Intelligent building
• Intelligent buildings are buildings that through their physical design and IT installations are responsive, flexible and adaptive to changing needs from its users and the organisations that inhabit the building during its life time. The building will supply services for its inhabitants, its administration and operation & maintenance. The intelligent building will accomplish transparent 'intelligent' behaviour, have state memory, support human and installation systems communication, and be equipped with sensors and actuators.
What is an intelligent building?

A building...

• who’s systems are self reliant

• with sensors relaying data

• that uses the latest technology

• that is the future of buildings
Effective Communication?
Objectives of IB

• Energy management
• **Indoor Comfort**
  Thermal comfort
  Visual Comfort
  Indoor air quality
Energy management

- 85% of the energy used in buildings is for low temperature applications such as space and water heating.
- Building designs involving clean and efficient technologies help to reduce energy consumption as well as to provide a better quality of life for citizens.
- Under almost all circumstances it is necessary at some point in time to provide some form of auxiliary heating, cooling, lighting or ventilation since natural sources cannot always cover the requirements for thermal comfort, visual comfort and IAQ that are the prerequisite for a well balanced, comfortable and healthy indoor environment.

Energy consumption in buildings is required for the following uses:
- Heating
- Cooling
- Ventilation
- Lighting
- Equipment and machinery
- Domestic hot water
Indoor comfort

Comfort is defined as the sensation of complete physical and mental well being. Thermal neutrality, where an individual desires neither a warmer nor a colder environment, is a necessary condition for thermal comfort.

The factors affecting comfort are divided into personal variables:
- activity
- Clothing

and environmental variables,
- (air temperature,
- mean radiant temperature
- air velocity
- air humidity

Good indoor air quality is a function of a number of parameters including: the initial design and continuous maintenance of HVAC systems; use of low toxic emittance building materials; and consideration of all sources of indoor air pollution such as occupant activities, operation of equipment and use of cleaning products.
Thermal Comfort – Energy Balance
Active Roof Component

- Solar light
- Solar heat
- Convection flow
History of Intelligent Building

- 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 ≠ high-tech building
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
Building Energy Management Systems

- Building Energy Management Systems aim to optimise the use of energy in buildings by maintaining at the same time the indoor environment under comfort conditions.
- Practically, a BEMS is a computerised system that attempts to “control” all or some of the energy consuming operations in a building:
  - HVAC systems (Heating Ventilating and Air Conditioning)
  - Lighting systems (natural and artificial)
  - Indoor climate
BEM Systems – Architecture [1]

- General Architecture

![Diagram showing the general architecture of BEM Systems with a central unit connected to sensors and actuators.](image-url)
BEM Systems – Architecture [2]

- General Architecture
Goals of Building Automation
3 main goals

• 3 main goals:
  – Building management
  – Space management
  – Business management
3 main goals

• 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
Effective Communication?
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)
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

• 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 @ Home

• Present technology
  – Phones and intercoms
  – Home automation
  – Audio distribution (e.g. hi-fi speaker)
  – Video distribution (e.g. TV)
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IB @ Home

• Future home
  – Home networking
  – Internet appliances
  – Webcam, web phones
  – e-books, video walls
  – Home office
  – Virtual clinic/hospital
  – ......
INTEGER = Intelligent + Green
http://www.integer.com.hk/

Welcome to INTEGER

The INTEGER Hong Kong Pavilion, situated on the Tamar site in the heart of Hong Kong Island, is an exhibition demonstrating how intelligent and green technologies can deliver better value and performance in housing. Its main themes are innovation in construction, technology and environmental performance.
House_n: MIT Home of the Future
(http://architecture.mit.edu/house_n/)
Case study: James Law cybertecture International
commissioned by Vijay Associate (Wadhwa Developers) for Mumbai, India

The 32,000 sq m egg-shaped building will combine “iconic architecture, environmental design, intelligent systems, and new engineering to create an awe-inspiring landmark in the city

The building is due for completion by the end of 2010.
Concept

class concept was inspired by considering the world as an ecosystem allowing life to evolve. ’.
..” Cybertecture integrates technology, multimedia, intelligent systems and user interactivity to create customizable living and working spaces that focus on experience. The Cybertecture Egg takes this principle working theme a step further with ‘cybertecture health’ - interactive features that monitor occupant’s vital health statistics, like blood pressure and weight. In keeping with the focus on health and wellness, users can customize their views with real time virtual scenery.
• The oblong office building incorporates passive solar design to decrease heat gain and lower energy loads.
• A sky garden on the top of building which performs thermolysis (the dissipation of heat from the surface).
• The Cybertecture Egg will use solar photovoltaic panels and rooftop wind turbines to generate onsite electricity.
• A water filtration system will also be incorporated into the building to recycle grey water for flushing and irrigation purpose.
By using this “Egg” shape, compared to a conventional building, the structure has approximately 10-20% less surface area. Within the building, an innovative structure derived from the skin of the egg creates up to 30m spans of columnless floors.

The egg itself is orientated and skewed at an angle to create both a strong visual language and to alleviate the solar gain of the building.

Within the building, there will be a series of innovative systems such as ‘cybertecture health’ in the washroom which is designed to keep track of the inhabitant’s health including blood pressure and weight.

The data collected may be retrieved and sent to a doctor if deemed necessary.
Virtual Reception

- Productivity gain for both user and service provider
- Process-centric
- System Integration with added functionality
  - Leveraging of core technology such as skyva
- Differentiator in Security (people circulation) offering
- HMI product and Front-End to building (calling card and talking point)
- SW Application