



**15th INTERNATIONAL OPERATIONS & MAINTENANCE CONFERENCE** IN THE ARAB COUNTRIES  
UNDER THE THEME: “**SMART MAINTENANCE**” CONICIDE WITH THE 15<sup>TH</sup> ARAB MAINTENANCE EXHIBITION

# THINK INTELLIGENTLY, ACT SMART

HOW INTELLIGENT SYSTEMS CAN BENEFIT YOUR OPERATIONS

**SIMON LONG**





# Content

- What is a smart building?
- Why do we need intelligent systems and smart buildings?
- How do we create, control and use an intelligent environment?
- What intelligent controls can be fitted?
- Measuring the benefits of intelligent systems and smart buildings

A vertical image on the left side of the slide shows a worker in a red jumpsuit and a white hard hat. The worker is positioned on a complex network of industrial pipes and scaffolding, appearing to be working or inspecting the system. The background is a blurred industrial setting with more pipes and structures.

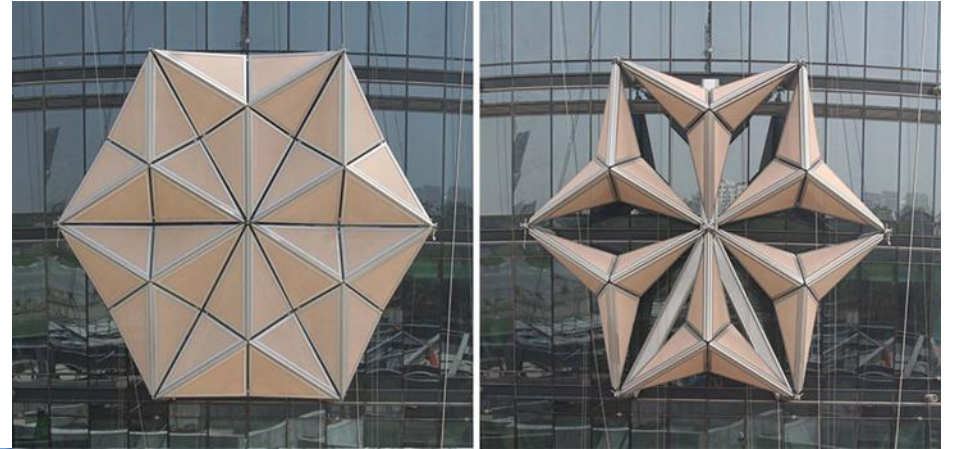
# What Is a Smart Building?

One where the combination of technologies and interconnected systems supports the use of the accommodation by the building's users, enables the efficient operation of the building and enables reconfiguration of the space in response to changing use<sup>(1)</sup> and one which is aware of internal and external occurrences, then makes a decision as to how to provide the optimum environment for the occupants and also one that quickly responds to requests<sup>(2)</sup>

1. Institute of Engineering and Technology (2011)
2. Aitken (1998)



# Al Bahar Tower (ADIC), Abu Dhabi, UAE



**Mashrabiya that responds  
to the sun, reducing thermal  
gains acting on the building**

A vertical image on the left side of the slide, tinted in a reddish-orange hue. It depicts an industrial setting with a worker in a white hard hat and dark clothing, leaning over a complex network of pipes and machinery. The background shows more industrial structures, including a large white cylindrical tank.

# Why Do We Need Intelligent Systems and Smart Buildings?

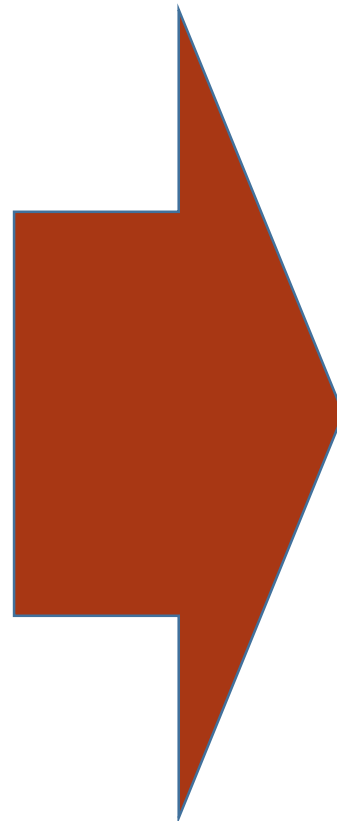
- Greater efficiency
- Removal of “human factor”
- Ability to move away from rigid PPM schedules
- Increase in life cycle of plant and equipment
- Reduced labour costs
- Reduced OPEX



# How Do We Create, Control And Use An Intelligent Environment?

## Traditional Typical Tasks - Visual Inspection

- Small Power
- General Lighting
- Emergency Lighting
- Pumps
- Pipework & Distribution
- Roller shutter doors
- Automatic Doors
- Air Handling Units
- Water features



Labour Intensive  
=  
Time and Cost



## Intelligent Solution Examples

- Pipework & Distribution – Leak detection
- Doors - constant knowledge on status (open/closed)
- Temperature – monitor for out of range values
- Metering – remote monitoring
- Lighting - automatic monitoring and notification of any failure
- Pumps – detection of vibrations to indicate possible problems

# What Controls Can Be Fitted?

											
TEMPERATURE	TEMPERATURE 3 FOOT PROBE	WATER TEMP	RTD HIGH TEMPERATURE	RTD LOW TEMPERATURE	DUCT TEMPERATURE	WATER DETECT	WATER DETECT PLUS	WATER ROPE	HUMIDITY	GRAINS PER POUND	MOTION DETECTION
											
OPEN / CLOSED	DRY CONTACT	CARBON MONOXIDE	LIGHT DETECTION	LIGHT METER	ASSET	SINGLE-INPUT PULSE COUNTER	MULTI-INPUT PULSE COUNTER	MAGNET DETECTION	ACTIVITY DETECTION	ACTIVITY VIBRATION COUNTING	ACTIVITY TIMER
											
ACCELEROMETER TILT	IMPACT DETECT	G-FORCE SNAPSHOT	G-FORCE MAX & AVG	0-1mA CURRENT METER	0-20mA CURRENT METER	RESISTANCE	VOLTAGE METER	VOLTAGE METER	VOLTAGE METER	VOLTAGE METER	VOLTAGE METER
											
VOLTAGE DETECT	1-50 VDC	50 PSIG PRESSURE METER	300 PSIG PRESSURE METER	BUTTON	COMPASS	FLEX	SEAT OCCUPANCY	AIR FLOW DETECTION	LIQUID LEVEL	VEHICLE DETECTION	VEHICLE COUNTER



## Sensor Examples



Temperature



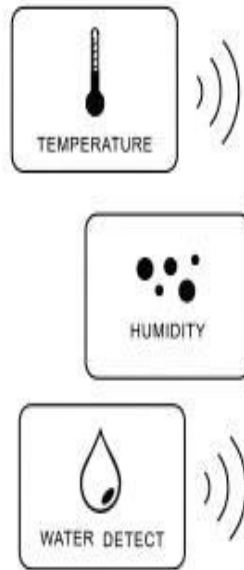
Water Detection



Door Status

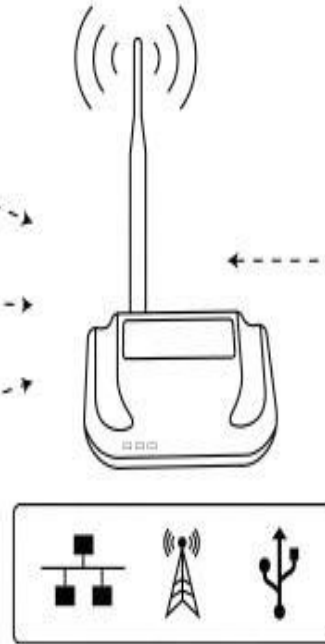
# Set-Up and Connection

## Wireless Sensors



Over 50 Different  
Wireless Sensor  
Types Available

## Wireless Gateway

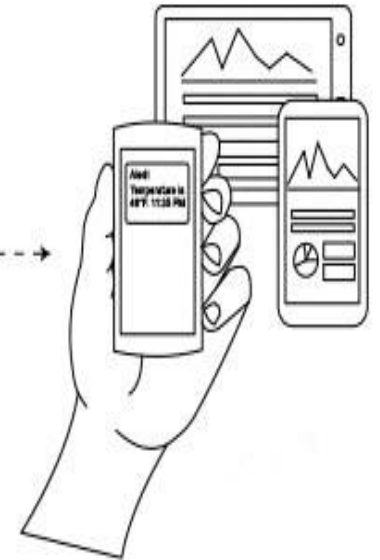


## Online Monitoring Software



Access Anytime

## Mobile Apps and Alerts

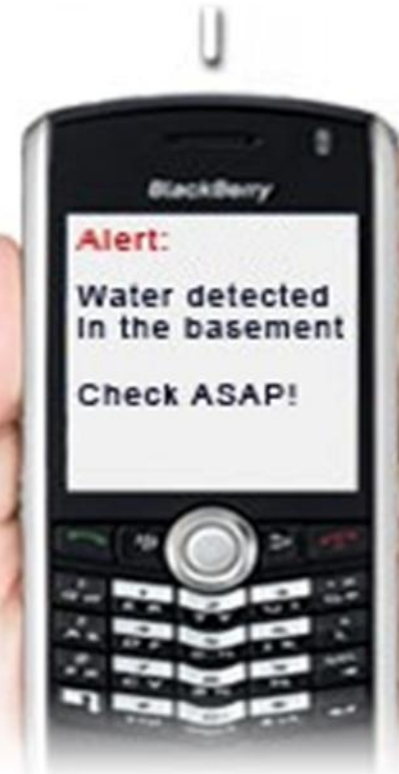


Stay Connected Anywhere  
Instant Notification With  
Text and Email Alerts



# Water Intrusion Monitoring

Gateway





# Server Rooms



# Gateway





# Smart Power Monitoring

## Gateway





# Parking Garages

## Gateway





# Fleet Management

## Gateway



# Building Access

## Gateway





# Facility Monitoring

## Gateway





# Building Costs

**80%** of the total costs of building arise during operation



**20%** building costs



**80%** operating costs

Of this

**40%** energy

**30%** maintenance

**10%** other costs

A vertical image on the left side of the slide shows an industrial worker in a red jumpsuit and white hard hat working on a complex network of pipes and scaffolding. The image has a reddish tint.

# Cost Considerations

- Initial costs
- Alterations. additions, upgrades
- Operation and maintenance
- Utility costs



## Typical Building Approach to Automation



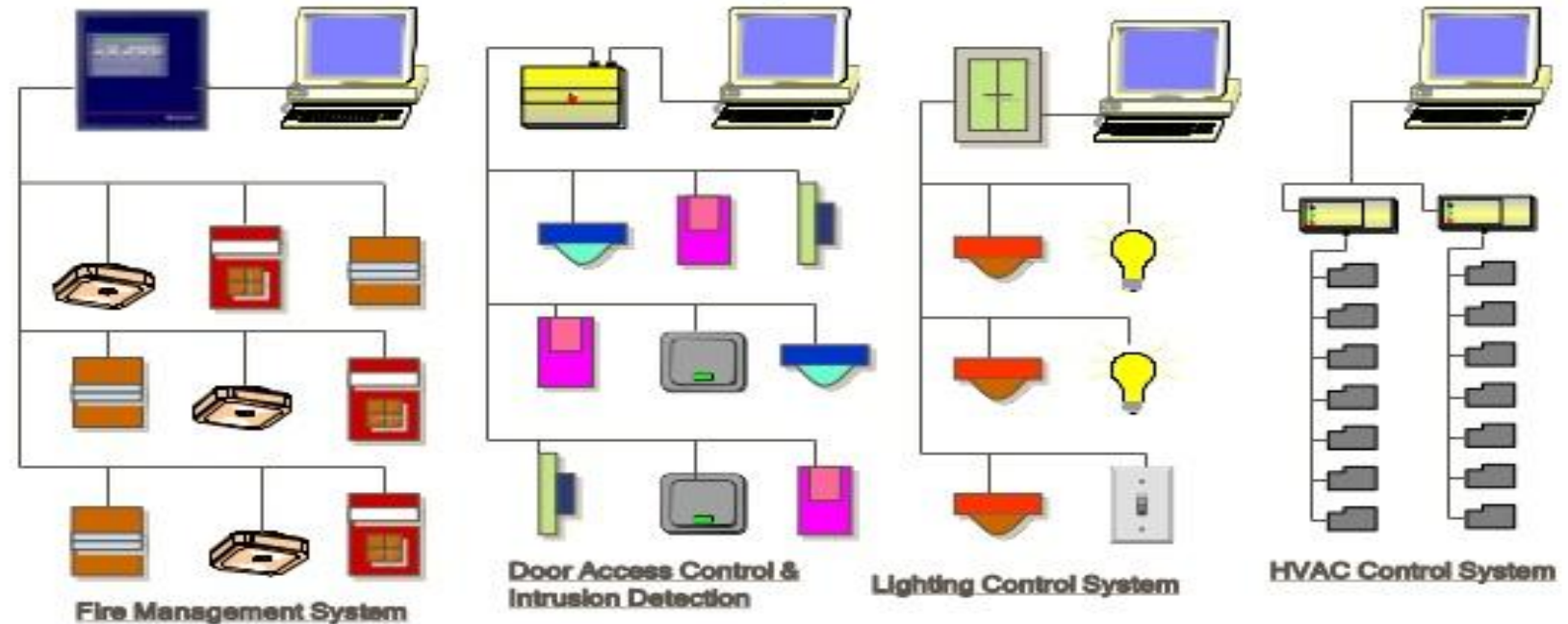
Emergency Generator



*No Integration !*  
5 User Interface Workstations!



Main Service Switchgear





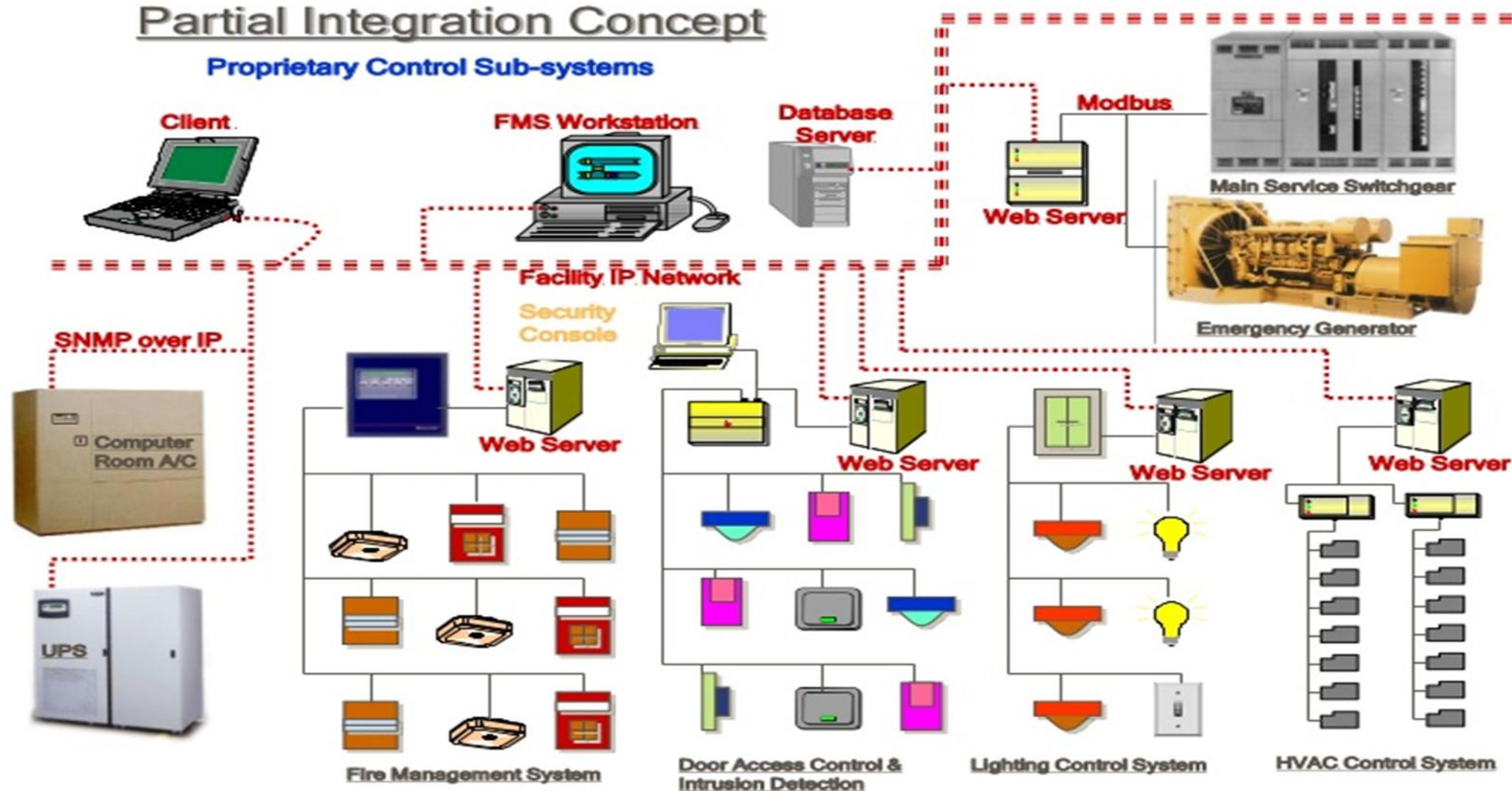
A vertical image on the left side of the slide shows a worker in a red jumpsuit and white hard hat working on a complex industrial structure made of pipes and scaffolding. The image has a reddish tint.

# No Integration Issues

- Engineering left with contractors
- Sole sourcing required to provide integration - \$\$\$\$
- Single purpose stand-alone systems
- Nobody responsible for technology integration

# Partial Integration Concept

## Proprietary Control Sub-systems





A vertical image on the left side of the slide shows a worker in a red jumpsuit and white hard hat working on a complex industrial structure with many pipes and valves. The image has a reddish tint.

# Partial Integration

## ISSUES

- Software integration on IP networks
- Hardware intensive

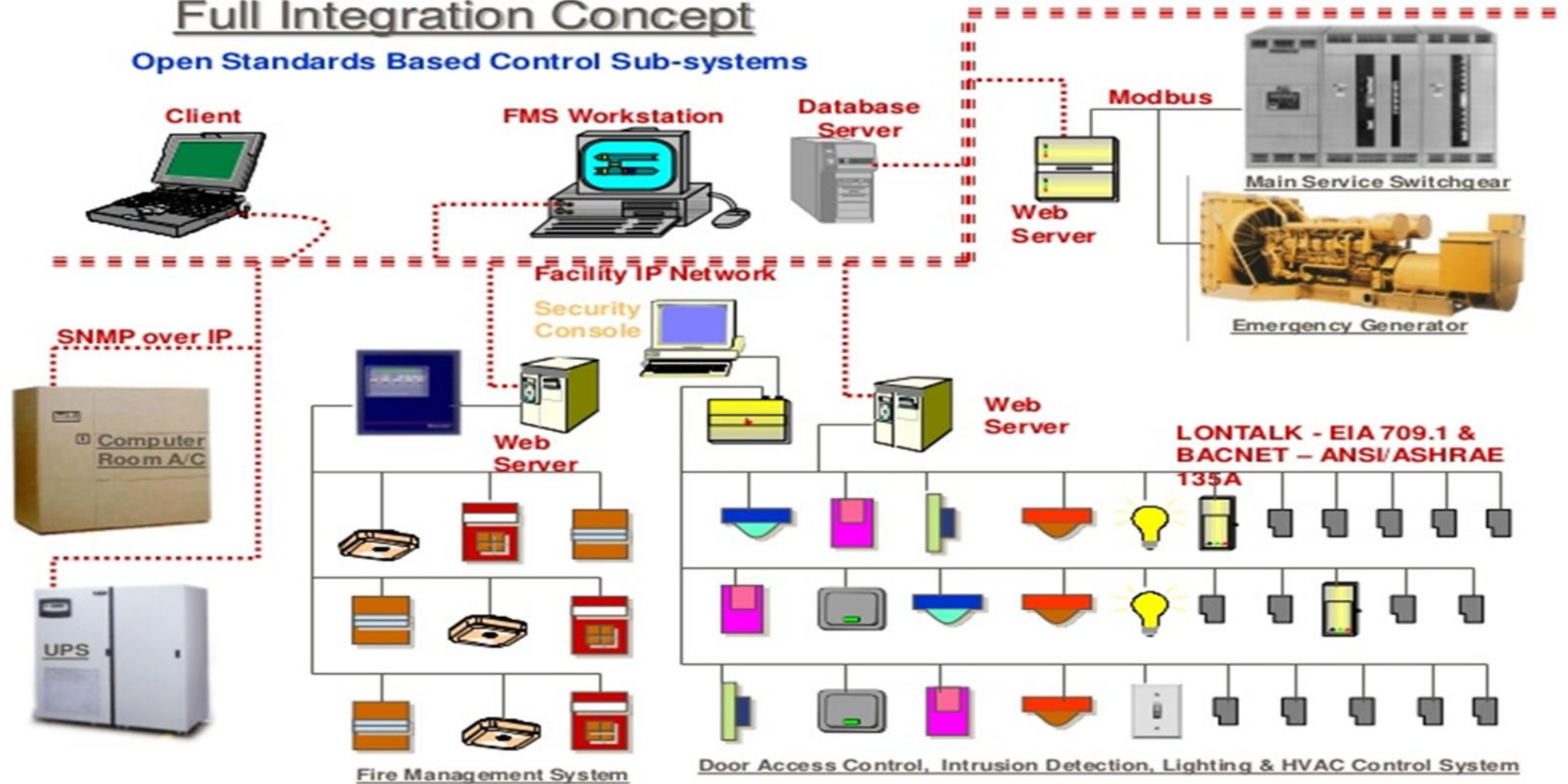
## BENEFITS

- Single user interface for all systems
- Permits migration to open control networks – competitive bids
- Development of databases – Asset/energy/maintenance management etc.



# Full Integration Concept

## Open Standards Based Control Sub-systems





A vertical image on the left side of the slide shows a worker in a red jumpsuit and a white hard hat working on a complex industrial structure. The structure is composed of numerous pipes, valves, and scaffolding, typical of a refinery or chemical plant. The worker is positioned on a platform, reaching towards a part of the machinery.

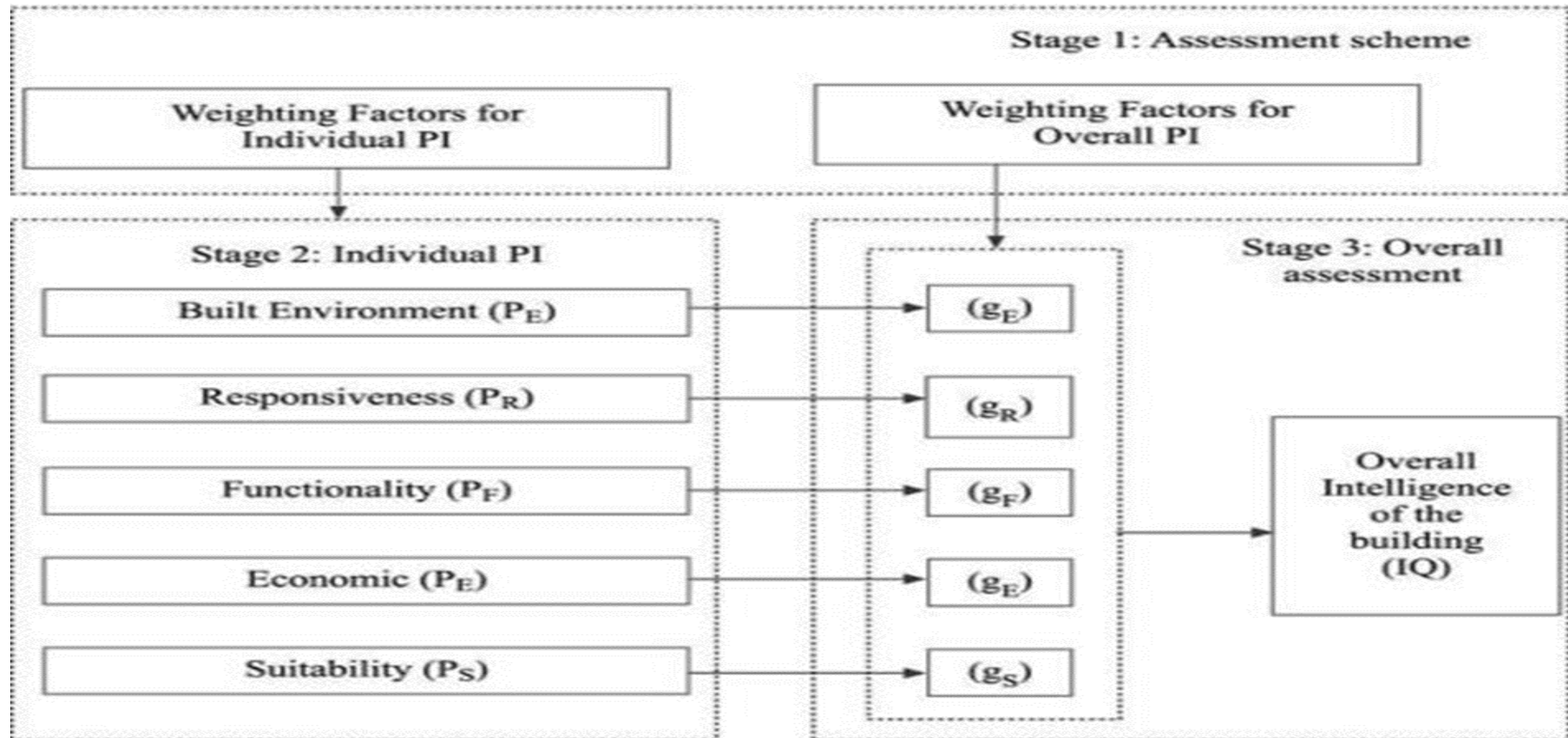
# Full Integration Benefits

Same as partial integration PLUS

- Integrated building sub-systems – i.e. lighting, HVAC, power management, security etc.

**LOWEST LIFE CYCLE OPTION**

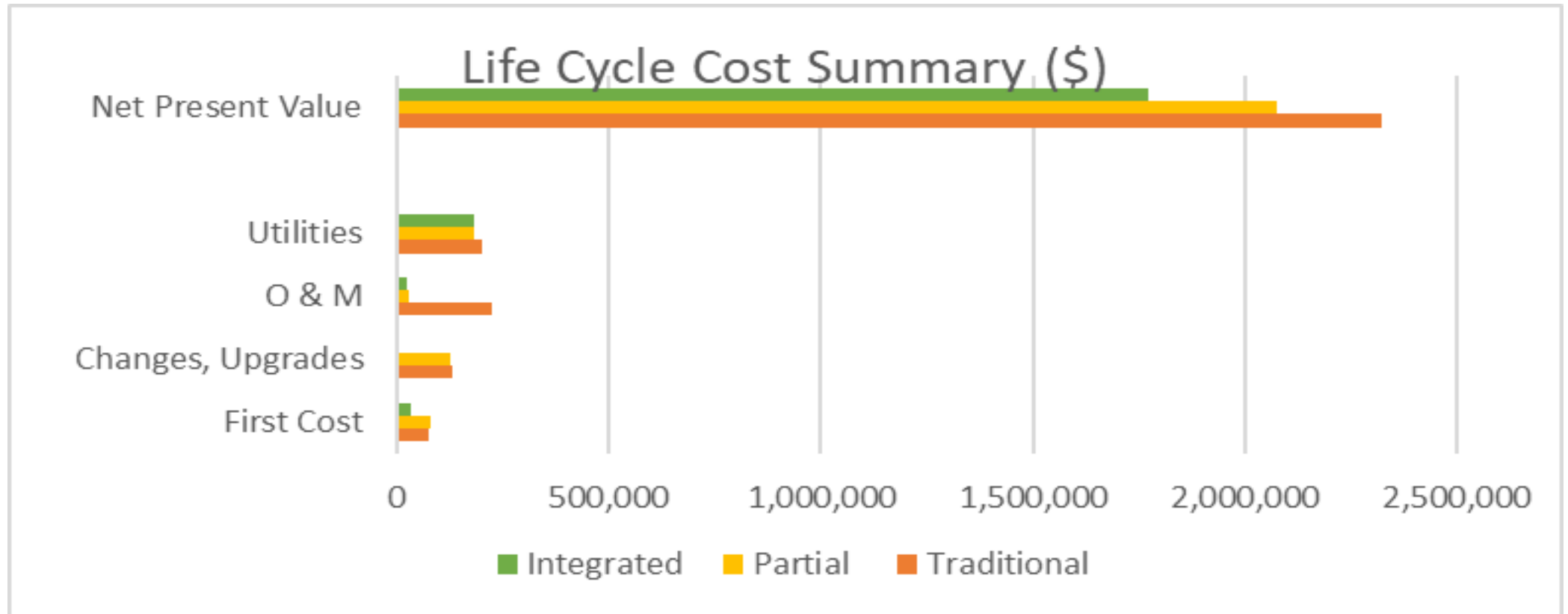
# How Do We Measure the Benefits?



Kolokotsa et al (2007)



# How Do We Measure the Benefits?



Source: LEED 2015

## Savings

Full Integration compared to Traditional – \$551,739

Full Integration compared to Partial – \$300,598

# How Smart Do We Want To Be?







**THANK YOU**