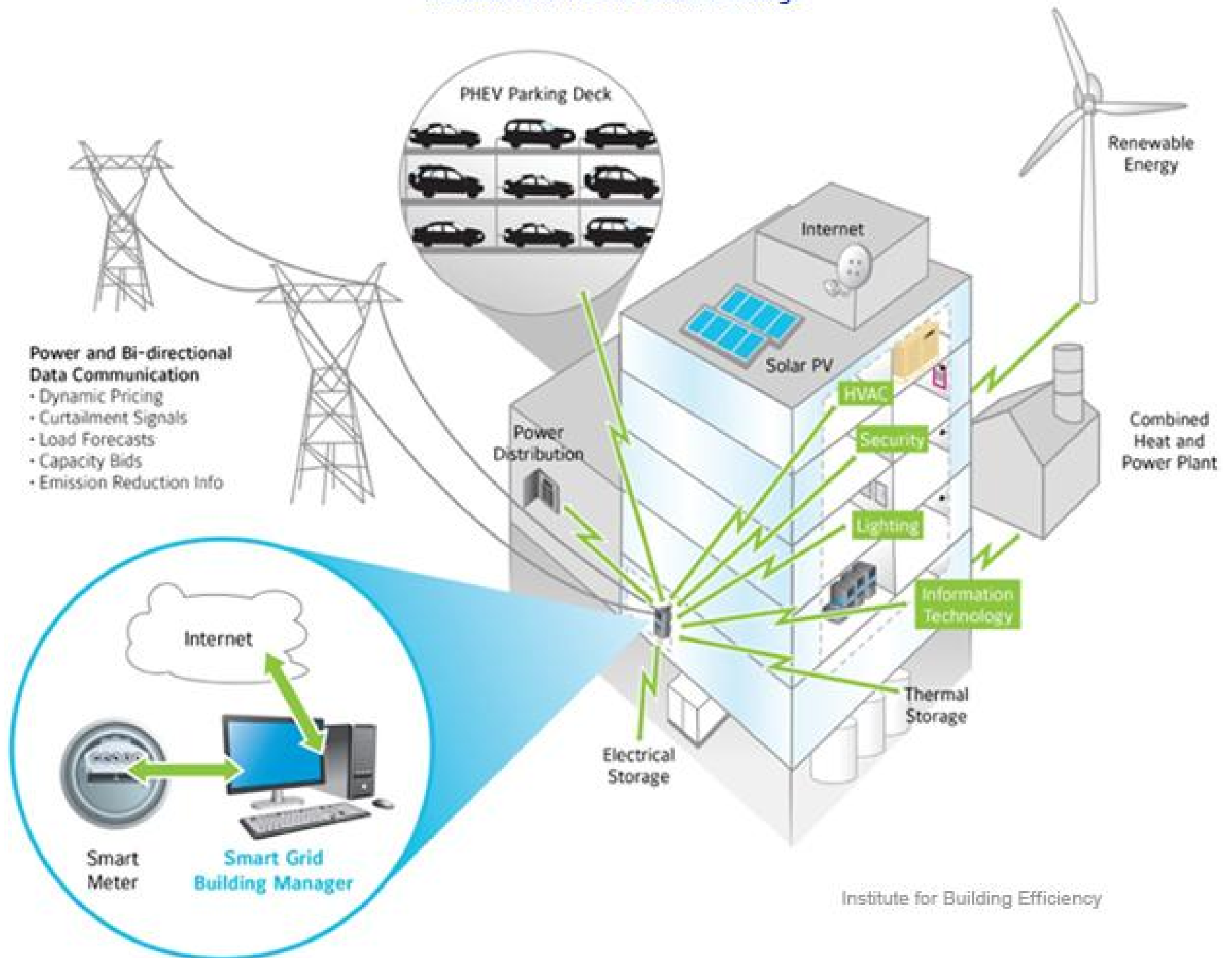
sub station

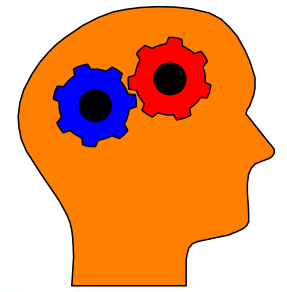
residential area

greenhouse



A Smart Grid Needs Smart Buildings

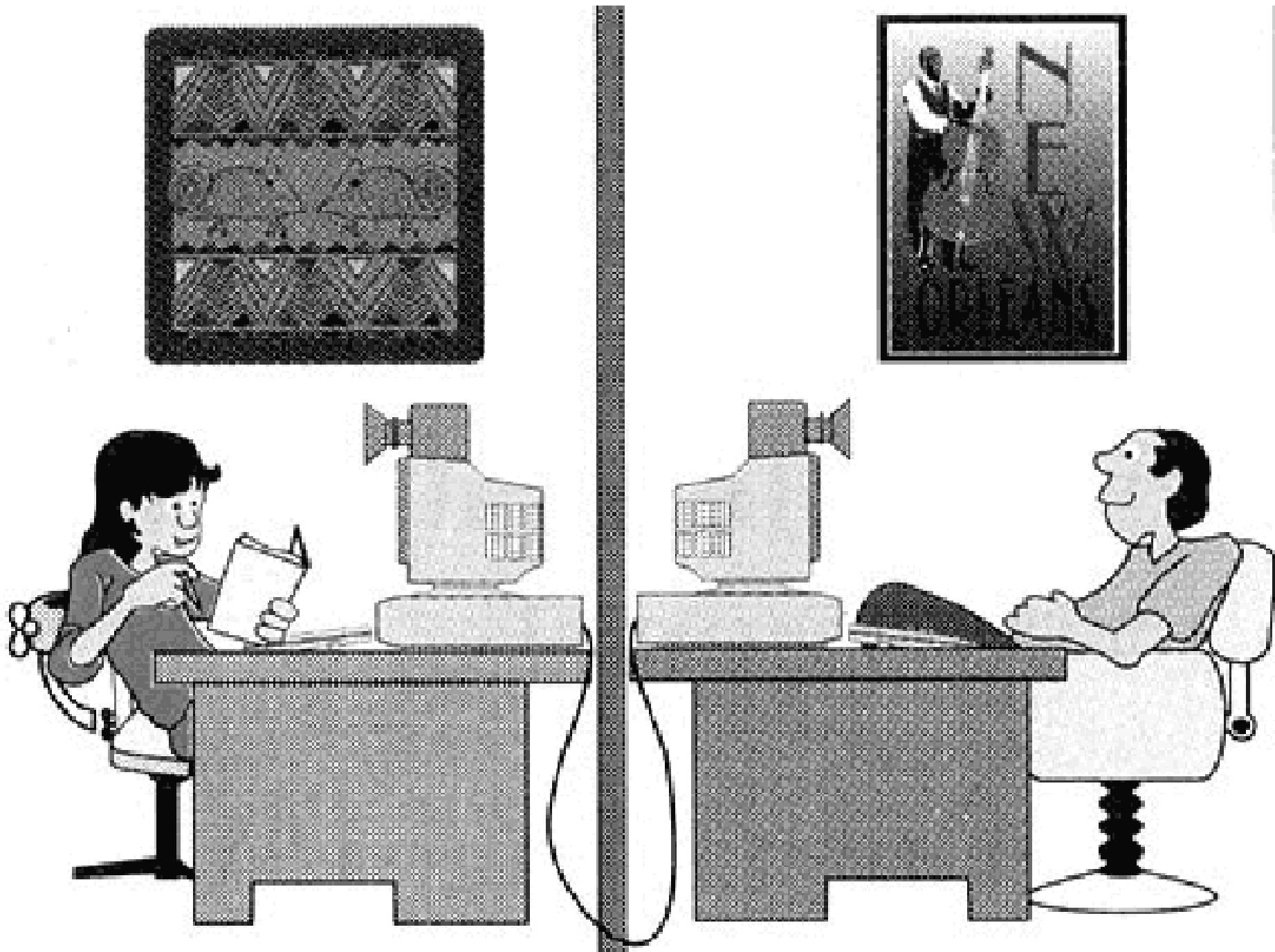


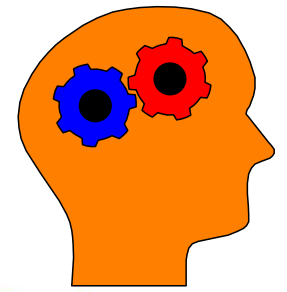


Intelligent and Smart

- Major IB features
 - Automatic reactions (adjust internal conditions)
 - Effective communication & IT management
 - Responsiveness to changes
- Integrated pyramid
 - Single function/dedicated systems
 - Multifunctional systems
 - Integrated systems
 - Computer integrated building

Is this Effective Communication ?





Intelligent and Smart



- My own definition: “An intelligent/smart building is one that doesn't make the occupants look stupid.”
 - Maximizes the efficiency of its occupants and allows effective management of resource with minimum life costs
 - More responsive to user needs and has the ability to adapt to new technology or changes in the organizational structures

Components of an IB



- Building management:
 - Building automation and the physical environment
- Space management:
 - Building's internal space & operating costs
 - Capabilities & flexibility of the building to accommodate changes, personal moves & connectivity
- Business management
 - Management of the organization's core business

The Intelligent Building

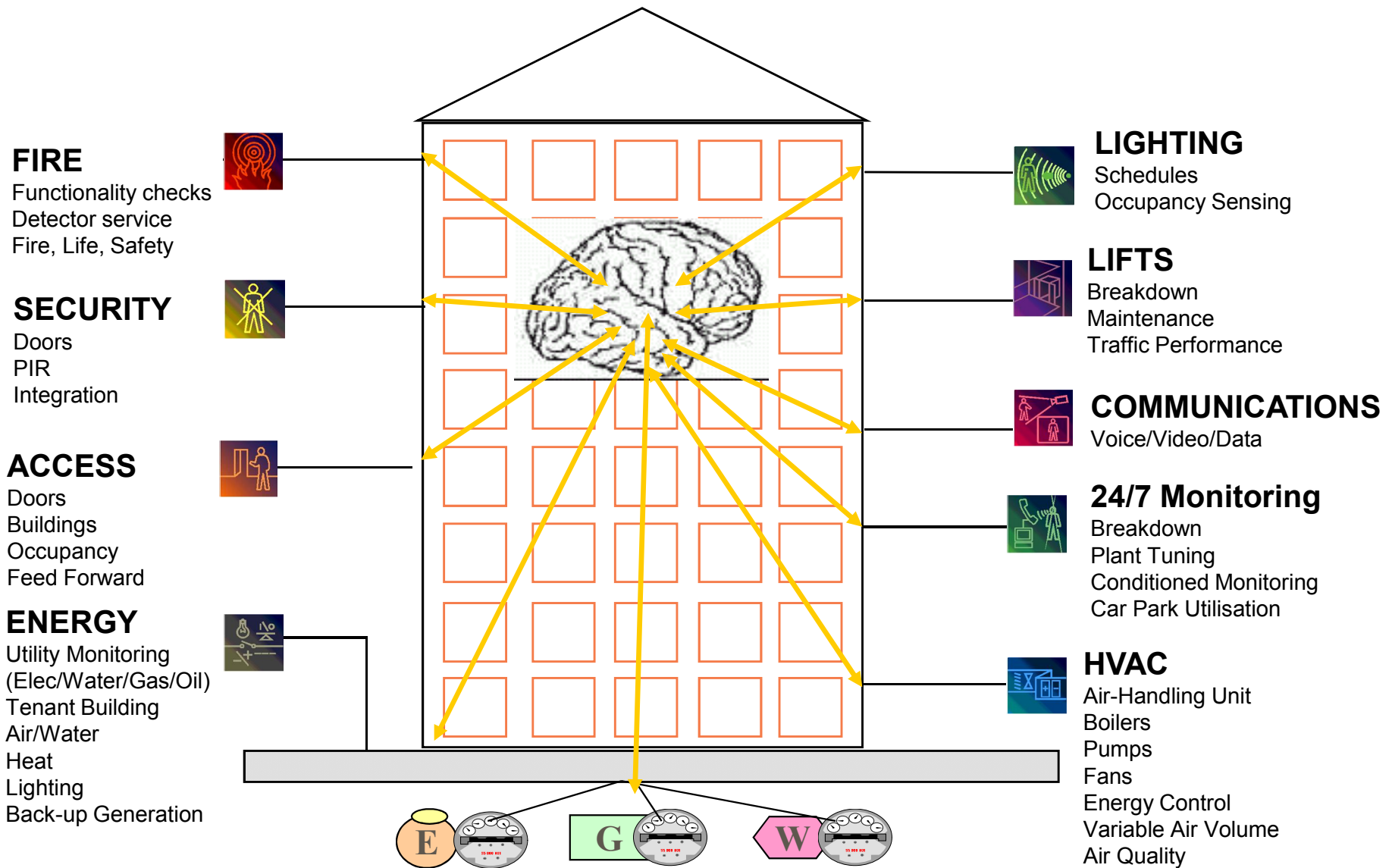
IB Goals	IB Tasks	IB Attributes	
Building management	Environmental control of building 	Design strategies and building shell attributes Facility management strategies	Building Automation systems (BA)
	User control of building systems		
Space management	Management of change (capacity, adaptability, flexibility, manageability) 		Computer Aided Facility Management systems (CAFM)
	Minimization of operating costs		
Business management	Processing of information		Communications
	Storage of information		
	Presentation of information		
	Internal communications		
	External communications		
		Office automation	
		Audiovisual systems	
		Business systems	

Components of an IB



- Major categories:
 - Energy efficiency
 - Energy management and control
 - Lifesafety systems
 - Fire alarm and security
 - Telecommunications systems
 - PABX telephone, videotext, cablevision, e-mail
 - Workplace automation
 - Data processing, word processing, computer-aided design (CAD), information services

Major elements of intelligent buildings



Building automation systems for intelligent buildings



Components of an IB



- Four main aspects:
 - **Facility management**
 - Take care & maintain various functions for occupant comfort & operation
 - **Information management**
 - Office automation (OA), LAN, wiring
 - **Communication**
 - Tel/Fax, e-mail, Internet, video telecommunication
 - **Control**
 - Building automation system, direct digital control

Components of an IB



- Integration of various building systems
 - Energy management system
 - Lighting management system
 - Security systems & fire safety
 - Telecommunications & office automation
 - Local area networks (LANs)
 - Cabling management
 - Intelligent maintenance mgt. system (IMMS)
 - Computer aided facility management (CAFM)

IB @ Work



- Office space and commercial buildings
 - Such as speculative high-tech offices
 - Organizational/functional requirements
 - Impact of IT and business strategy
- Objectives
 - Responsive (to user needs / to climate)
 - Efficient (building design & systems)
 - Effective (operation & management)
 - Better integration (with IT & within systems)

IB @ Work



- Major systems
 - Building automation system (BAS)
 - Office automation system (OAS)
 - Communication automation system (CAS)
- Criteria
 - Business value/benefits
 - Efficiency
 - Effectiveness



The Building Information Network



Tenant Services

- High Speed Internet
- Wireless
- Unified Communications
- Interactive Media
- Digital Signage
- IP Telephony

Dashboards



Building Services

- Lighting
- Elevators
- 24/7 Monitoring
- HVAC Sensors
- Fire Control
- Video Security
- Energy Management
- Maintenance Management

IB @ Work



- IB + IoT (Internet of Things)
 - Video: Smart Buildings with Internet of Things Technologies (2:58) <http://www-ssl.intel.com/content/www/us/en/smart-buildings/overview.html>
- Major impact of building intelligence
 - Modern and flexible space design, improved comfort, productivity, and pervasive connectivity

IB @ Work

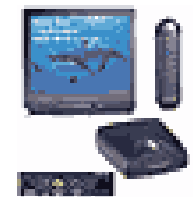
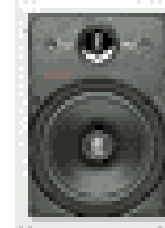


- Current and future development
 - New ways of working
 - More interaction
 - More collaboration (physically or electronically)
 - More individual autonomy
 - New patterns of space use
 - More group spaces
 - More shared spaces
 - More space for concentration
 - More intermittent space use

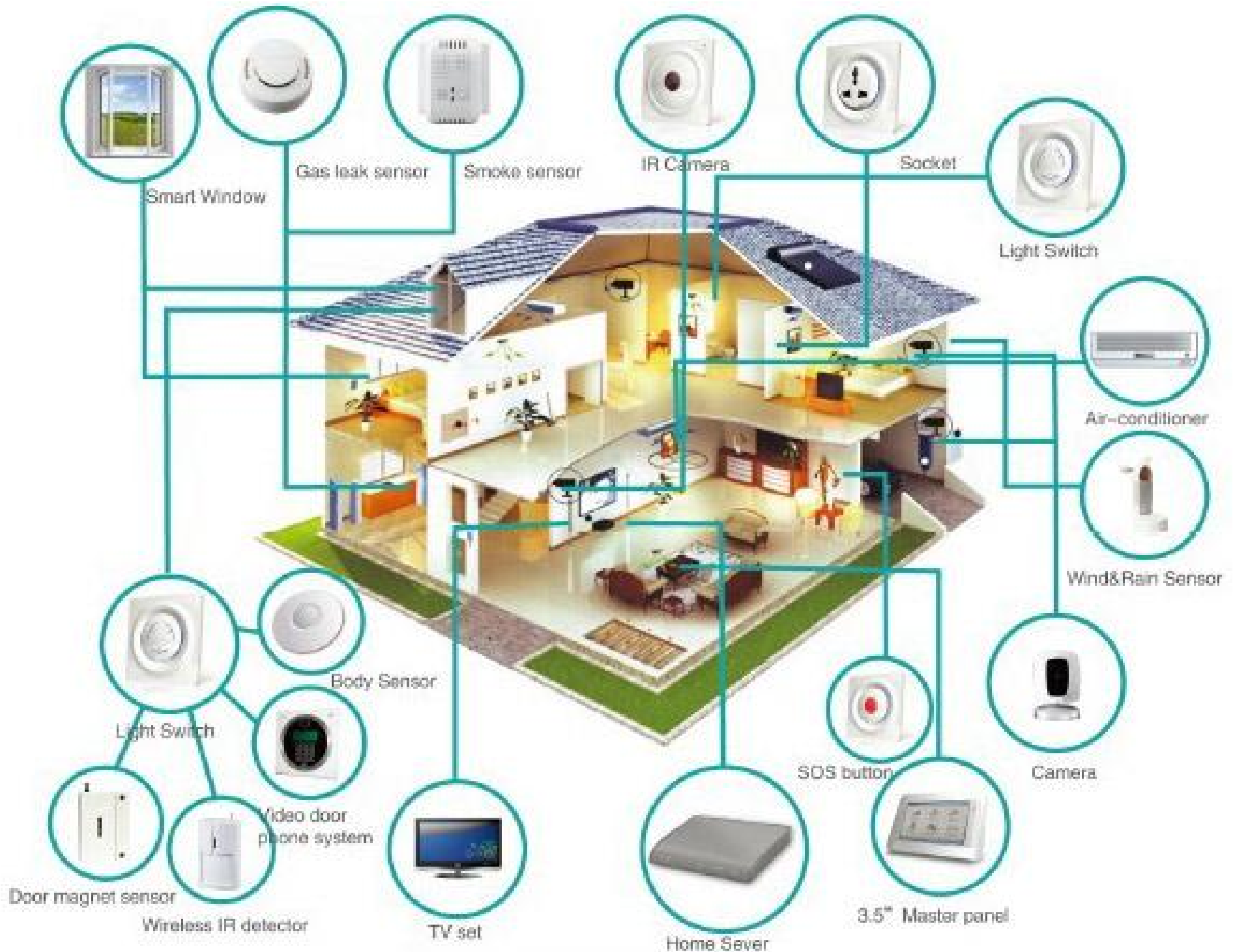
IB @ Home



- Present technology
 - Phones and intercoms
 - Home automation
 - Audio distribution (e.g. hi-fi speaker)
 - Video distribution (e.g. TV)
 - Video surveillance (e.g. security)
 - Structured wiring
 - Home theater, game station



Intelligent home/house



IB @ Home



- Home automation
 - Climate control and energy management
 - Home networking
 - Home theatre
 - Integrated lighting control
 - Multi-room A/V systems
 - Residential gateways
 - Safety and security
 - Structured wiring
 - Whole house automation



Remote control with smart plugs in intelligent home



IB @ Home



- Future home
 - Home networking
 - Internet appliances
 - Webcam, web phones
 - e-books, video walls
 - Home office
 - Virtual clinic/hospital
 -



Surf the web without wires!