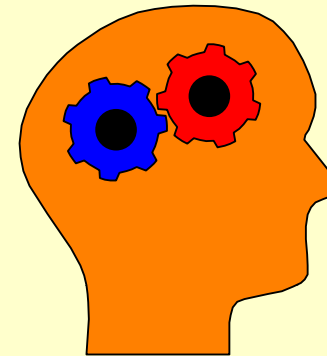


MECH3023: Building Energy Management & Control Systems

<http://www.hku.hk/bse/mech3023/>



Intelligent Buildings



Dr. Sam C M Hui

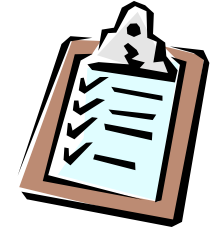
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Mar 2009

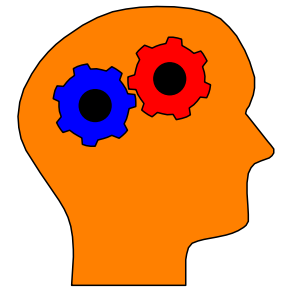
Contents



- Defining Intelligent Building
- Components of an Intelligent Building
- IB @ Work
- IB @ Home



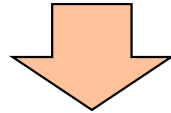
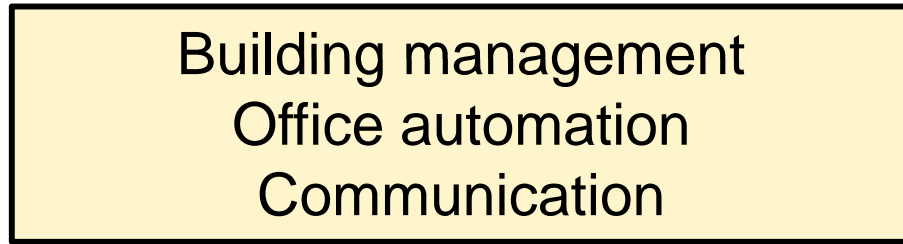
Defining Intelligent Building



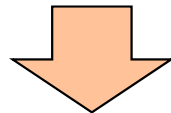
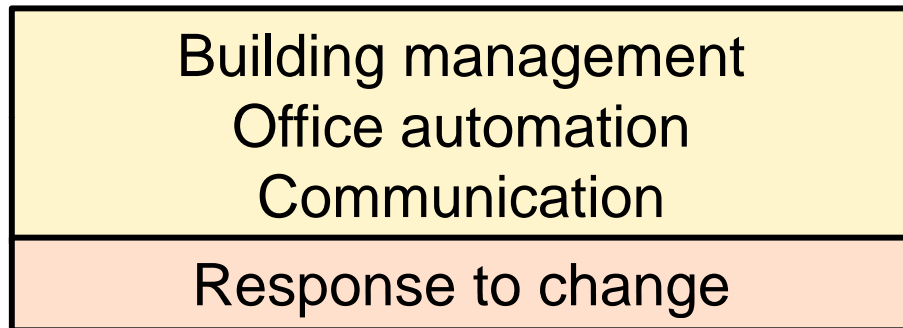
智慧型大廈
智能建築

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

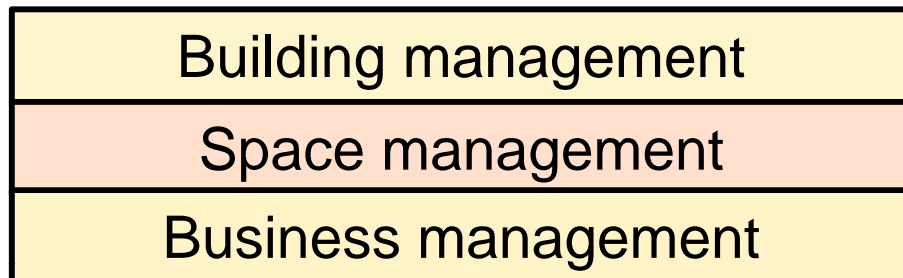
Automated buildings (1981-1985)



Responsive buildings (1986-1991)



Effective buildings (1992-)

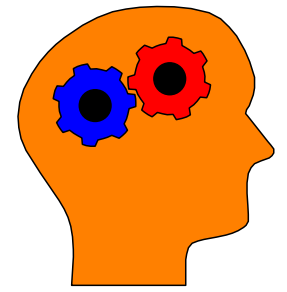


An intelligent building is a collection of innovative technologies

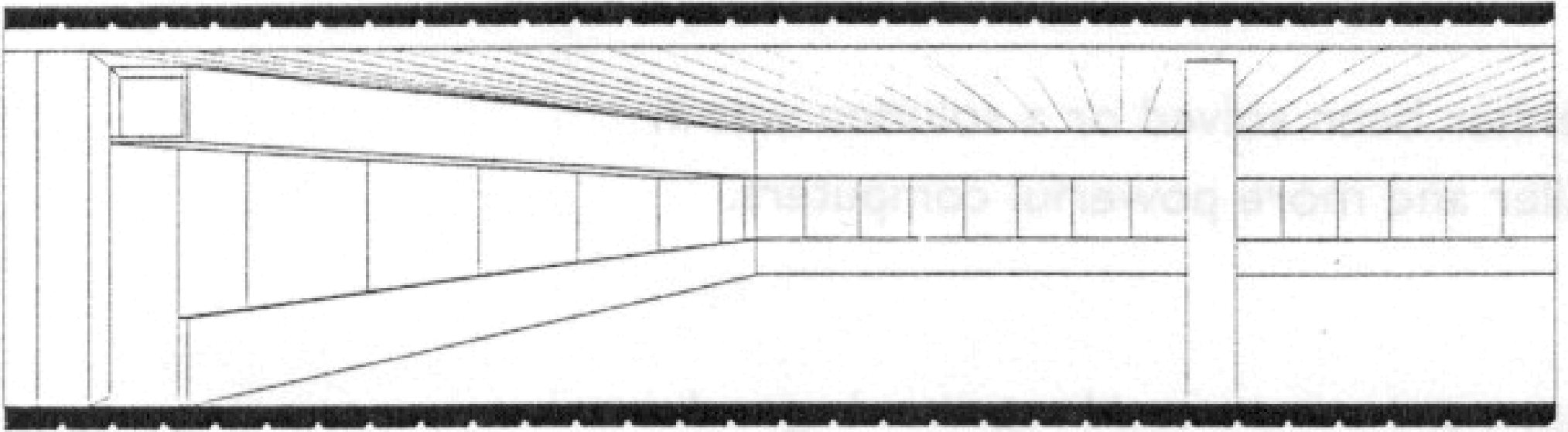
An intelligent building is a collection of technologies able to respond to organizational change over time

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.

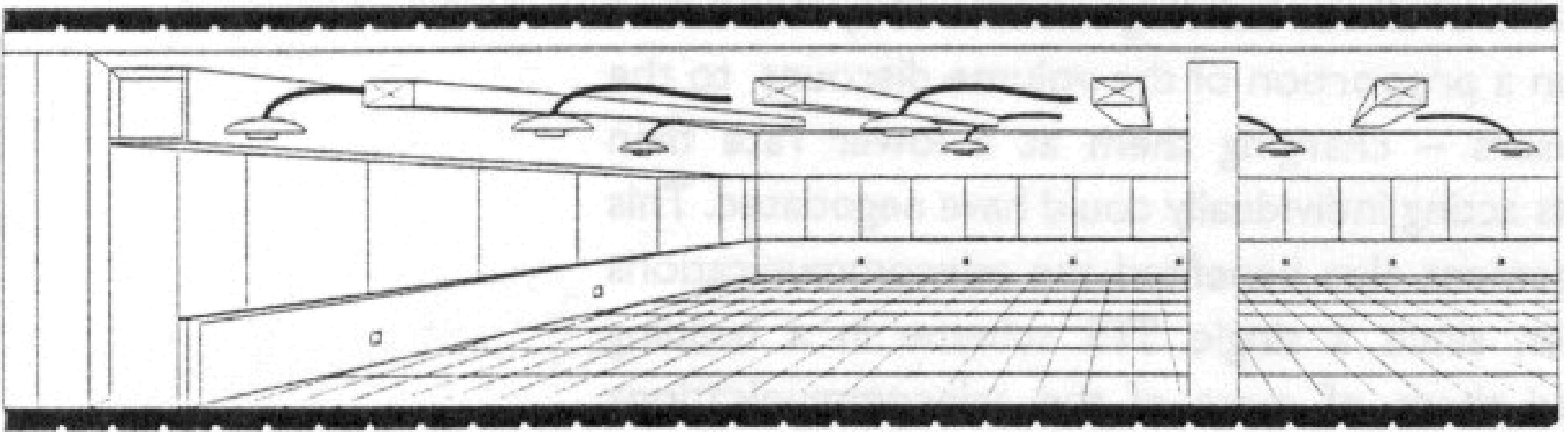
Defining Intelligent Building



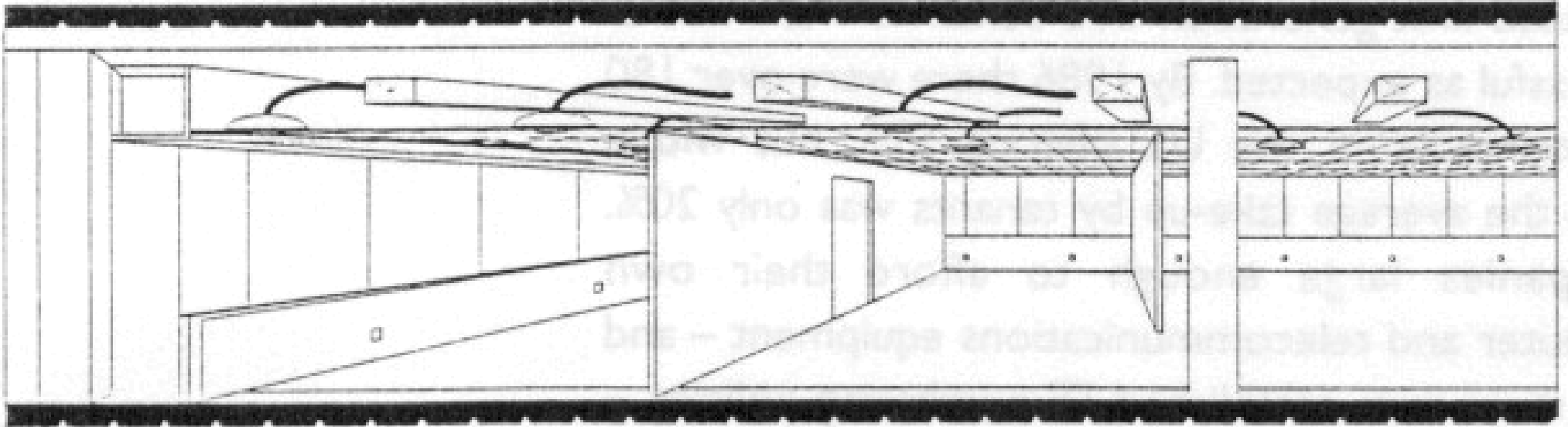
- IB in Europe study (early 1990s)
 - IB “... provides a responsive, effective and supportive intelligent environment within which the organization can achieve its business objectives.” -- DEGW (1992)
- Three main goals of IB:
 - Building management
 - Space management
 - Business management



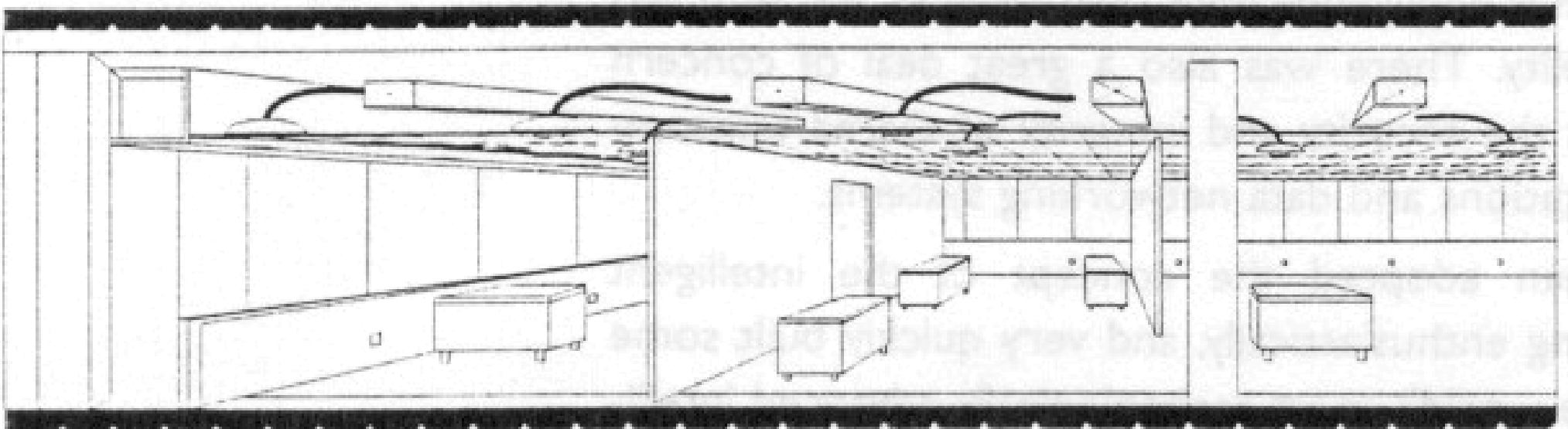
Building shell: 50-75 years (structure cladding)



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

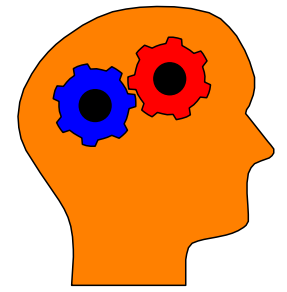


Fitting-out elements (scenery): 5 years (fixed interior elements, ceiling, partitions, finishes, IT equipment)





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

Defining Intelligent Building

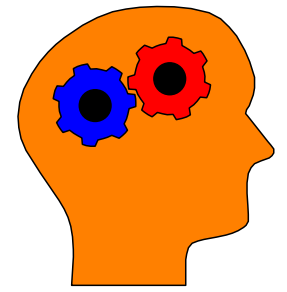


- Building management:
 - Building automation and the physical environment
- Space management:
 - Building's internal space & operating costs
 - Capabilities & flexibility of the building to accommodate changes, personal moves & connectivity
- Business management
 - Management of the organization's core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

The Intelligent Building

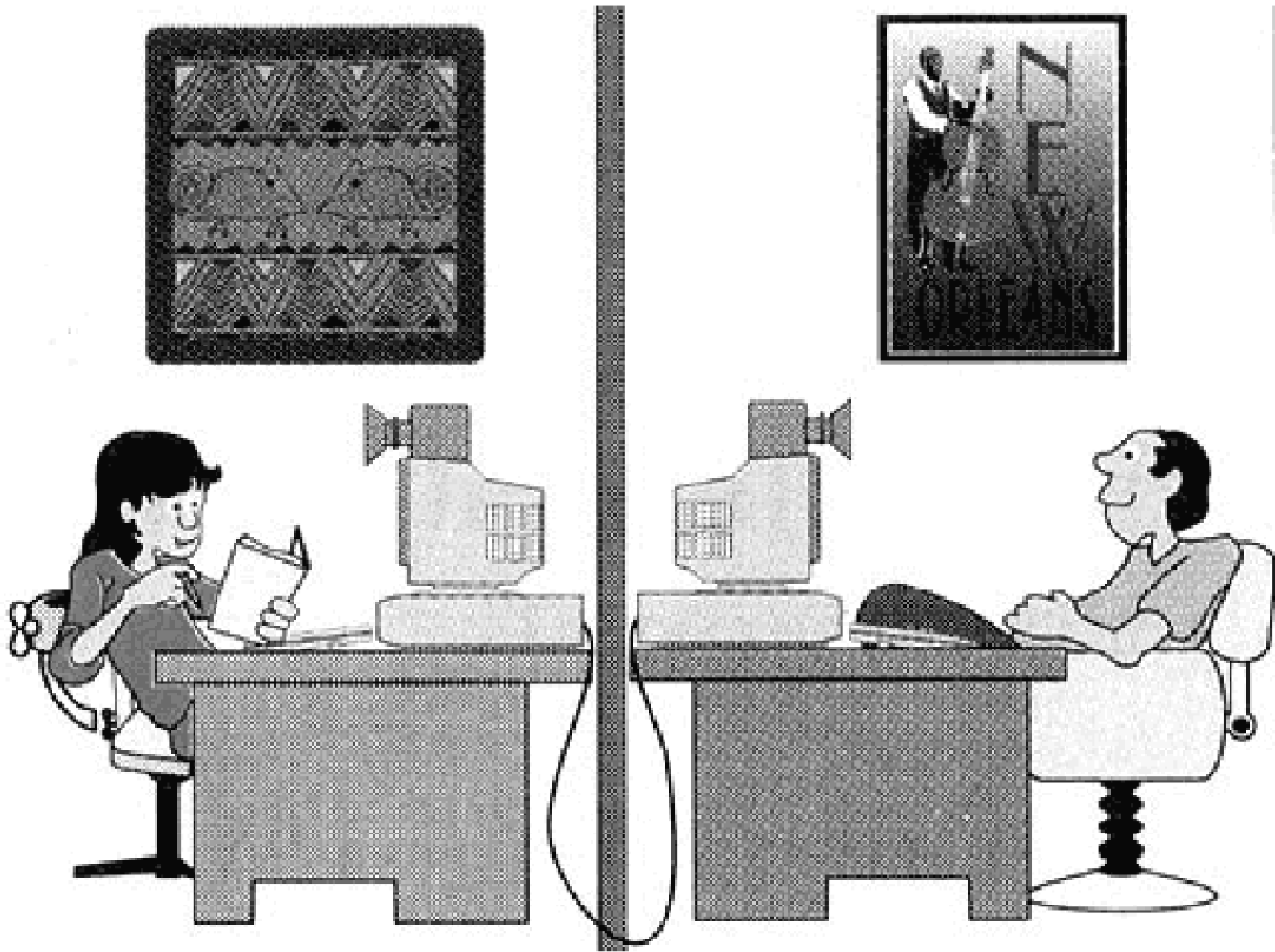
IB Goals	IB Tasks	IB Attributes	
Building management	Environmental control of building 	Design strategies and building shell attributes Facility management strategies	Building Automation systems (BA)
	User control of building systems		
Space management	Management of change (capacity, adaptability, flexibility, 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	

Defining Intelligent Building

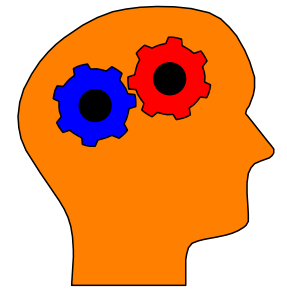


- Major IB features
 - Automatic reactions (adjust internal conditions)
 - Effective communication & IT management
 - Responsiveness to changes
- Integrated pyramid
 - Single function/dedicated systems
 - Multifunctional systems
 - Integrated systems
 - Computer integrated building

Is this Effective Communication ?



Defining Intelligent Building



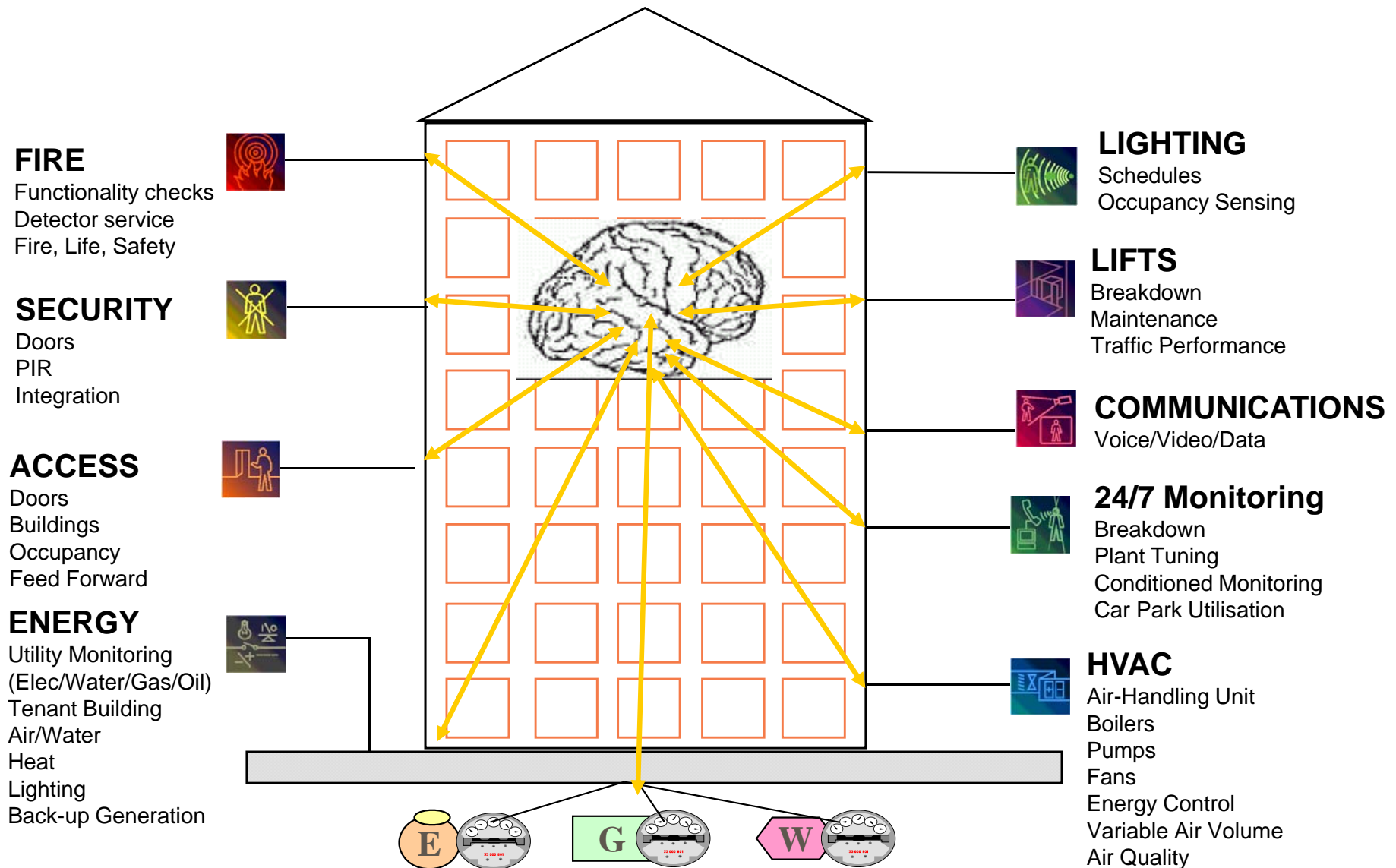
- My own definition: “An intelligent building is one that doesn't make the occupants look stupid.”
 - Maximizes the efficiency of its occupants and allows effective management of resource with minimum life costs
 - More responsive to user needs and has the ability to adapt to new technology or changes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

Components of an IB



- 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)

Major elements of 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, video telecommunication
 - **Control**
 - DDC, building automation system

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, CAD, information services

Components of an IB

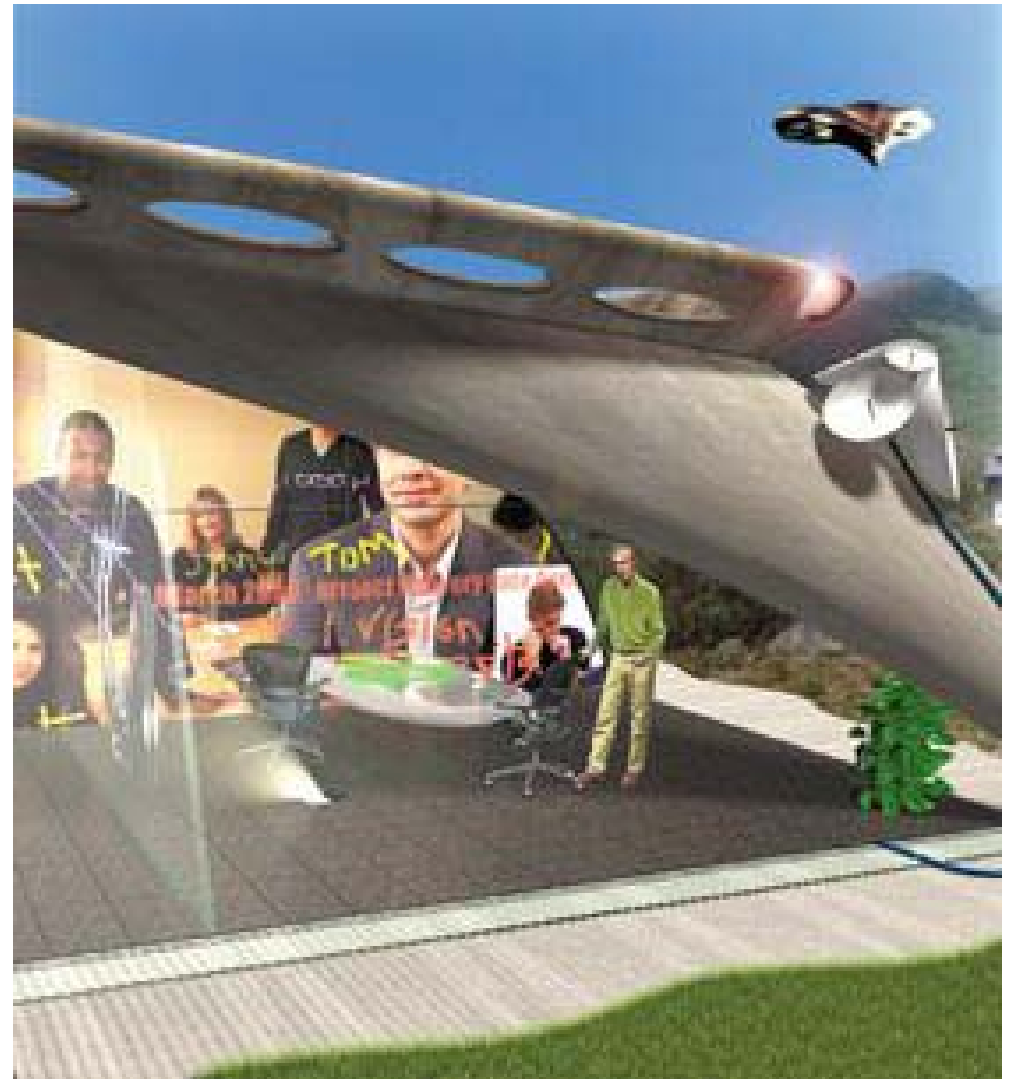


- Common needs of intelligent building tenants:
 - Built-in Internet wiring
 - LAN/WAN connectivity
 - Conduits for cabling
 - High-tech HVAC
 - Wiring for high-speed networks

Components of an IB



- Critical performance qualities
 - Functional or spatial quality
 - Thermal quality
 - Air quality
 - Aural quality
 - Visual quality
 - Building integrity



Future office spaces

IB @ Work



- Office space and commercial buildings
 - Speculative offices (USA or European)
 - 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



- 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 @ Work



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

IB @ Work



- Examples in Hong Kong (see notes)
 - Citibank Plaza (1992)
 - Hongkong Telecom (PCCW), Quarry Bay (1995)
- Major areas
 - Site
 - Shell
 - Building skin
 - Services
 - IT infrastructure

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



IB @ Home



- Home automation (see also www.caba.org)
 - 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

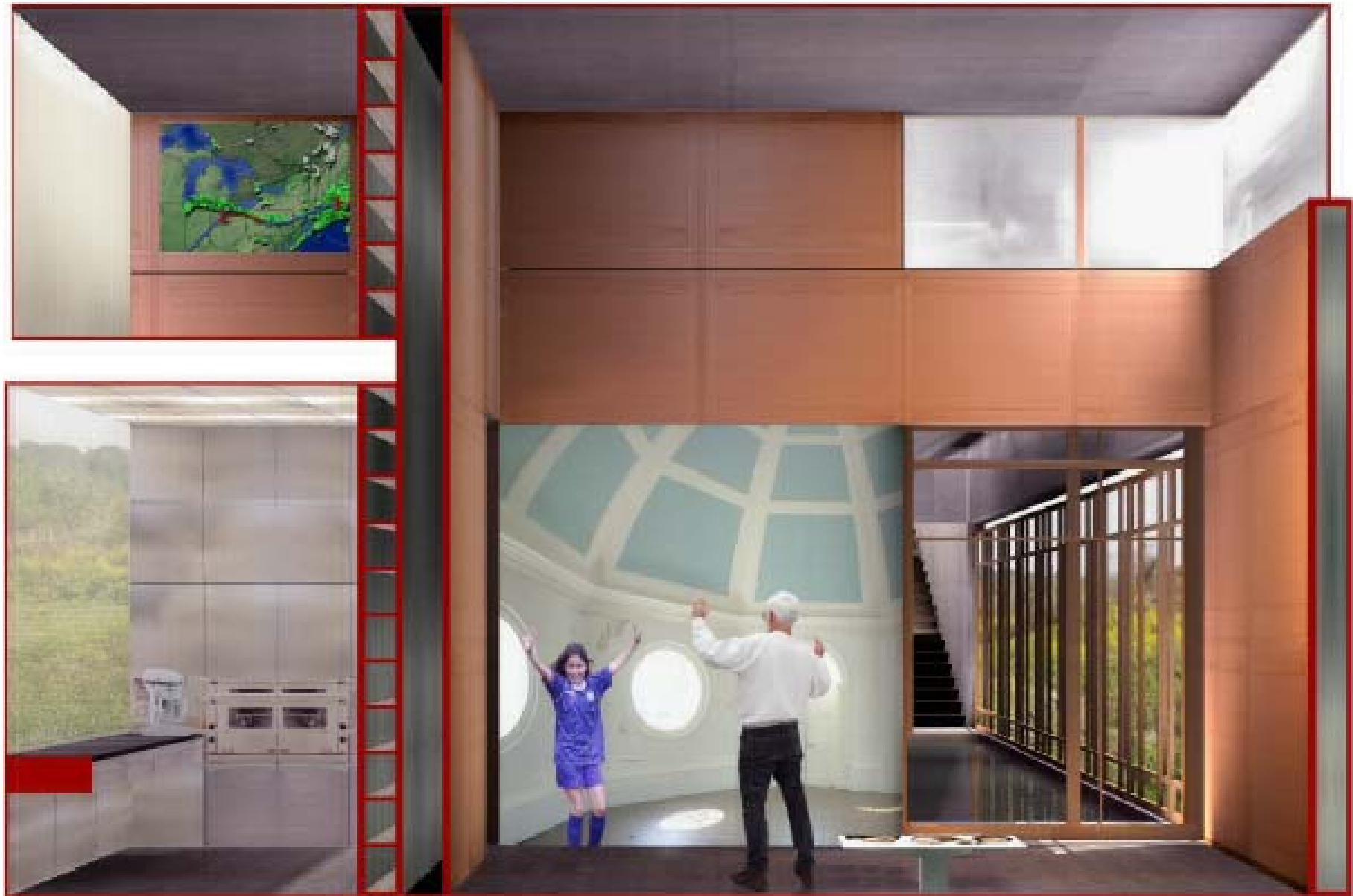
IB @ Home



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



Surf the web without wires!



House_n: MIT Home of the Future
(http://architecture.mit.edu/house_n/)

IB @ Home



- **House_n**: research by Massachusetts Institute of Technology (MIT) Dept of Architecture (http://architecture.mit.edu/house_n/)
 - The PlaceLab (living laboratory for studying people and their interaction with technologies)
 - Open Source Building Alliance (OSBA)
 - Just-in-time persuasive user interfaces for motivating healthy behaviors
 - Ubiquitous computer interfaces for the home