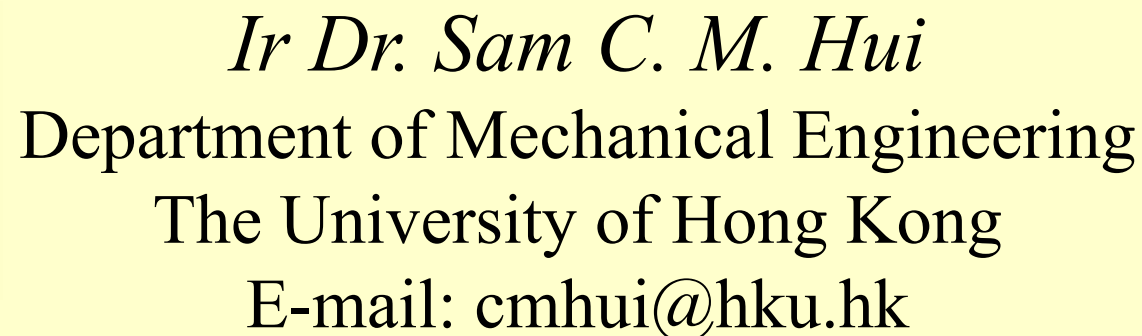


<http://ibse.hk/MEBS6000/>



Jan 2025

# Contents



- Basic concepts
- CABD and SMATV systems
- PBX and PA systems
- Security systems
- CCTV systems
- Access control systems
- Burglar & intruder alarms



# Basic concepts

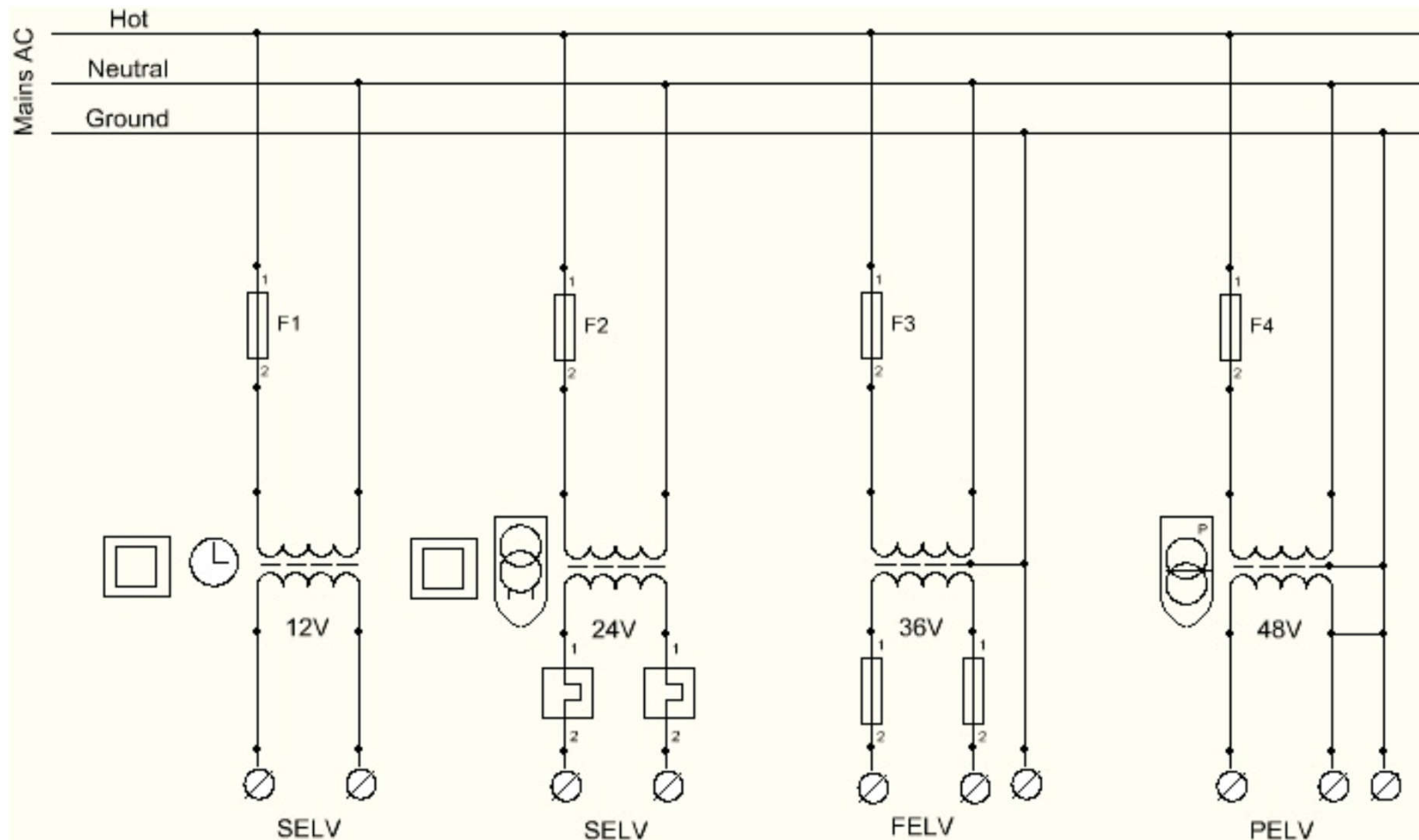
- Extra low voltage (ELV): (特低壓電 / 弱電)
  - $< 50$  volts AC or  $< 120$  volts DC (BS 7671)
  - Low risk of dangerous electrical shock
  - Intrinsically safe circuits (BS 1259)
- Three types of ELV sources:
  - Safety extra low voltage (SELV)
  - Protective extra low voltage (PELV)
  - Functional extra low voltage (FELV)



Do you  
know why  
we need  
ELV?

# Electricity supply voltage & installations for extra low voltage

Voltage range	AC RMS voltage (V)	DC voltage (V)	Defining risk
High voltage	> 1000	> 1500	Electrical arcing
Low voltage	50 to 1000	120 to 1500	Electrical shock
Extra-low voltage	< 50	< 120	Low risk



FELV = Functional extra low voltage; PELV = Protective extra low voltage; SELV = Safety extra low voltage

(Source: Extra-low voltage - Wikipedia [https://en.wikipedia.org/wiki/Extra-low\\_voltage](https://en.wikipedia.org/wiki/Extra-low_voltage))



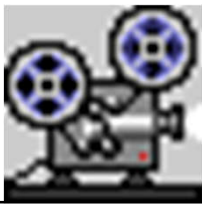
# Basic concepts

- Safety extra low voltage (SELV) must be
  - Safely separated from other circuits that carry higher voltages
  - Isolated from earth (ground) and from the protective earth conductors of other circuits
- The safety of an SELV circuit is provided by
  - The extra low voltage
  - Low risk of accidental contact with a higher voltage
  - Lack of a return path through earth (ground) that a current could take in case of contact with a human body



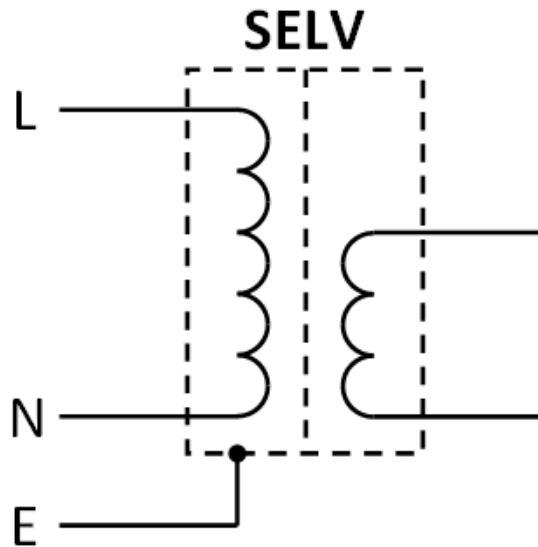
# Basic concepts

- Protective extra low voltage (PELV)
  - Has a protective earth (ground) connection
  - Such as a computer with a IEC Class I power supply
- Functional extra low voltage (FELV)
  - Any other extra low voltage circuit that does not fulfill the requirements for an SELV or PELV circuit
  - Such as part of the circuit uses an ELV
    - Protection requirements for the higher voltage have to be applied to the entire circuit



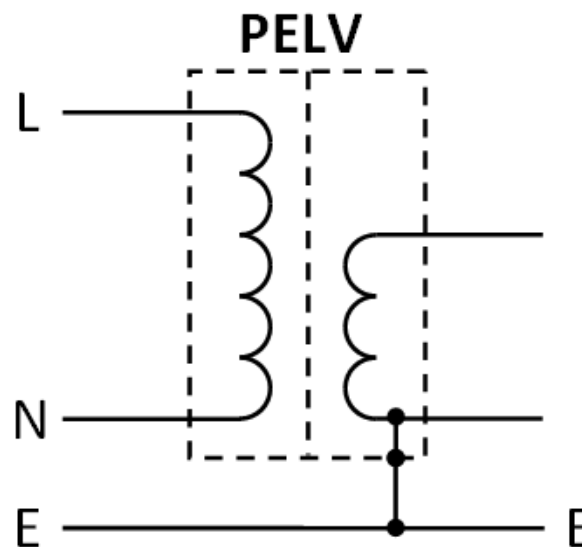
Video: Safety for extra low voltage circuit (5:18) <https://youtu.be/fdxE8bl8Kmo>

# Three types of extra low-voltage (ELV) systems



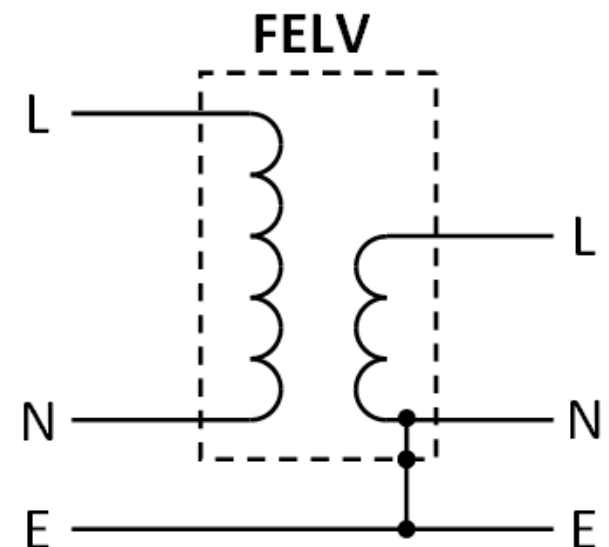
## Safety extra low voltage (SELV)

- Presence of a special insulation
- The loads are not isolated by earthing (grounding)
- Eliminate the connection between earth & the equipment



## Protective extra low voltage (PELV)

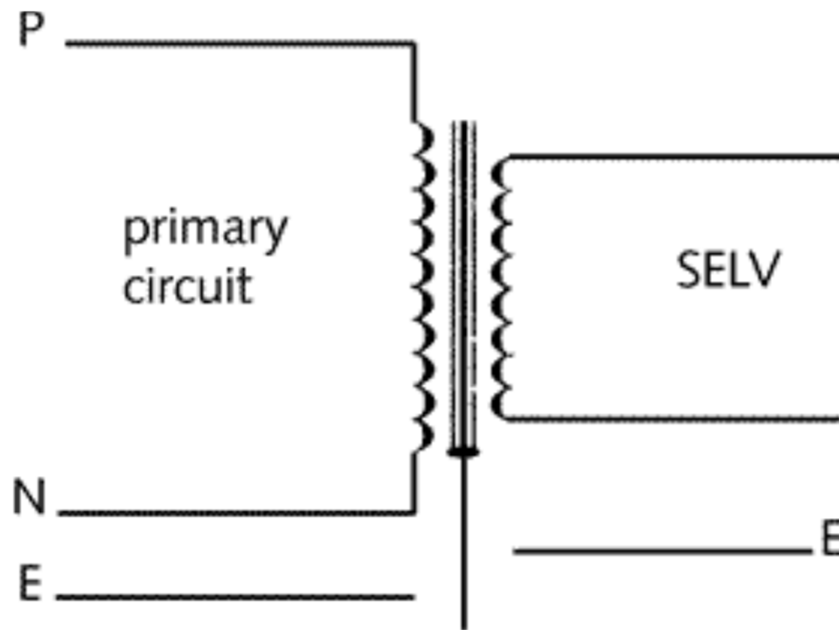
- Presence of a special insulation
- The loads are not isolated by earthing (grounding)



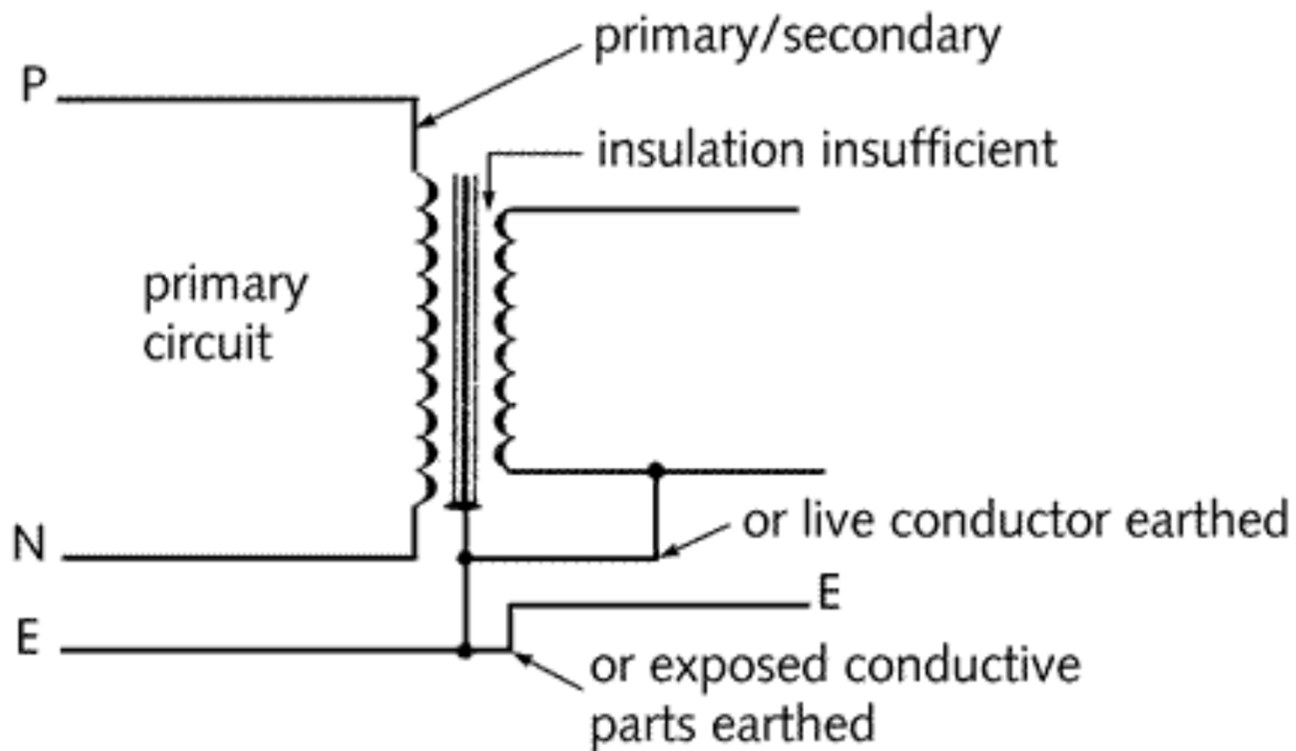
## Functional extra low voltage (FELV)

- Special insulation is not required
- The loads are not isolated by earthing (grounding)

## Earthing relationship, SELV and FELV systems



Safety extra low voltage (SELV)



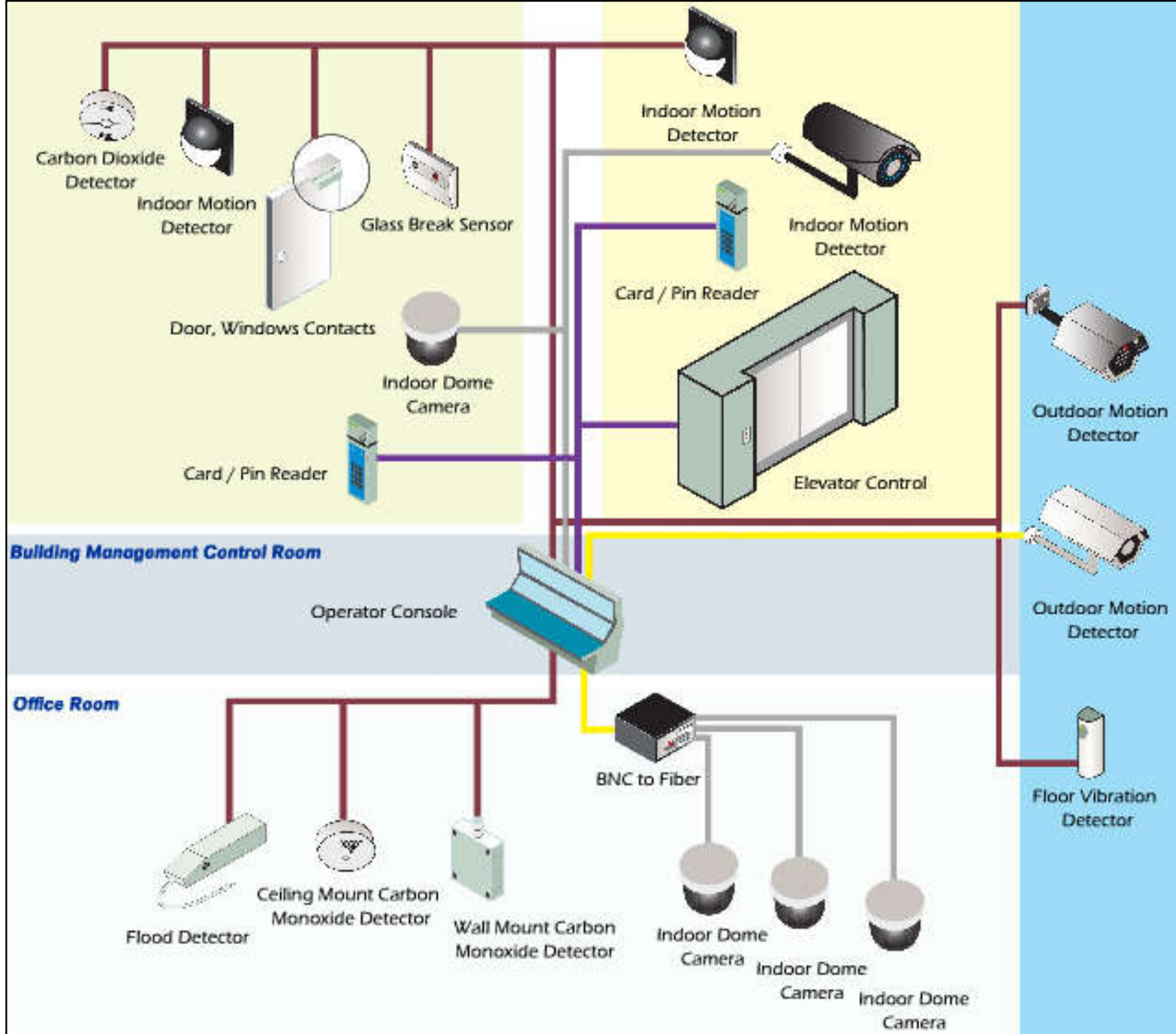
Functional extra low voltage (FELV)





# Basic concepts

- Common ELV systems include:
  - Communal aerial broadcast distribution (**CABD**)
    - Also known as “Public TV antenna” (公共天線)
  - Satellite master antenna television (**SMATV**) 衛星電視共用天線
  - Private branch exchange (**PBX**) telephone systems
  - Public address (**PA**) systems
  - Computer networking systems
  - Audio/visual system & intercom systems
  - Fire alarms & security systems



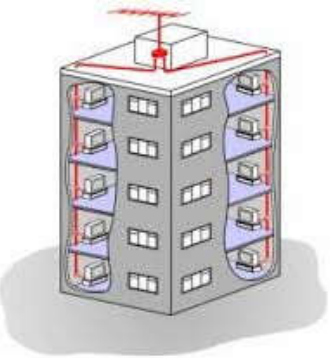
Examples of  
extra low  
voltage  
(ELV)  
systems &  
devices in  
buildings

# CABD and SMATV systems

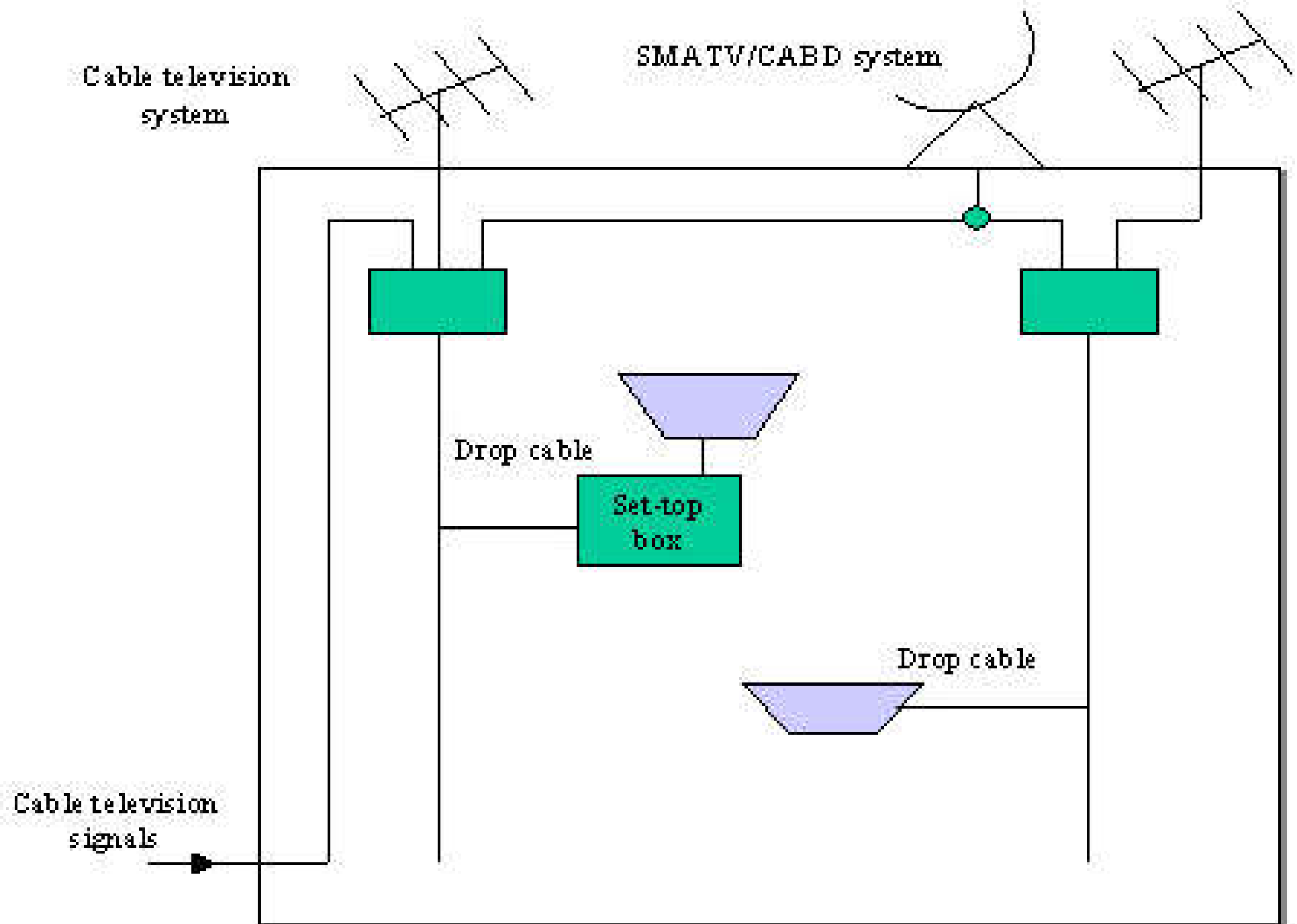


- CABD and SMATV systems

- Also known as “In-Building Coaxial Cable Distribution Systems” (IBCCDS)
  - Comprises aerial, head-end equipment (amplifier/filter) and co-axial cable network (block wiring systems) inside multi-storey buildings
  - For reception & distribution of TV & FM radio broadcast
  - In some buildings, it is also used to distribute cable TV, satellite TV, closed circuit television (CCTV) & Internet services



# In-building coaxial cable distribution system (IBCCDS)



# CABD and SMATV systems



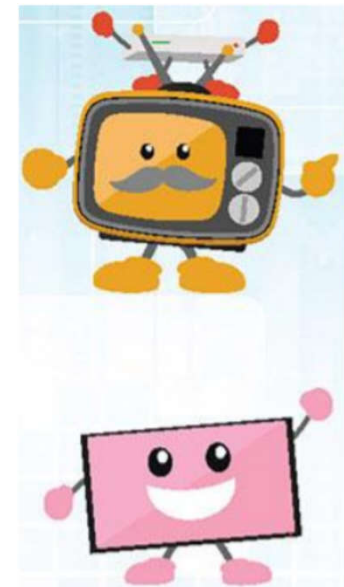
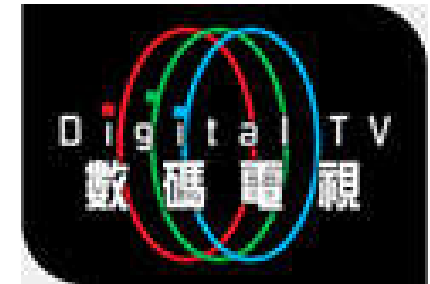
- CABD and SMATV systems (cont'd)
  - Services include:
    - Free TV Programme (TVB, HK Open TV & ViuTV)
    - Satellite TV
    - Pay TV (CableTV, PCCW Media & TVB Pay Vision)
    - Digital Terrestrial Television (DTT) (from 2007)
  - SMATV: receiver dishes on rooftops & signals are fed down through IBCCDS
  - Set-top boxes (機頂盒) : access function & security function

# CABD and SMATV systems



- Digital TV

- Broadcast TV services in digital format
  - Clear picture & no ghosting
- Supports more free-to-air TV channels, high definition TV (HDTV) & interactive TV
- Support mobile / portable reception
- How to receive it?
  - External decoder added between TV socket and conventional TV set
  - Integrated digital TV set with decoder built in



# Comparison of analogue & digital TVs



What type of  
TV do you  
have at  
home?

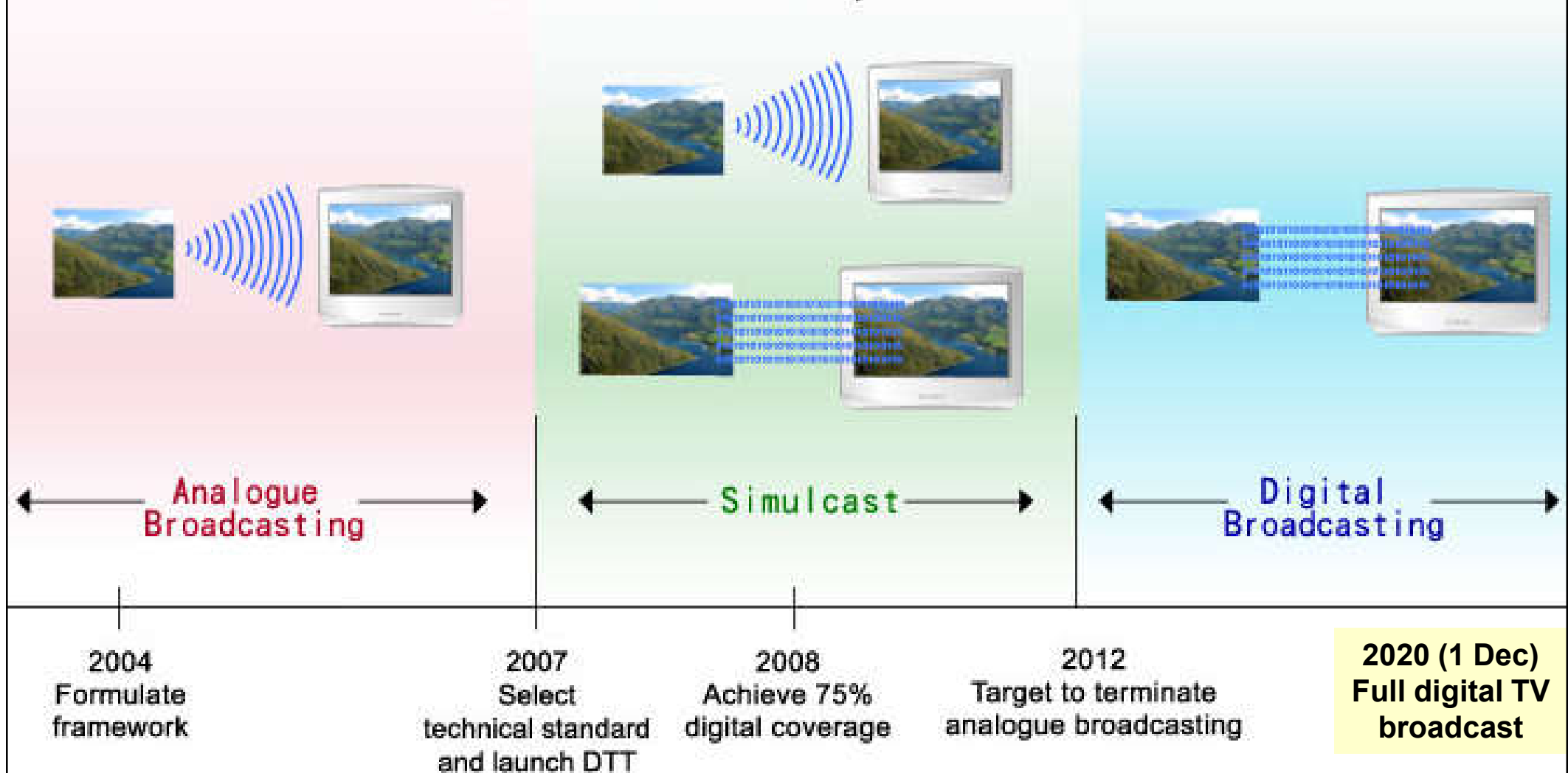


<b>Analogue TV (standard definition)</b>	<b>Digital TV (high definition)</b>
Resolution up to 575 lines (vertical) x 720 pixels (horizontal)	Resolution up to 1080 lines (vertical) x 1920 pixels (horizontal)
Aspect ratio 4:3	Aspect ratio 16:9 (Widescreen)
Stereo sound	Multi sound channels (e.g. Dolby 5.1 multi-channel sound)



# Timetable for Digital Terrestrial Television (DTT) implementation in HK

## Timetable for DTT Implementation



(\* Simulcast = simultaneous analogue & digital broadcasts)

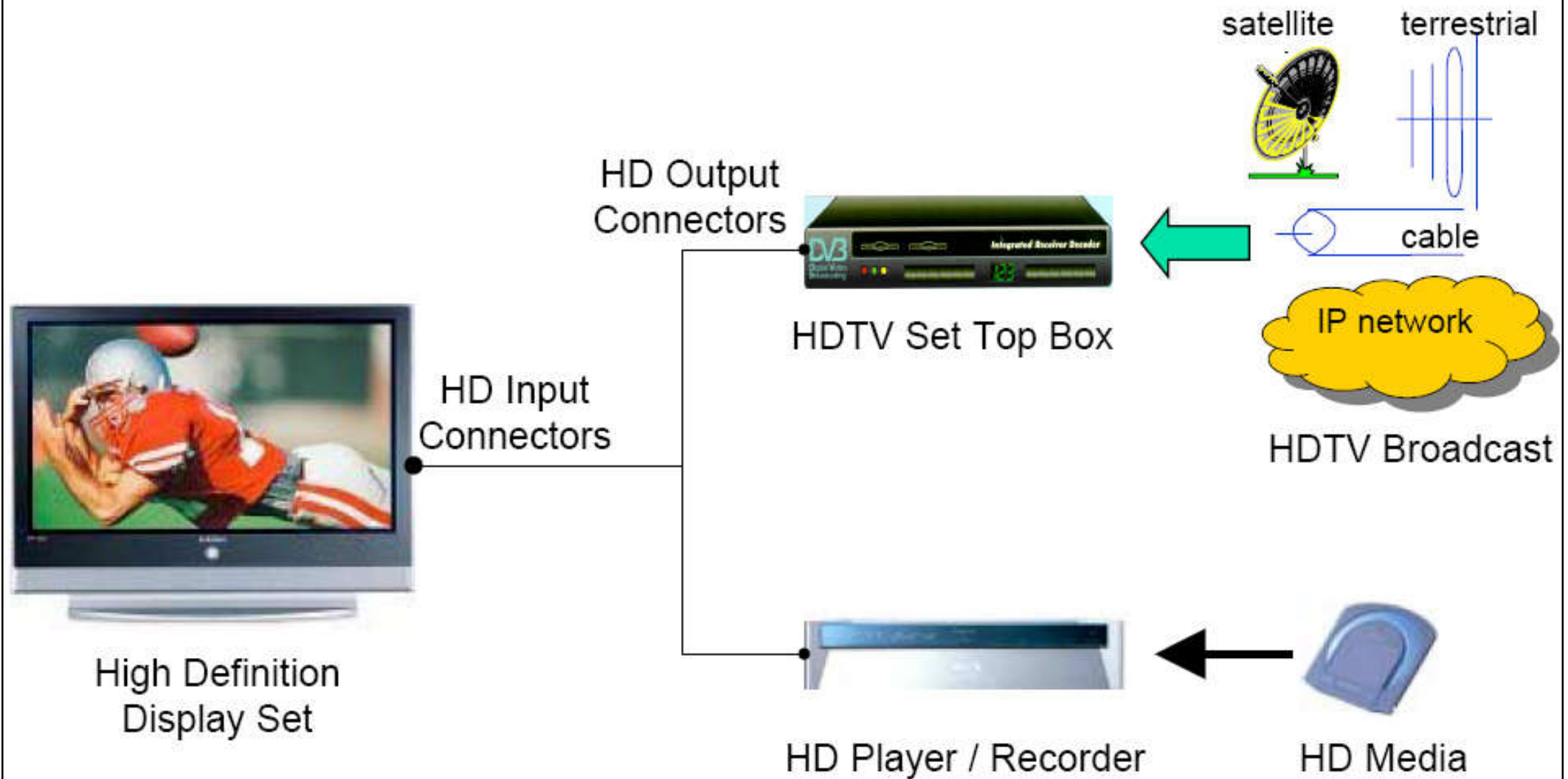


# CABD and SMATV systems



- Digital TV platforms in Hong Kong
  - Terrestrial radiocommunications
    - Through Ultra High Frequency (UHF) radio spectrum
    - By TVB and ATV (launched in Dec 2007)
  - Cable (e.g. by Cable TV)
    - Via hybrid fibre coaxial cable (HFC) network
  - Broadband network
    - By PCCW Media & TVB Pay Vision (Galaxy)
  - Satellite (through SMATV systems)
    - Some foreign & local satellite television broadcasts are providing HDTV programmes

# High definition TV (HDTV) equipment setup



# Transmitting stations of digital terrestrial television (DTT) in HK

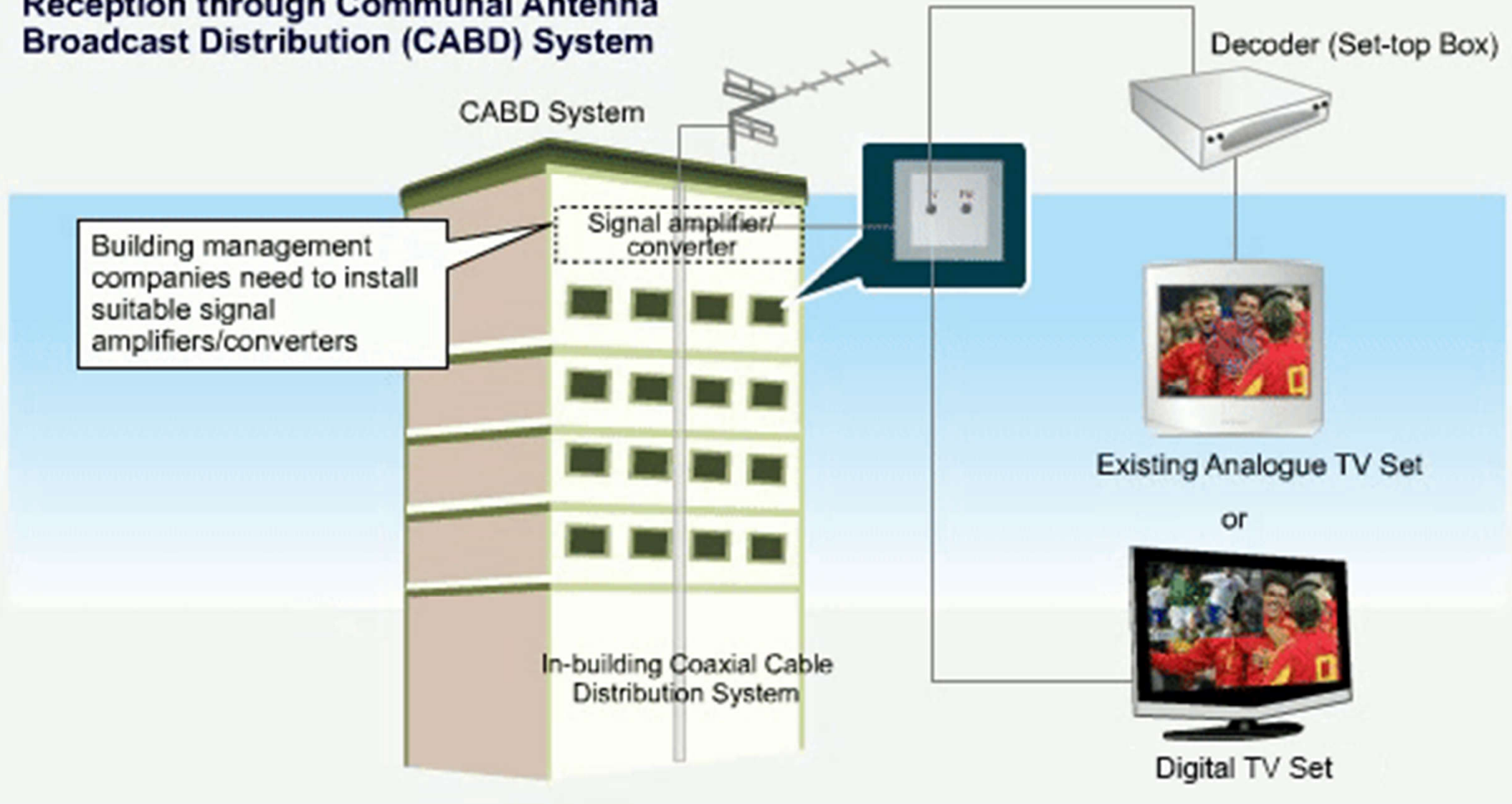


Remarks: Estimated locations of transmitting stations are shown for reference only

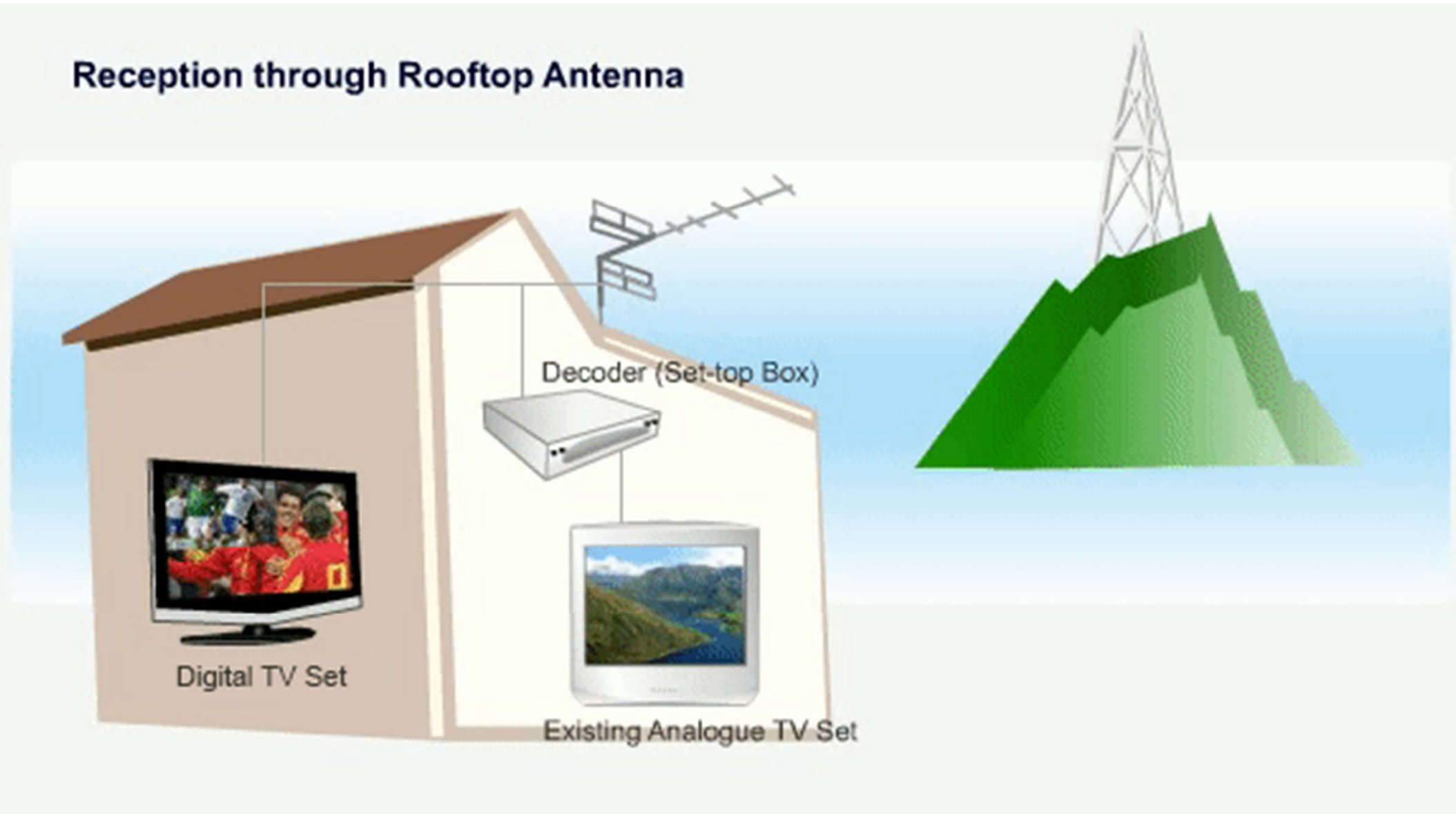
(Source: [www.digitaltv.gov.hk](http://www.digitaltv.gov.hk))

# Reception of Digital TV signals through CABD systems

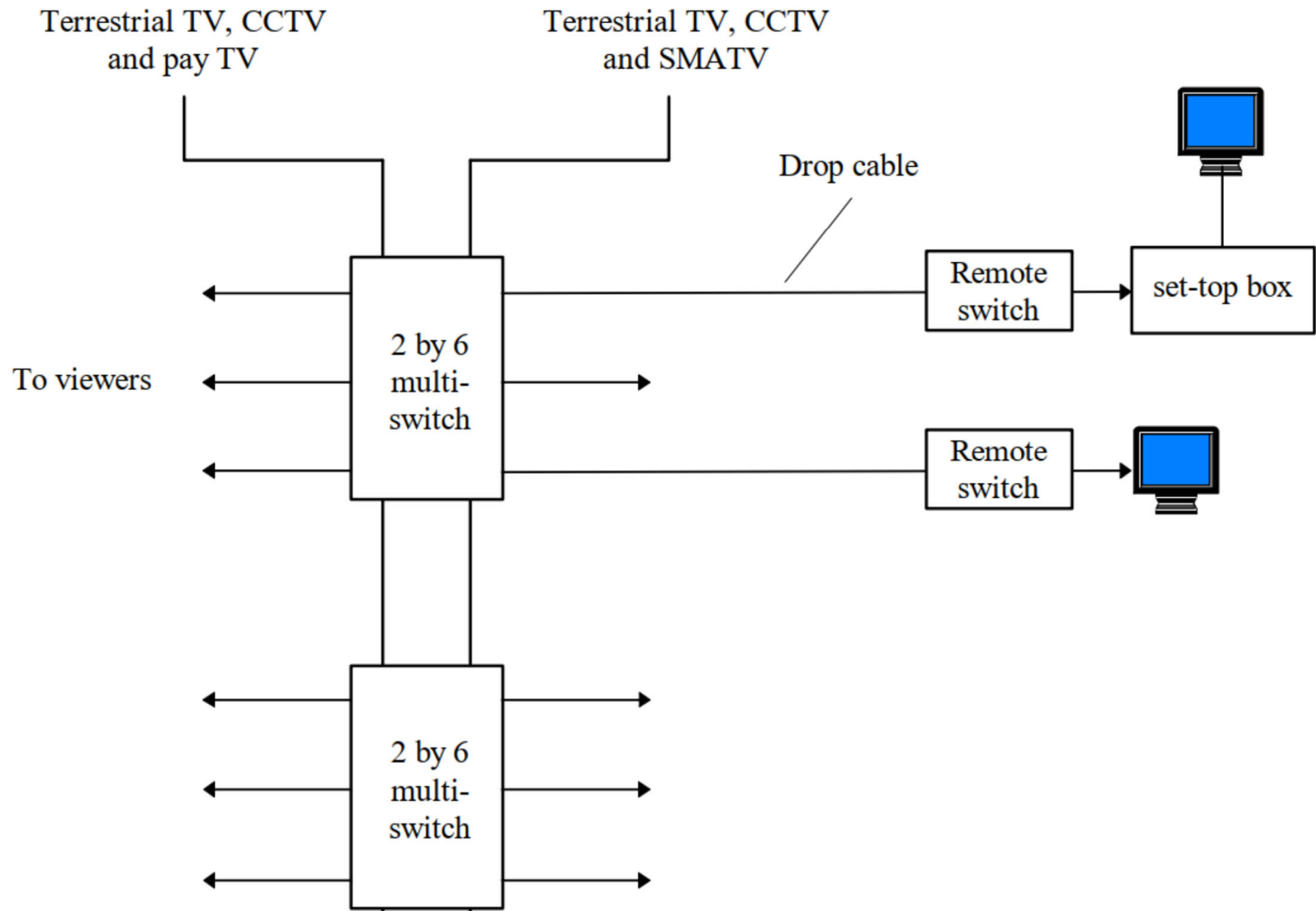
## Reception through Communal Antenna Broadcast Distribution (CABD) System



# Reception of Digital TV signals through rooftop antenna



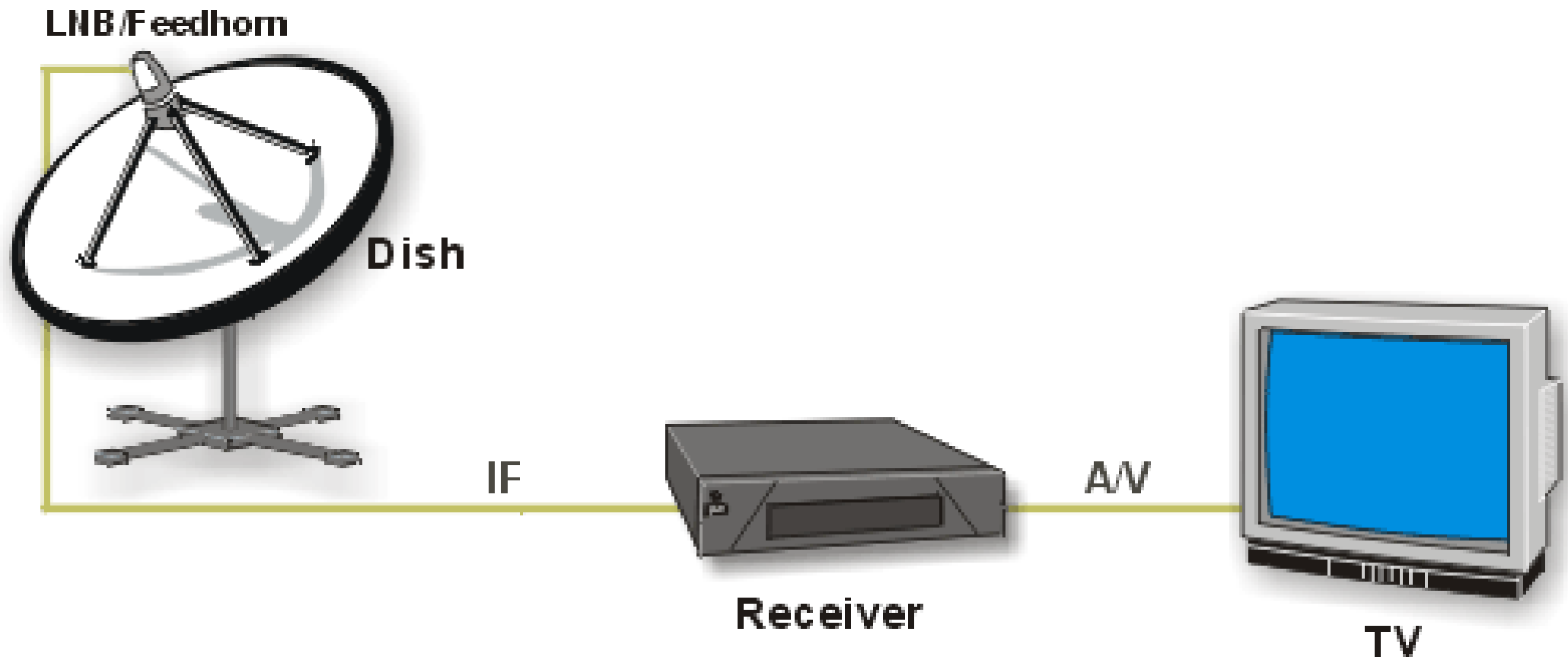
# Typical configuration of a parallel distribution system



(Source: CA, 2012. *Code of Practice for the Installation and Maintenance of In-Building Telecommunications Systems and In-building Access by Telecommunications Network Operators*, Communications Authority (CA), Hong Kong. <https://www.coms-auth.hk/filemanager/statement/en/upload/105/cop201202e.pdf>)



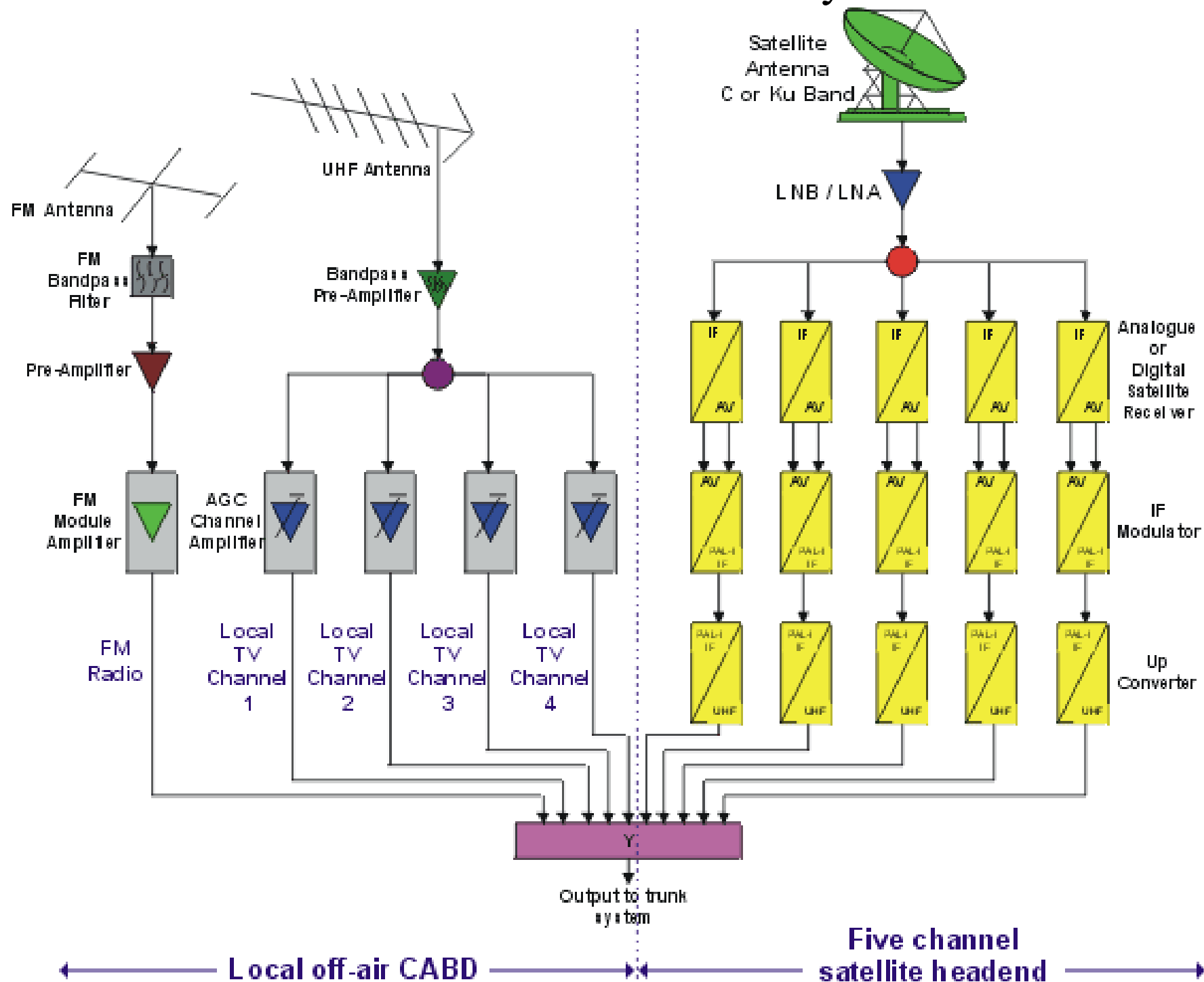
# Satellite antenna television system



Dish = satellite dish

LNB = low noise block down converter

# Satellite antenna television system





# CABD and SMATV systems

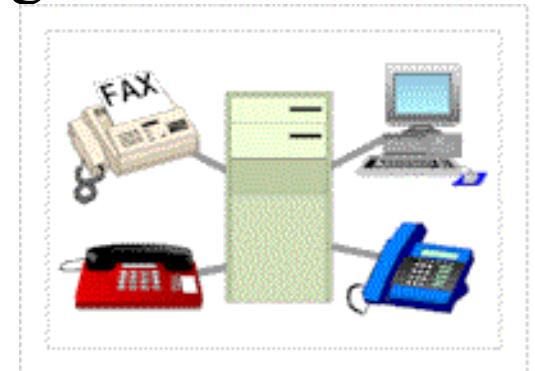


- Satellites receivable by SMATV systems in HK  
[https://www.ofca.gov.hk/filemanager/ofca/en/content\\_295/st\\_smatv.pdf](https://www.ofca.gov.hk/filemanager/ofca/en/content_295/st_smatv.pdf)
  - Apstar 6C (亞太衛星6C), Apstar 7 (亞太衛星7)
  - AsiaSat 5 (亞洲衛星5), AsiaSat 7 (亞洲衛星7)
  - Chinasat 6A (中星6A), Chinasat 6B (中星6B)
  - Intelsat 19 (國際19), Intelsat 20 (國際20)
  - Measat 3/3a (馬星3/3a)
  - Palapa D (印尼Palapa D)

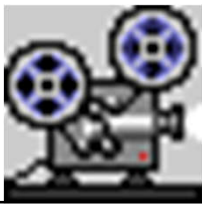


# PBX and PA systems

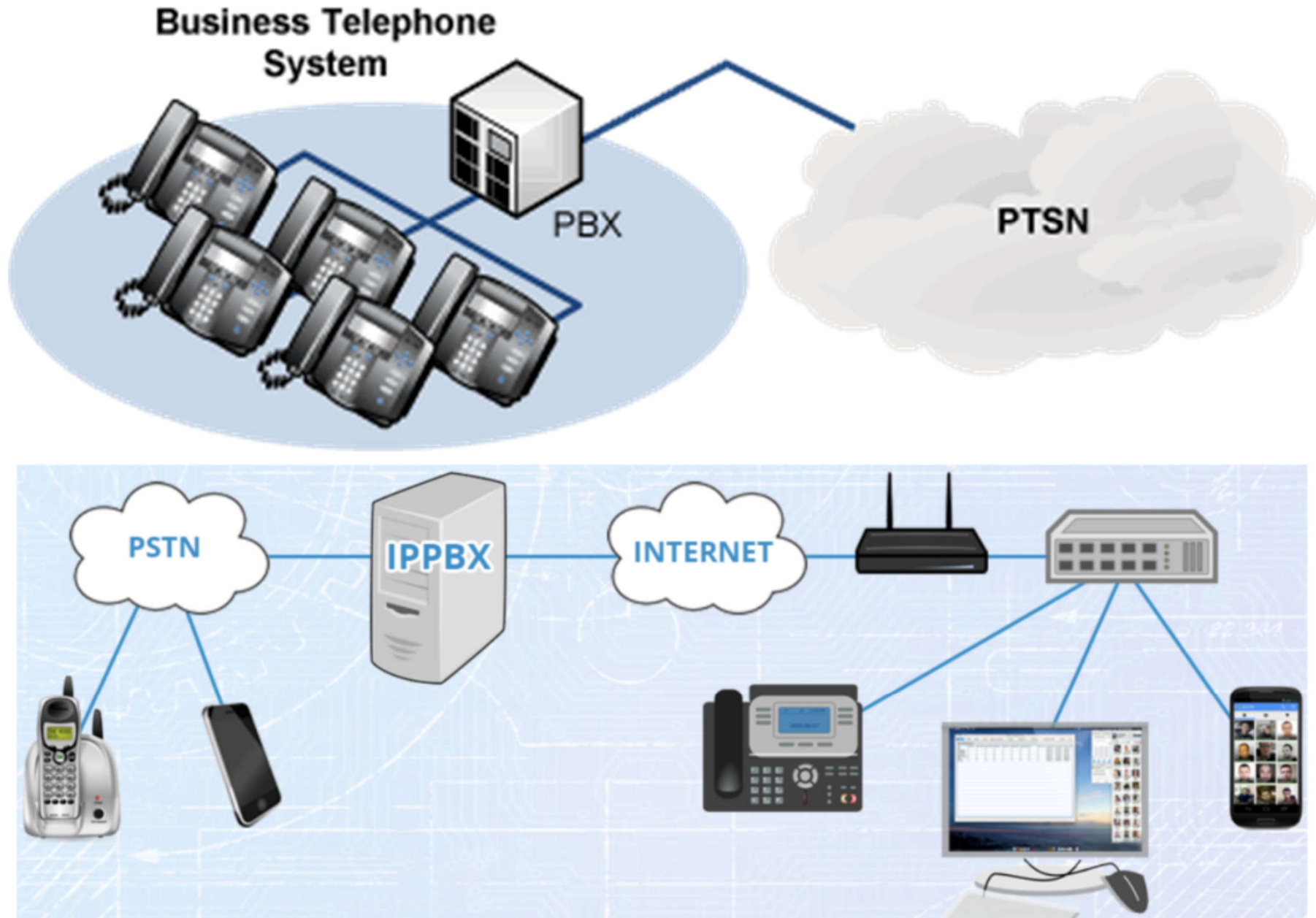
- Private branch exchange (PBX) systems
  - Also, private automatic branch exchange (PABX)
  - A telephone exchange that is owned by a private business, to allow all users to share a certain number of external phone lines
    - Main purpose: to save the cost of requiring a line for each user
  - Old PBXs use analog technology
  - New PBXs use digital technology



Video: What is PBX? (2021) (3:48) [https://youtu.be/KviuXiNr\\_7w](https://youtu.be/KviuXiNr_7w)



# Old PBX with publicly switched telephone network (PSTN) & “IPBX” uses Internet Protocol to carry calls



(Source: <https://www.businesstelephonesystem.org/pbx-telephone-systems-explained/>, <https://worlditpark.com/pbx-private-branch-exchange-in-telephony/>)



# PBX and PA systems

- PBX performs three main duties
  - Establish connections (circuits) between the telephone sets of two users (e.g. mapping a dialled number to a physical phone, ensuring the phone isn't already busy)
  - Maintain such connections as long as the users require them. (i.e. channeling voice signals between the users)
  - Provide info for accounting purposes
- Other functions, e.g. call transfer



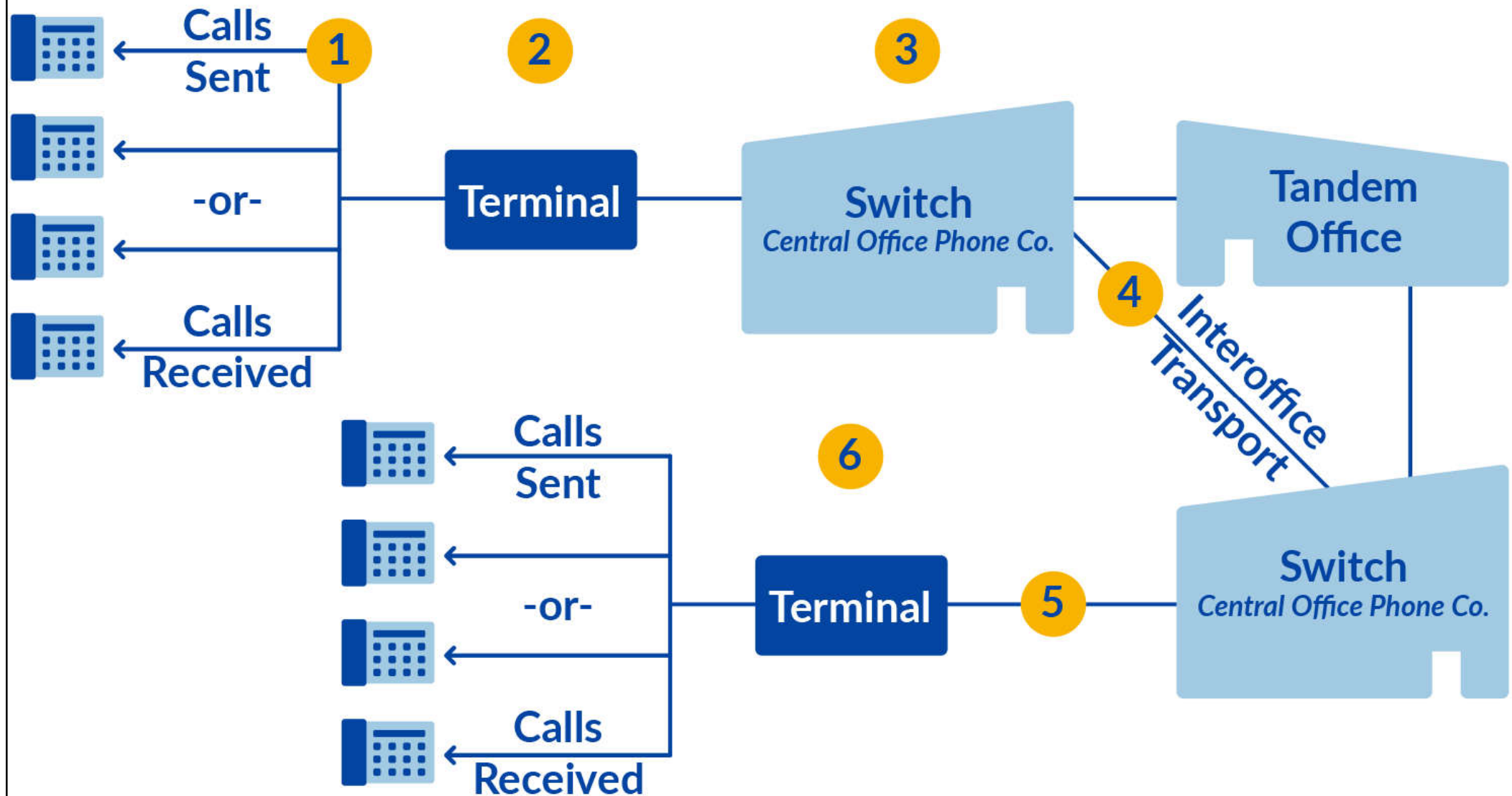


# PBX and PA systems

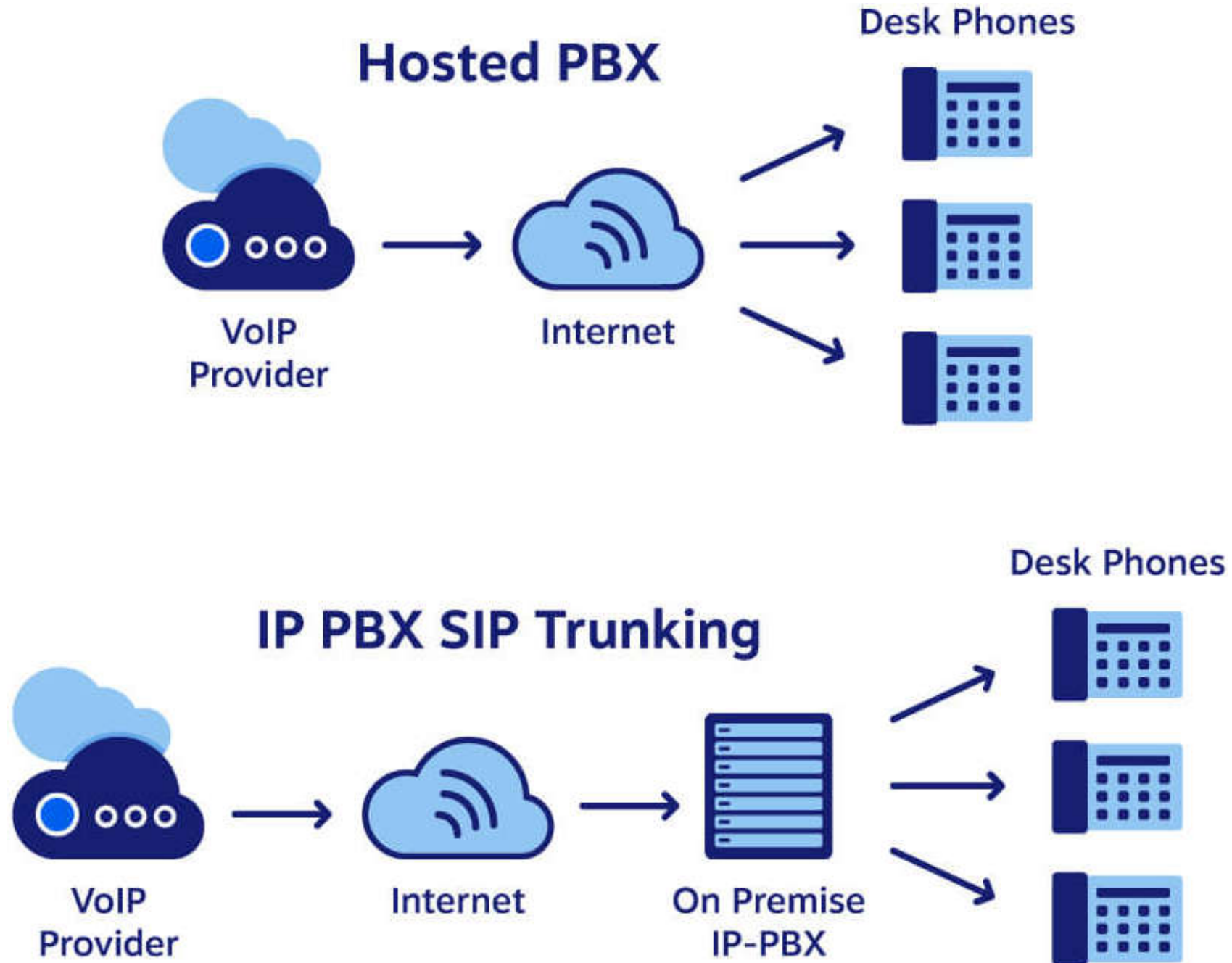
- A PBX includes:
  - Telephone trunk (multiple phone) lines that terminate at the PBX
  - A computer with memory that manages the switching of the calls within the PBX and in and out of it
  - The network of lines within the PBX
  - Usually a console or switchboard for a human operator
- Larger manufacturers of PBXs:
  - Lucent Technologies, NORTEL, Rolm/Siemens, NEC, GTE, Intecom, Fujitsu, Hitachi, and Mitel
- Latest trends: “IPBX” uses Internet Protocol to carry calls, the use of cloud PBX (hosted/virtual PBX)



# Plain old telephone system using publicly switched telephone network (PSTN)



# New PBX system using Internet Protocol (IP), Session Initiation Protocol (SIP) & Voice over Internet Protocol (VoIP) technology



(Source: <https://www.nextiva.com/blog/what-is-pbx.html>)



# PBX and PA systems

- Public address (PA) systems

擴音系統

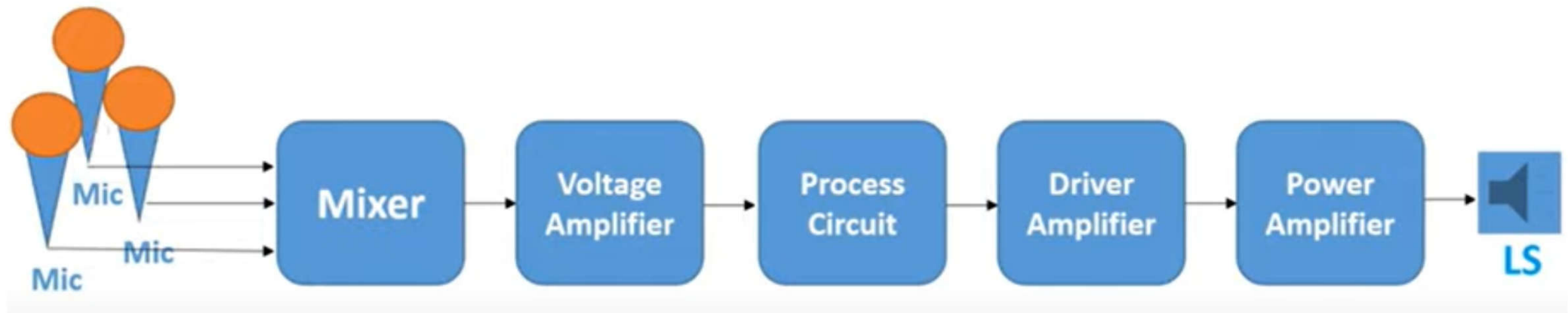
- Also known as “Tannoy”
- An electronic amplification system used as a communication system in public areas



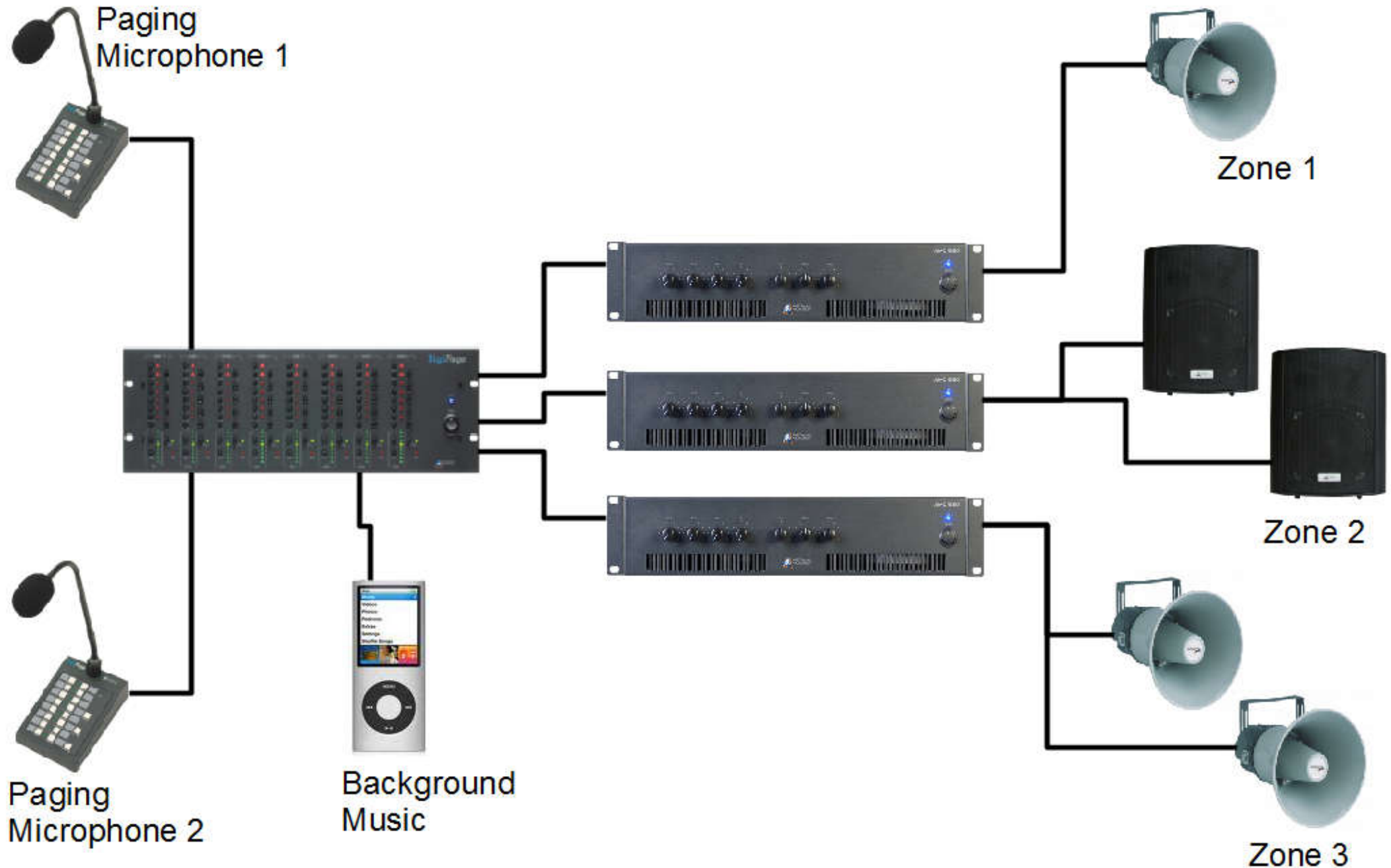
- Amplifier, loud speaker & mixer for sound control
- Can be fixed or portable, indoor or outdoor
- For general announcement, background music or emergency messages
- Details of equipment are determined by discussion with the manufacturers



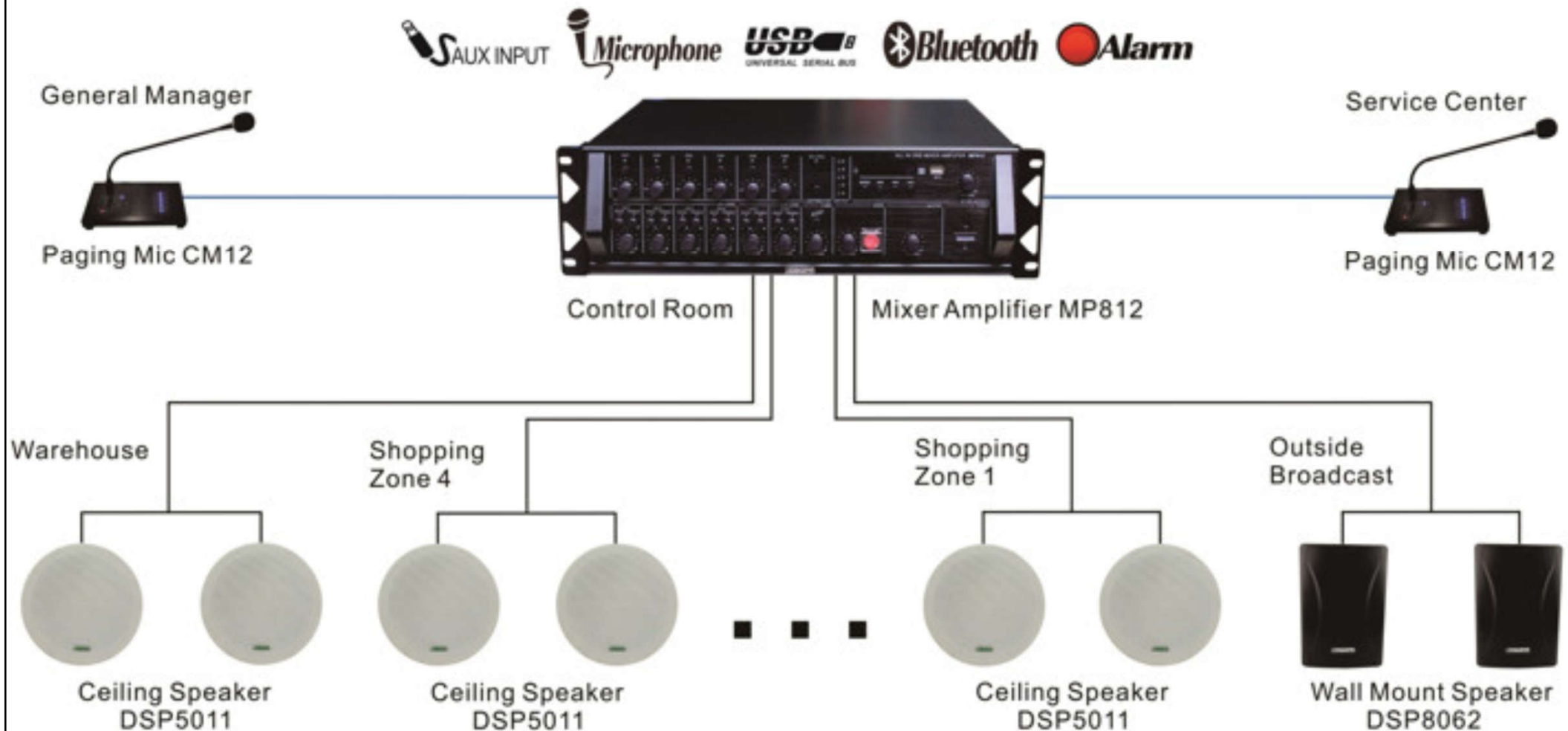
# Examples of public address (PA) systems



# Public address (PA) system with electronic sound amplification & distribution



# An examples of public address (PA) system for shopping centre



# PBX and PA systems



- Public address (PA) systems

- Typical PA components for assembly hall or playground in schools:
  - Microphone complete with floor-stand
  - Cassette deck
  - Mixer power amplifier
  - Column speakers (for assembly hall) and horn speakers (for covered playground)
  - Monitor speaker
  - Wooden Cabinet for housing the items



Do you know  
how to select &  
plan the PA  
systems?



# PBX and PA systems

- Basics of public address (PA) systems
  - Intensity of sound decreases with distance
  - Amplification is required for comfortable listening
  - For better understanding, sound quality is crucial
  - PA system can improve sound quality in big space
  - It is used in sports meet, public meetings, auditoriums, concerts, functions, etc.
  - Ambient noise, acoustic feedback & reverberation



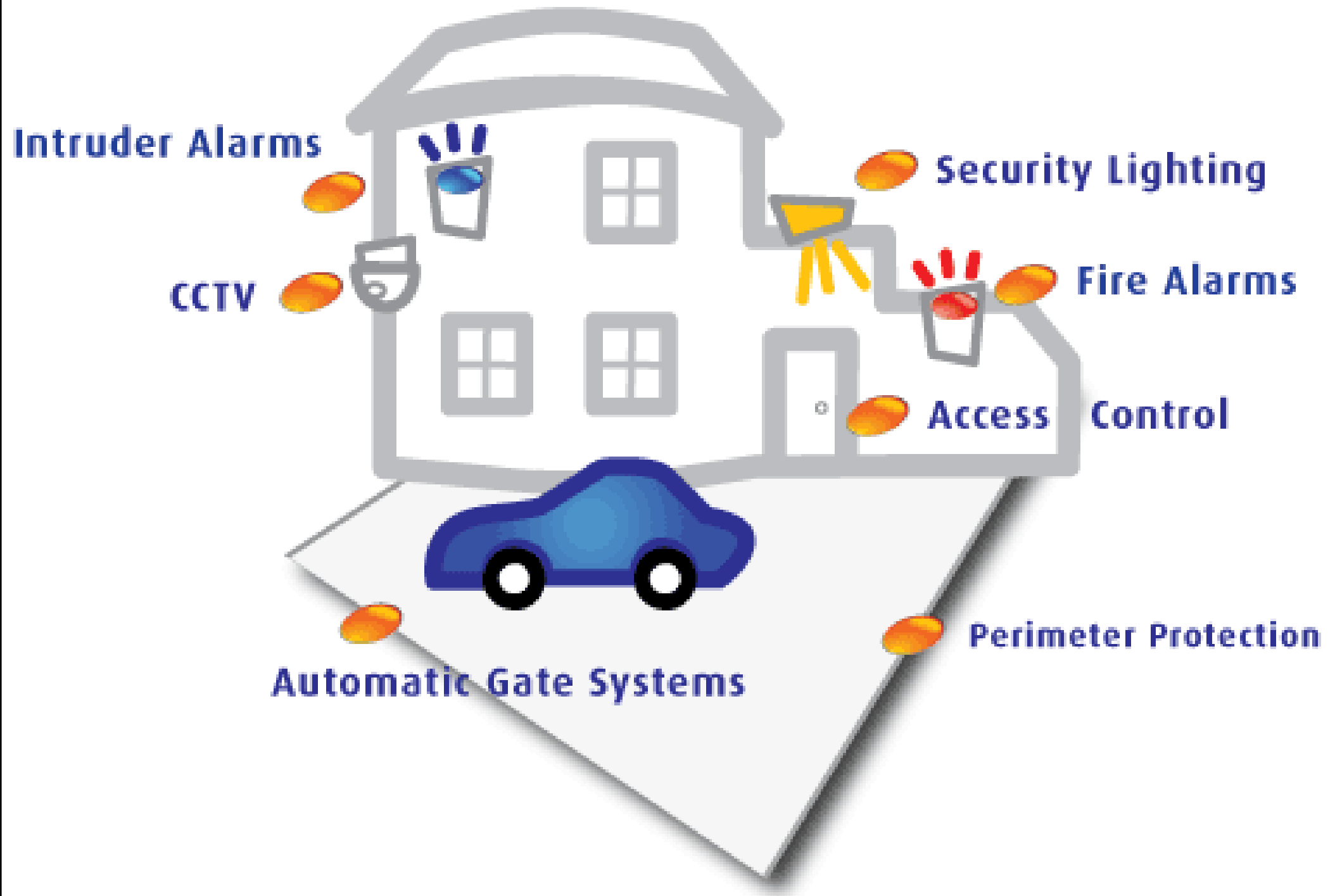
# Security systems



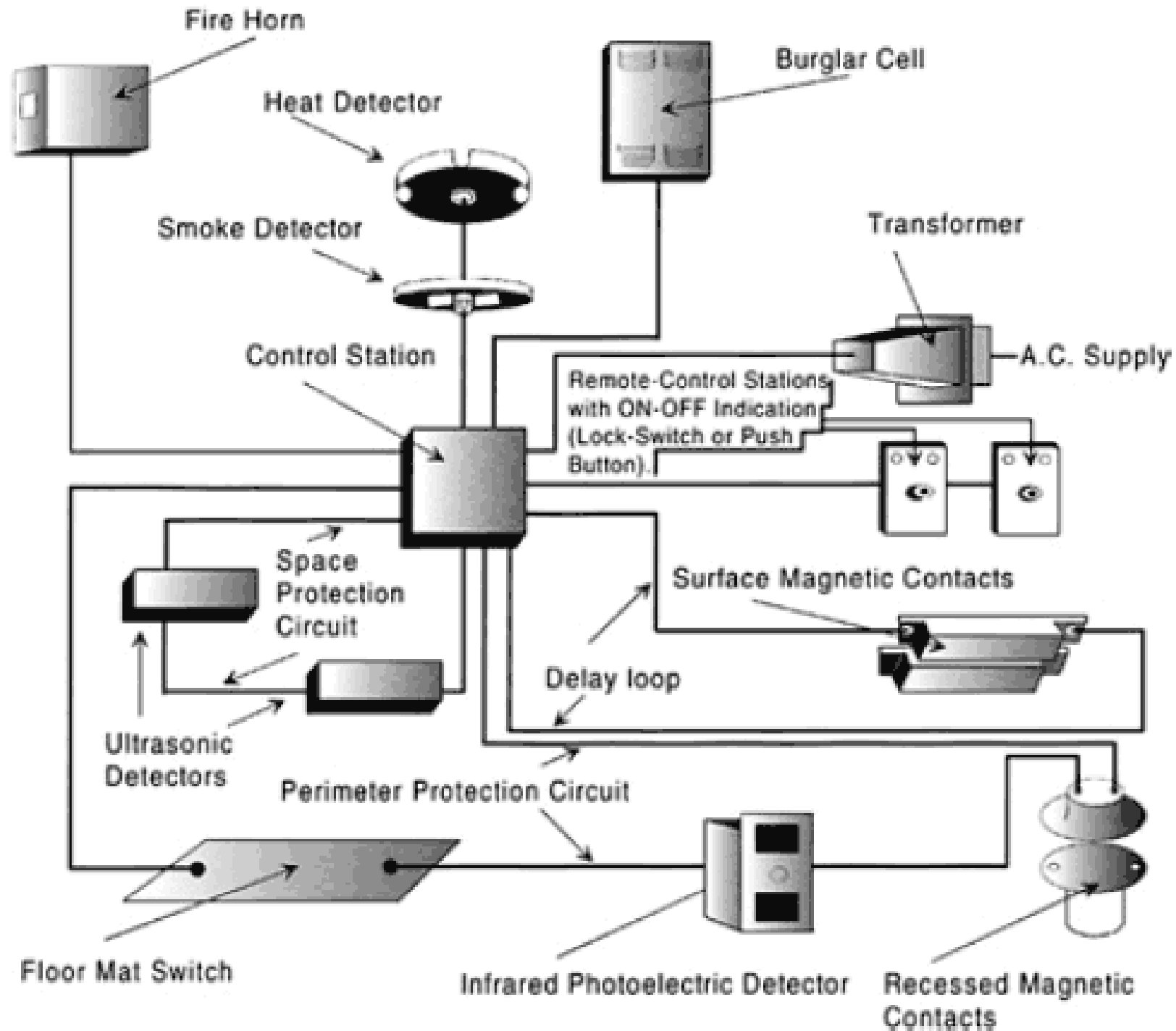
- Electronic security systems 電子防盜系統
  - For security operations like surveillance, access control, alarming or an intrusion control
  - Applied to residential buildings, workplaces, commercial places, shopping centres, and public places like railway stations & traffic management
  - Often work together with fire alarm/detection & building automation/management systems



# Security and alarm systems



# Components for a typical security/fire-alarm system



(Source: Kennedy, T. and Traister, J. E., 2002. *Low Voltage Wiring: Security/fire Alarm Systems*)

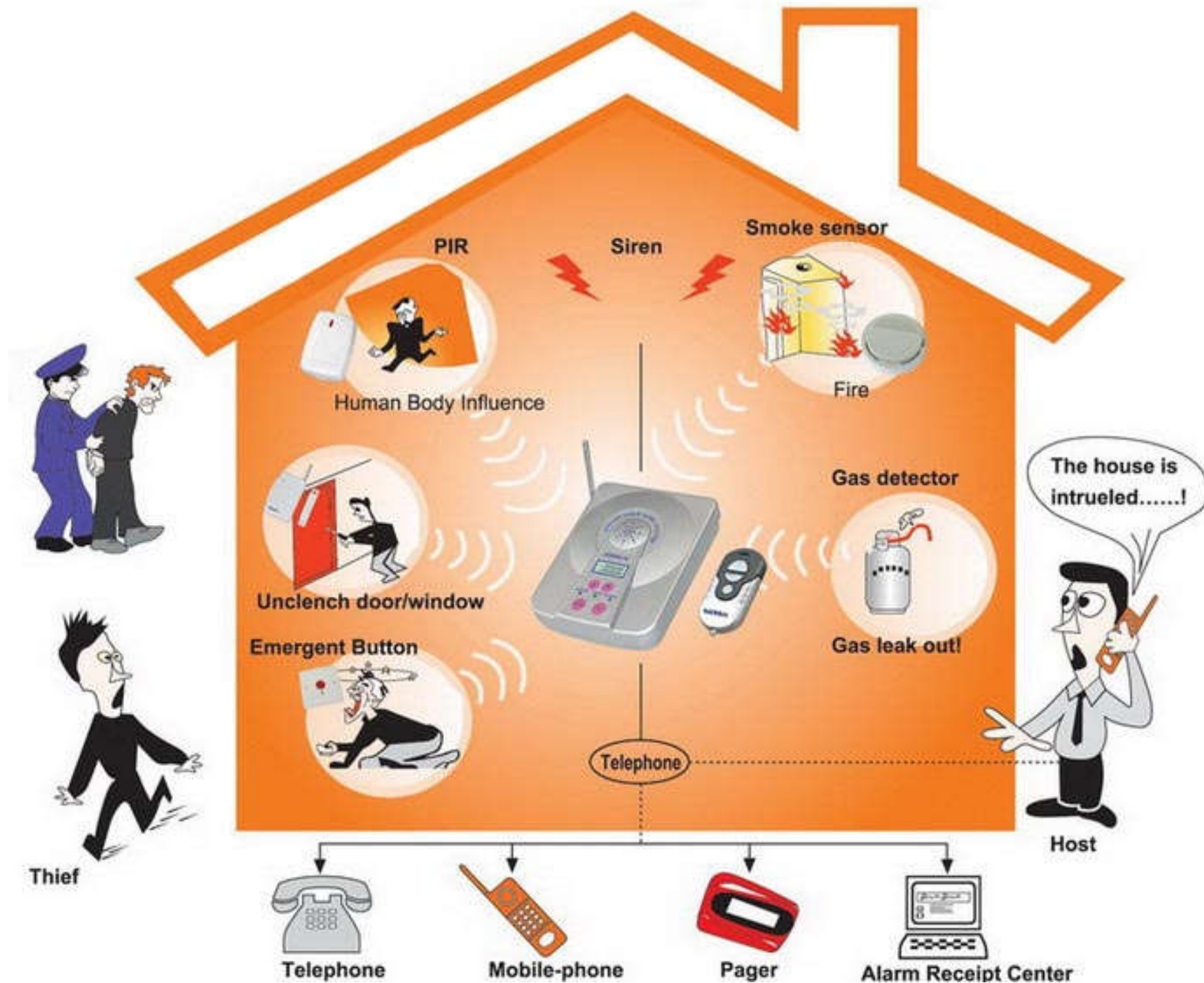




# Security systems

- Common types of security systems
  - Burglar alarm system
    - Central or local (w/ direct link to police)
  - C.C.T.V. surveillance system
  - Intruder detection & access control
  - Intercom systems (audio/video)
  - Door-phone system & interlocking system
  - P.A. (panic attack) button & sound system
  - Security lighting
  - Guard tour/monitoring system

# Example of home security system



# Typical components of security and alarm systems



**Intrusion  
Alarms**



**Closed Circuit  
Television**



**Digital Video  
Surveillance**

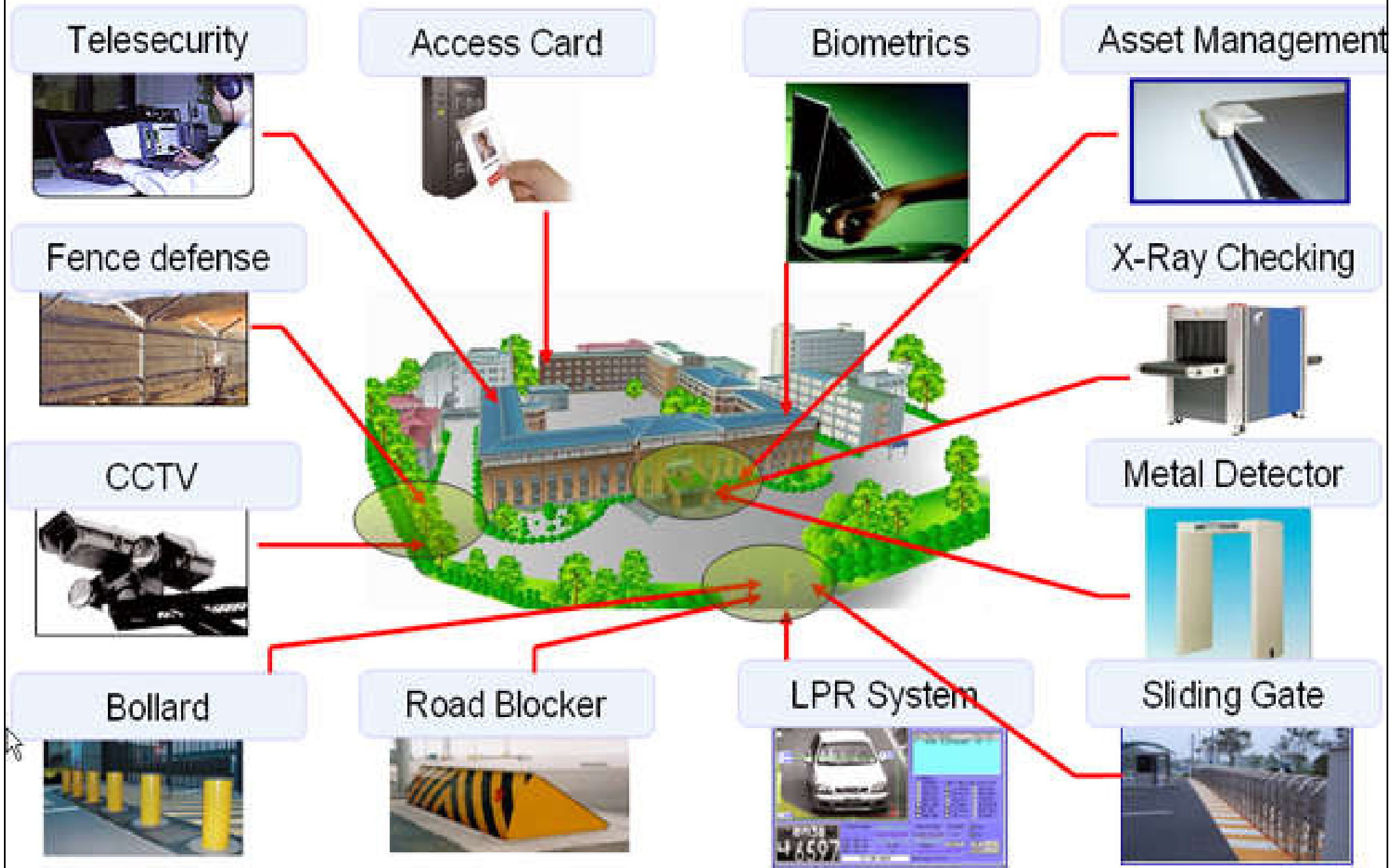


**Access  
Control**



**Critical Process  
Monitoring**

# Integrated security in a typical building management solution



# Example of a highly secured premise in Hong Kong



CCTV

Security control  
centre



Access  
control



Blocks &  
fencing





# A typical building security & car park control system



- (1) Building entry access system with intercom system
- (2) Lift access control restricting tenants within floors
- (3) Secure alarmed areas within office complexes
- (4) Energy management & building service control systems (lighting and air conditioning)
- (5) Car park access control for entry and exit

(Source: <http://www.baps.co.nz>)





# Security systems

- Security Products (HK Police Crime Prevention)  
[http://www.police.gov.hk/ppp\\_en/04\\_crime\\_matters/cpa/sec\\_products.html](http://www.police.gov.hk/ppp_en/04_crime_matters/cpa/sec_products.html)
  - Access control systems, alarms, CCTV
  - Guard monitoring systems
  - Security lighting
  - Locks
  - Perimeter protection (fencing, barriers)
  - Personal panic alarm
  - Property marking
  - Screening, storage
  - Vehicle security system

Are you  
aware of the  
security  
products  
around us?

# Security systems



- Security company licence in HK
  - Type I – provision of security guarding services
  - Type II – provision of armoured transportation services
  - Type III – installation, maintenance and/or repairing of a security device and/or designing (for any particular premises or place) a security system incorporating a security device
- Managed by the Security and Guarding Services Industry Authority (SGSIA)



<http://www.sb.gov.hk/eng/links/sgsia/>



# CCTV systems



- Closed circuit television (CCTV) system 閉路電視

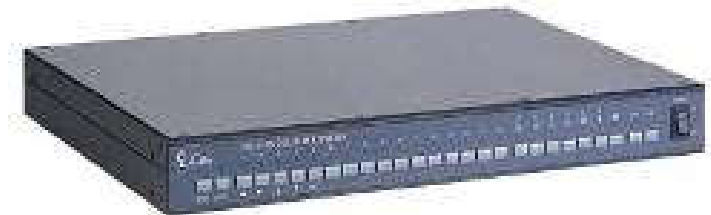
- Functions

- 24 hour surveillance/deterrence
- Real time or time lapse recording (on a closed loop basis)
- Motion/alarm activated monitoring & recording
- Area search using remotely controlled cameras
- Integration with access control & other security systems

- Components (now mainly digital)

- Video camera (colour or monochrome)
- Monitors, recorders and switchers
- Multiplexer (triplex operation simultaneous playback and recording)

- Key factors: quality, storage, export, playback



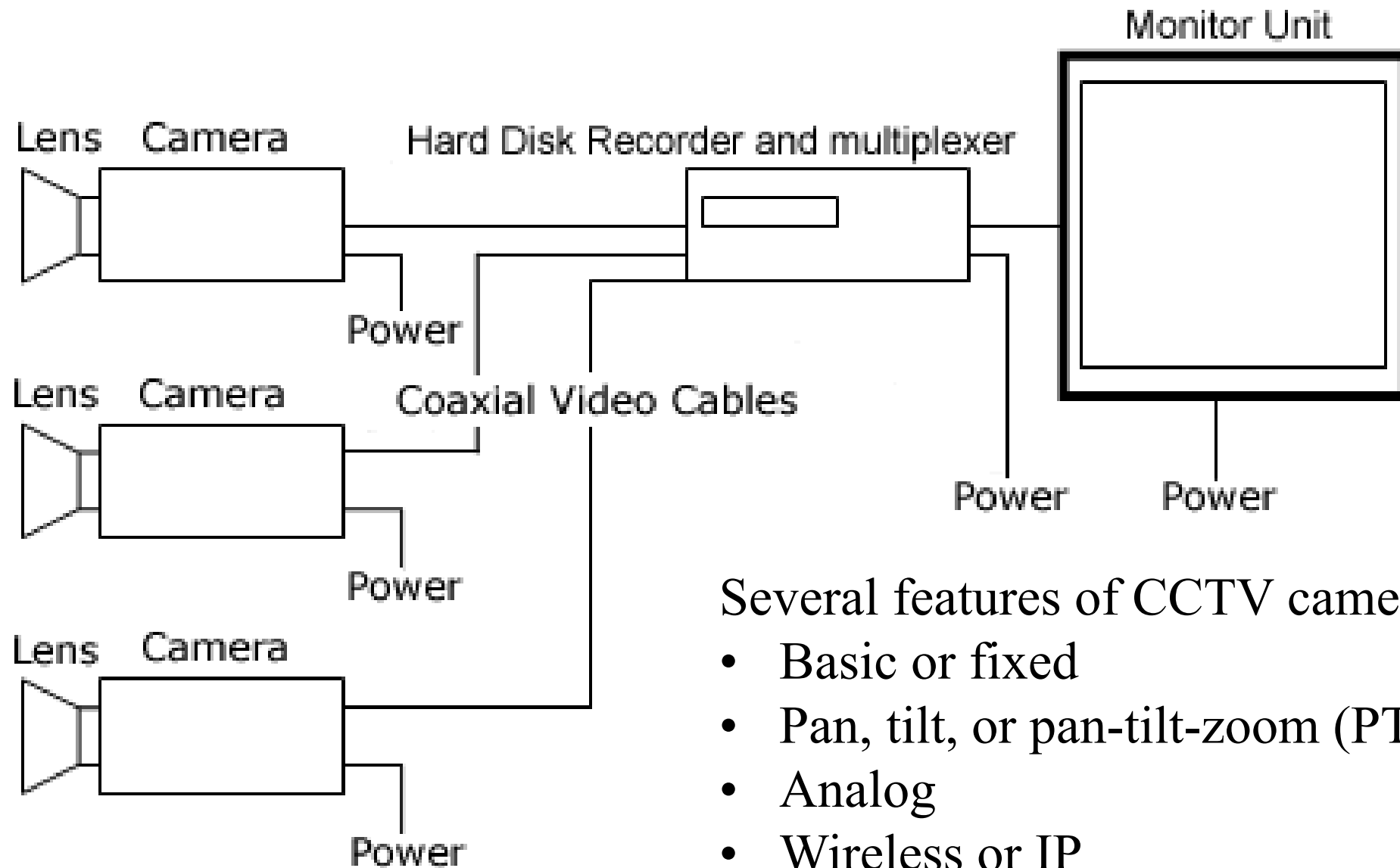
# Different types of CCTV cameras



Types of cameras:-

- Dome camera
- Bullet camera
- Fisheye camera
- C-Mount camera
- Pan-tilt-zoom (PTZ) camera
- Day/Night camera
- Thermal camera
- Infrared/Night vision camera
- Network/IP camera
- Wireless camera
- High-definition HD camera

# Basic concept of a multi-camera CCTV system



Several features of CCTV cameras:

- Basic or fixed
- Pan, tilt, or pan-tilt-zoom (PTZ)
- Analog
- Wireless or IP
- Night vision
- Exterior
- Motion-detection



# CCTV systems

- Uses of CCTV systems:
  - Crime prevention (and deterring)
  - Crime investigation (a forensic tool)
  - Vehicle traffic monitoring (e.g. in car parks)
  - Pedestrian traffic (crowded) monitoring
  - Allow drivers to confirm people are clear of doors
  - Monitor access to secure or private areas
  - Employee/staff monitoring
  - Video surveillance in schools, shops or homes



The resolution makes a big difference – comparing CCTV cameras



(Source: <https://kintronics.com/ip-cameras-better-analog-cctv-cameras/>)

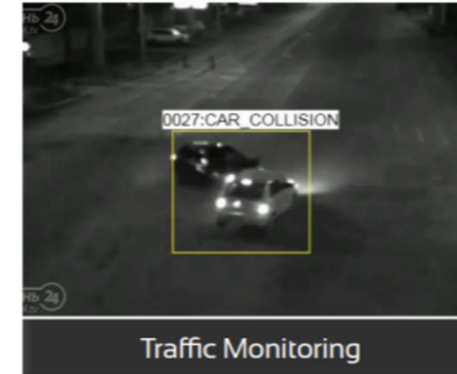
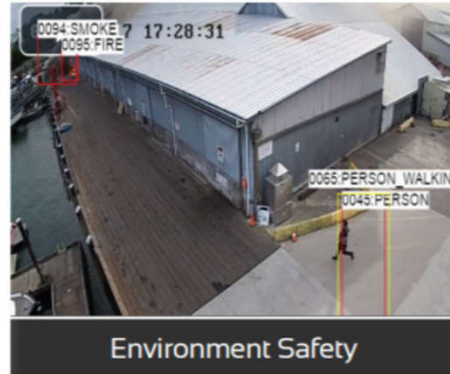


# CCTV systems

- Technological advances of CCTV systems:
  - Video at full-colour & high-definition
  - Compression & storage of recordings
  - Save to the cloud via wired or Wifi network
  - Video content analysis (e.g. artificial intelligence)
    - Facial & image recognition, behaviours (suspicious or violent activities)
  - Internet protocol (IP) cameras
  - Wireless & networking security cameras
  - Talking CCTV (by the operator)

Do you know  
the potential  
of CCTV for  
image  
recognition?

# Behavioral recognition by using CCTV video content analysis



## Violent Activity

- People fighting
- Brawl/Riot
- Vandalism
- Person with blood
- Person with weapon

## Suspicious Activity

- Contextual loitering, tailgating
- Person abandons an object
- Person with mask /no mask
- Person running/walking/falling
- Person gets in/out of a vehicle

## Person & Crowd Behaviour

- Crowd classification by size
- Crowd moving /gathering /dispersing
- Occupancy analytics
- Person to person proximity

## Perimeter Protection

- Person entering/exiting predefined zone
- Vehicle entering/exiting predefined zone

## Traffic Monitoring

- Vehicle counting & classification
- Vehicle behaviour
- Accidents & hazards recognition
- Urban mobility (vehicle+person)
- Traffic congestion

## Environment+Personal Safety

- Smoke/Fire
- Person with/without safety equipment
- Person/Equipment in hazard
- Person falling/on the ground



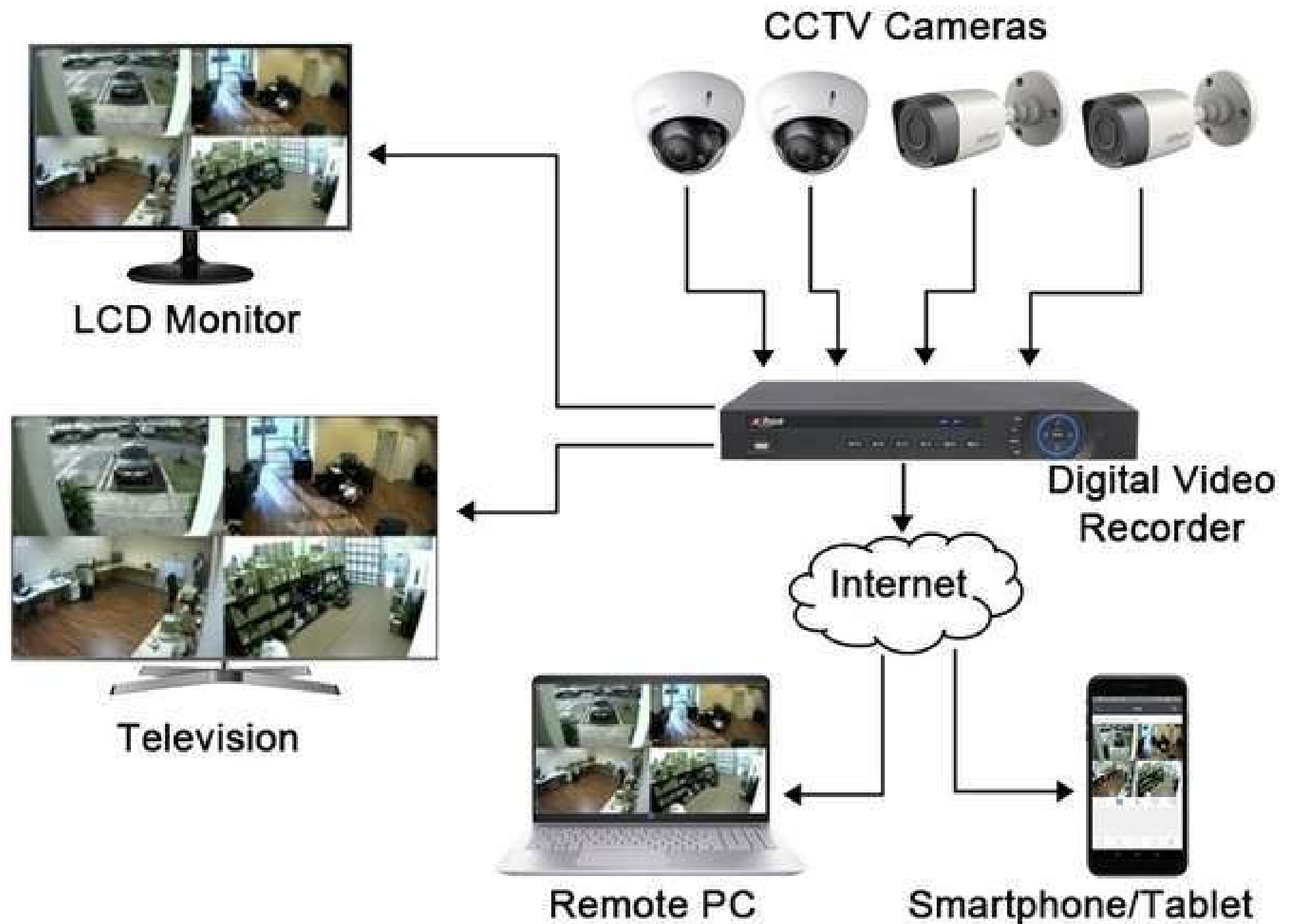
Video understanding for security and surveillance (3:04)

<https://www.viisights.com/products/wise/>

(Source: <https://www.viisights.com/>)



# Internet-based CCTV systems

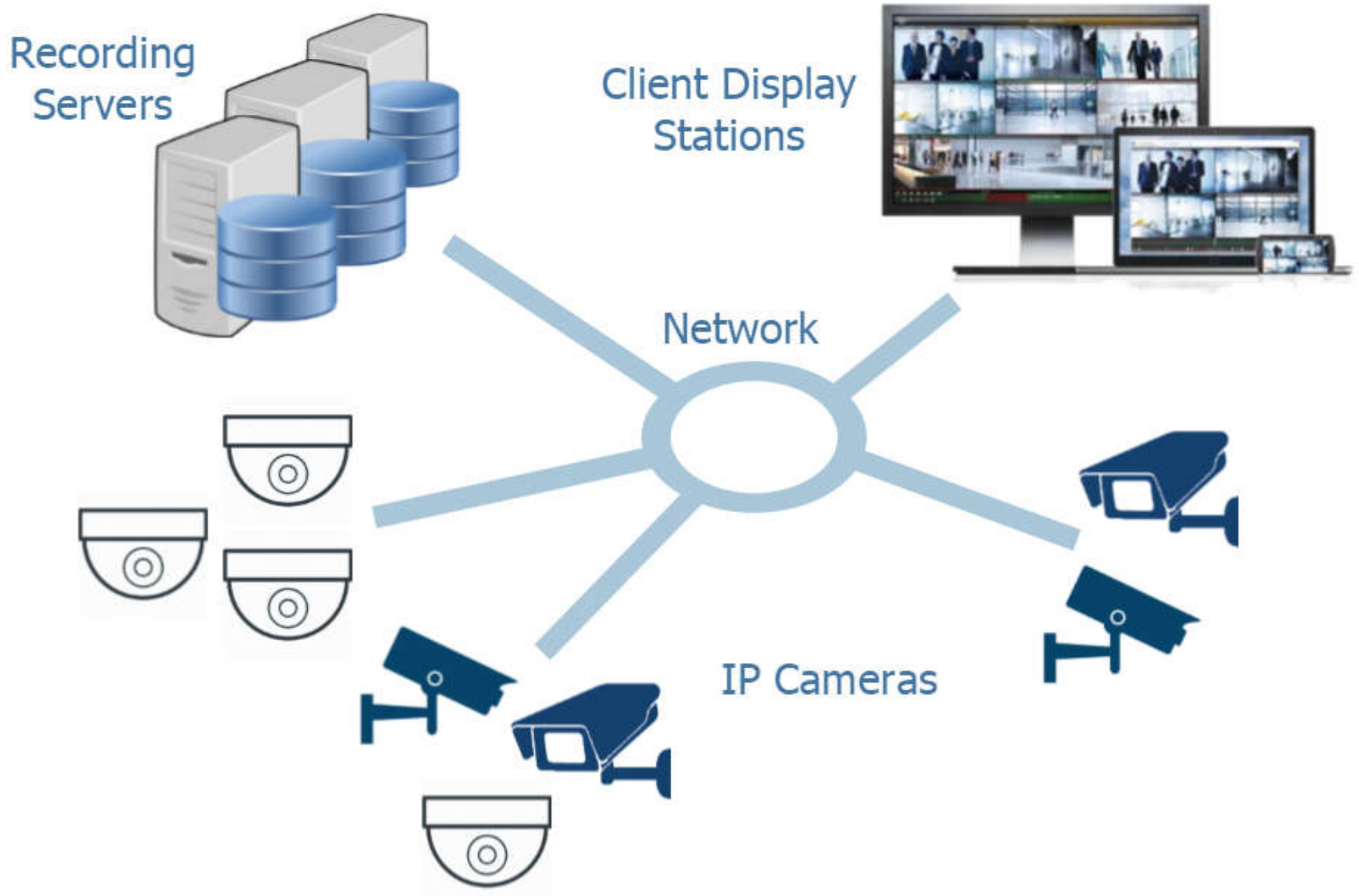




# CCTV systems

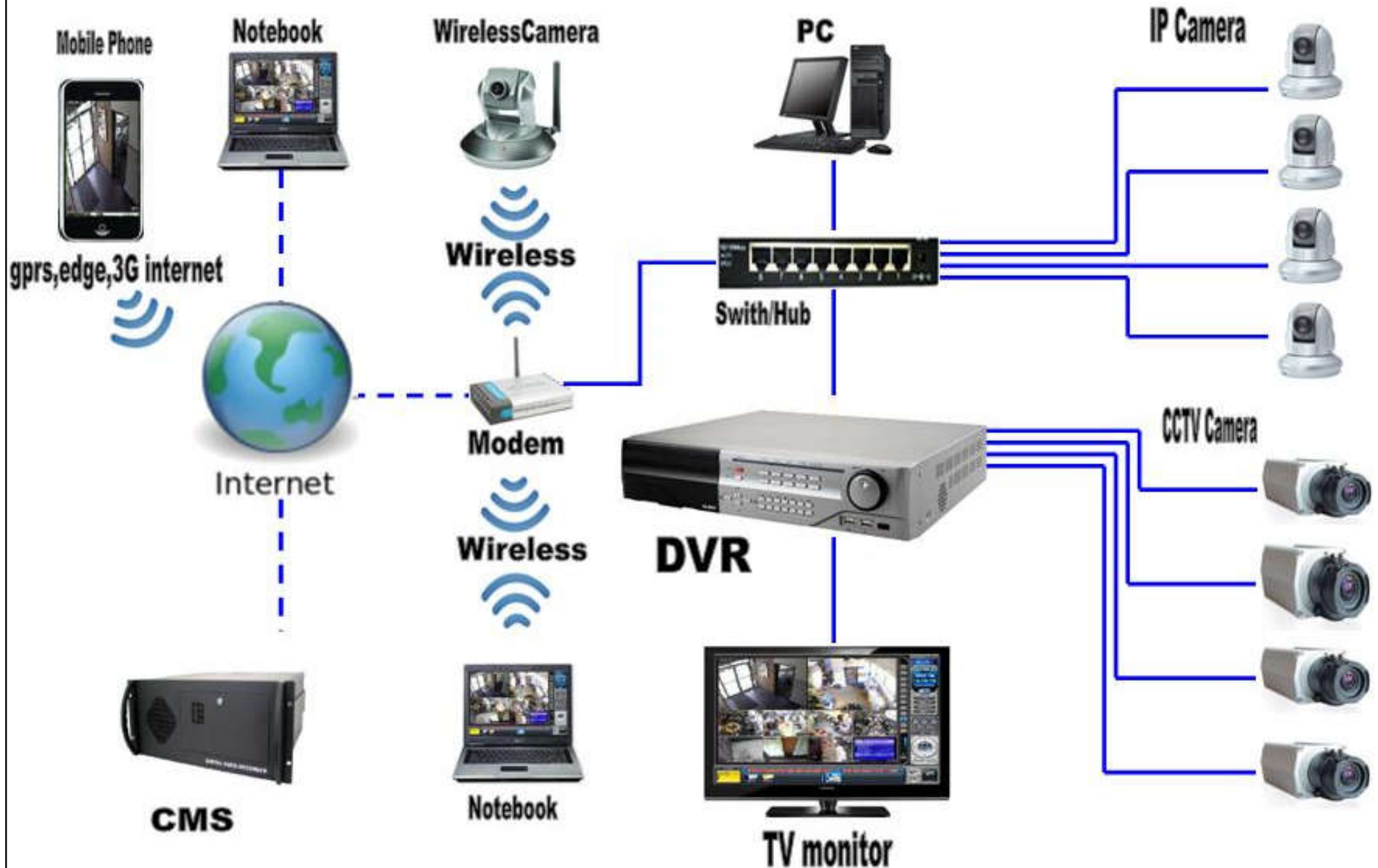
- Internet protocol (IP) cameras
  - Connect to the network rather than to a digital video recorder (DVR) using a coax cable
  - The IP camera system includes not only the cameras but also the video recording system
  - Network infrastructure
  - Power over Ethernet (PoE): enough power to support IP devices
  - Video management & recording system
  - Network video recorders (NVR)

# IP camera system diagram

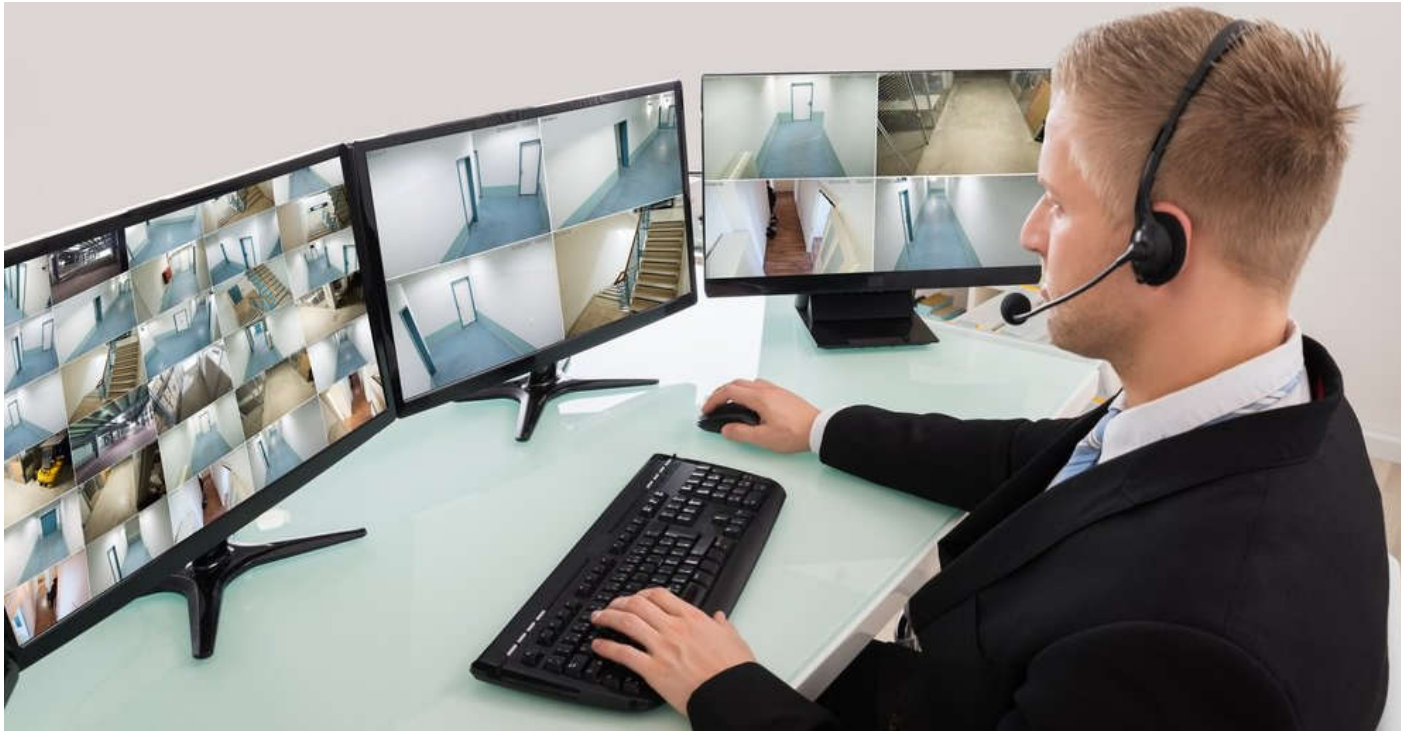




# Examples of CCTV installations with wireless, IP & analogue cameras



Talking CCTV - the system's operator can challenge criminals or members of the public via an intercom system (help stop antisocial behaviour)



# Access control systems



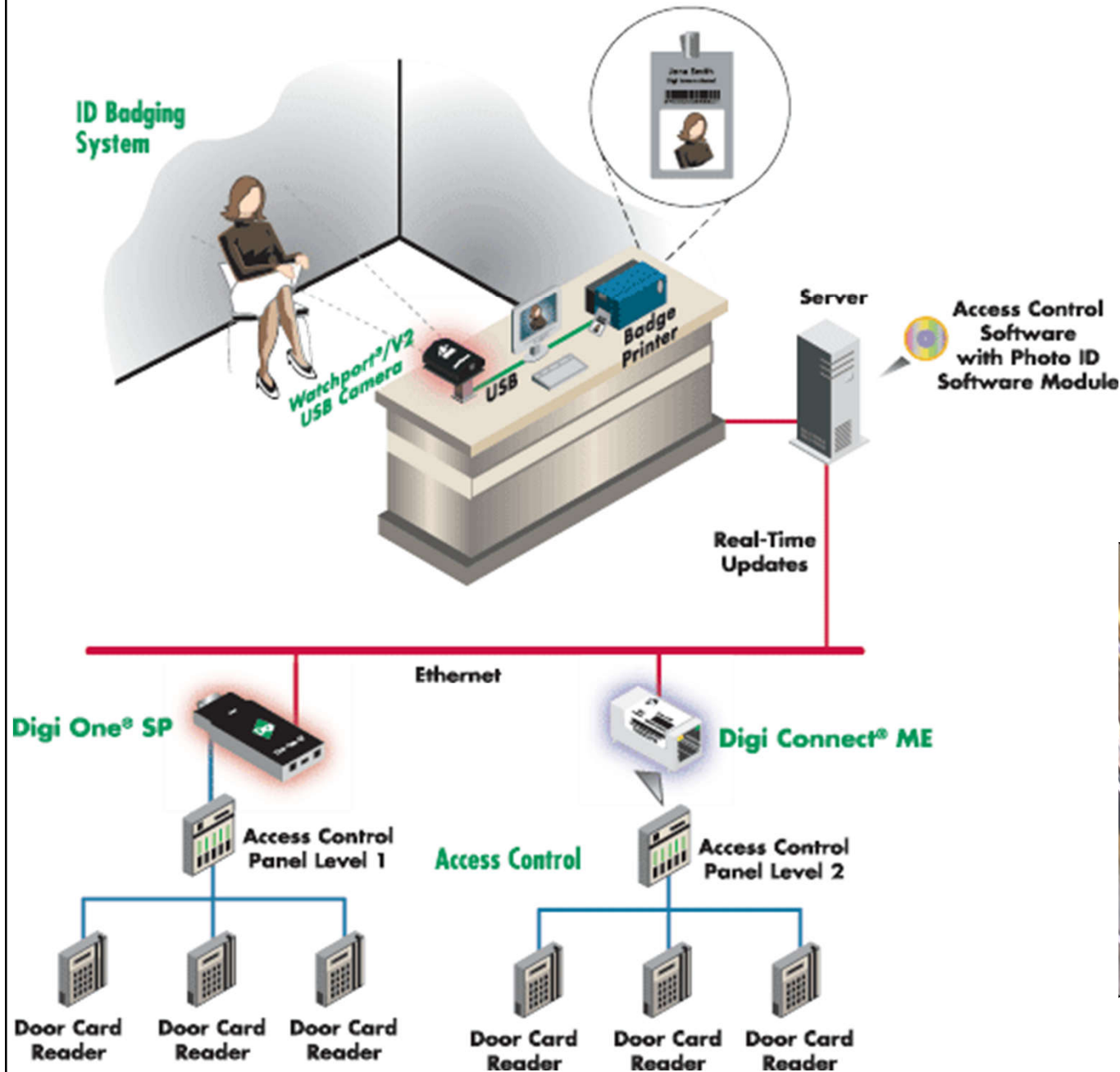
- Access control

- Stand-alone or online systems
- Methods:
  - Digital codes
  - Magnetic stripe cards
  - Embedded wire cards
  - Proximity cards/tags
  - Biometric access control (e.g. retina, finger prints)
- Pedestrian turnstiles (like those in subway stations)
- Car park control (e.g. car park ticket validation)





## Integrated Photo ID Badge and Access Control System



(Source: [www.digi.com](http://www.digi.com))

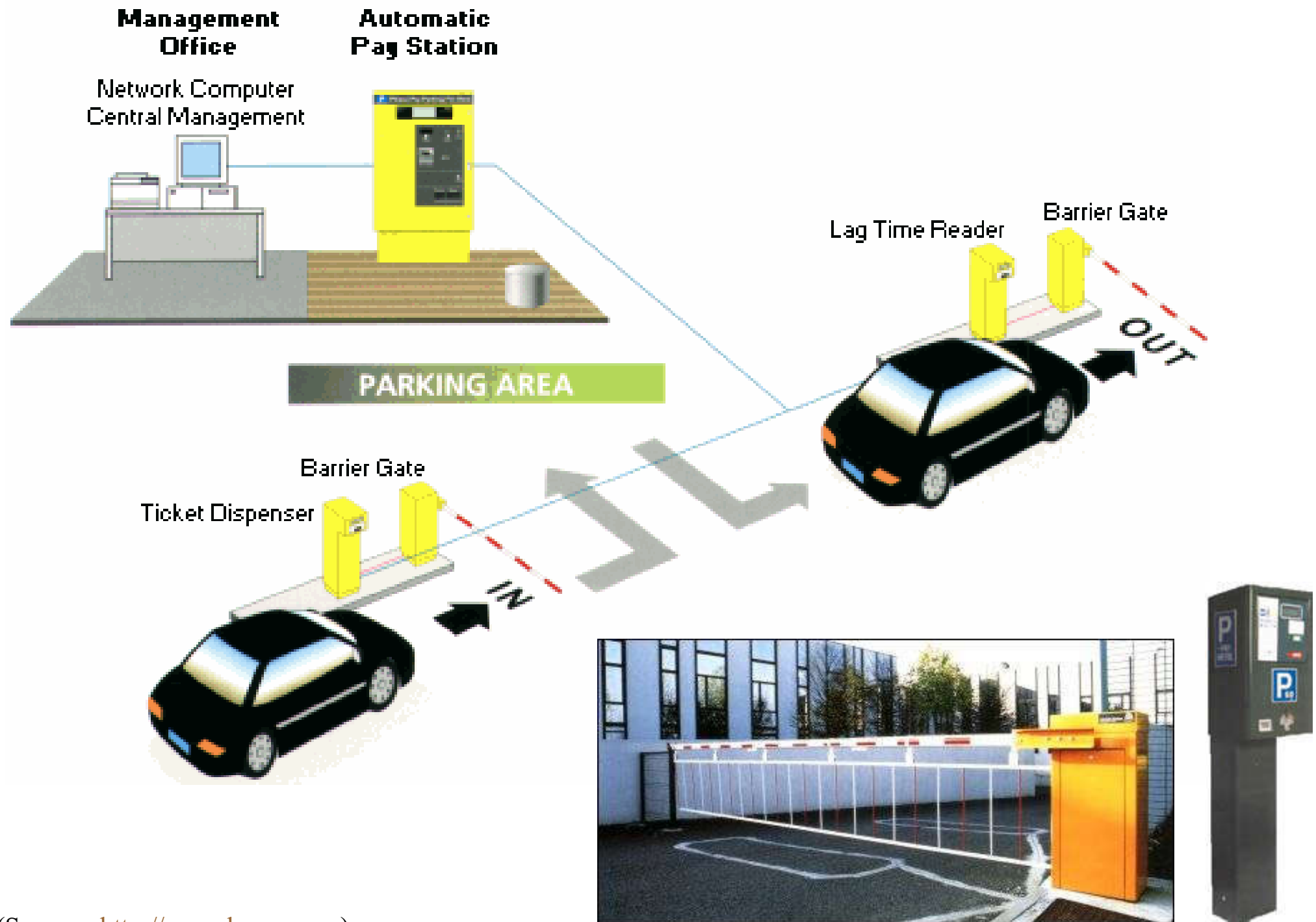
## Access control system



Pedestrian turnstiles

(Source: <http://www.baps.co.nz>)

# Car park control system



# Access control systems



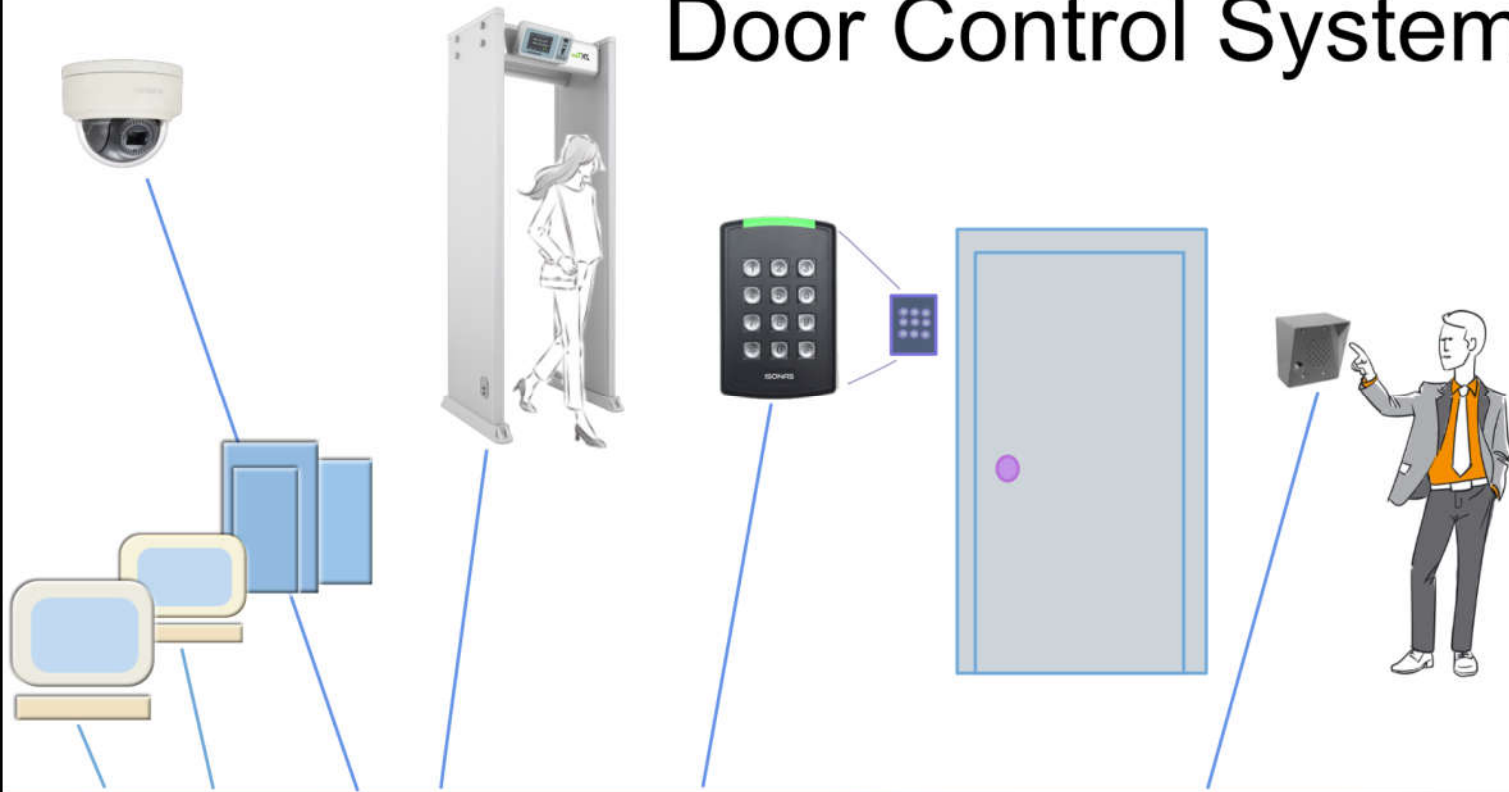
- Access control system (ACS)
  - Control passage into or out of any area
  - Computer-based, electronic access control
  - Basic components:
    - Access cards
    - Card readers
    - Access control keypads
    - Electric lock hardware
    - Access control field panels
    - Access control server computer
  - Latest trend: wireless & cloud-based systems





Examples of door access control systems (with door control readers, metal detectors, intercoms, IP cameras & emergency paging system)

## Door Control Systems



What are the key factors for door access control?



(Source: <https://kintronics.com/security-provided-access-control-systems/>)

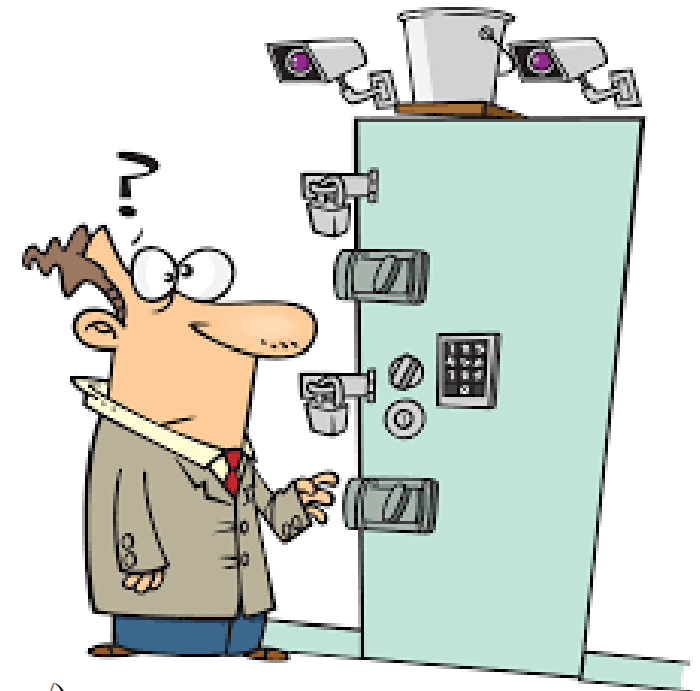
# Various levels of security for door access control systems

Level 1 Security – PIN Numbers	Lock with keypad Door Reader with keypad
Level 2 Security – Credentials	RFID IP Reader
Level 2.5 Credentials With Video	Intelligent IP Reader
Level 3 Security – Dual Authentication Systems	RFID IP Reader
Level 3.5 Dual Authentication Plus Video	Intelligent IP Reader with Keypad
Level 4 Security – Biometric Readers	Biometric IP Reader
Level 4.5 Biometric Readers Plus Video	

PIN = Personal identification numbers

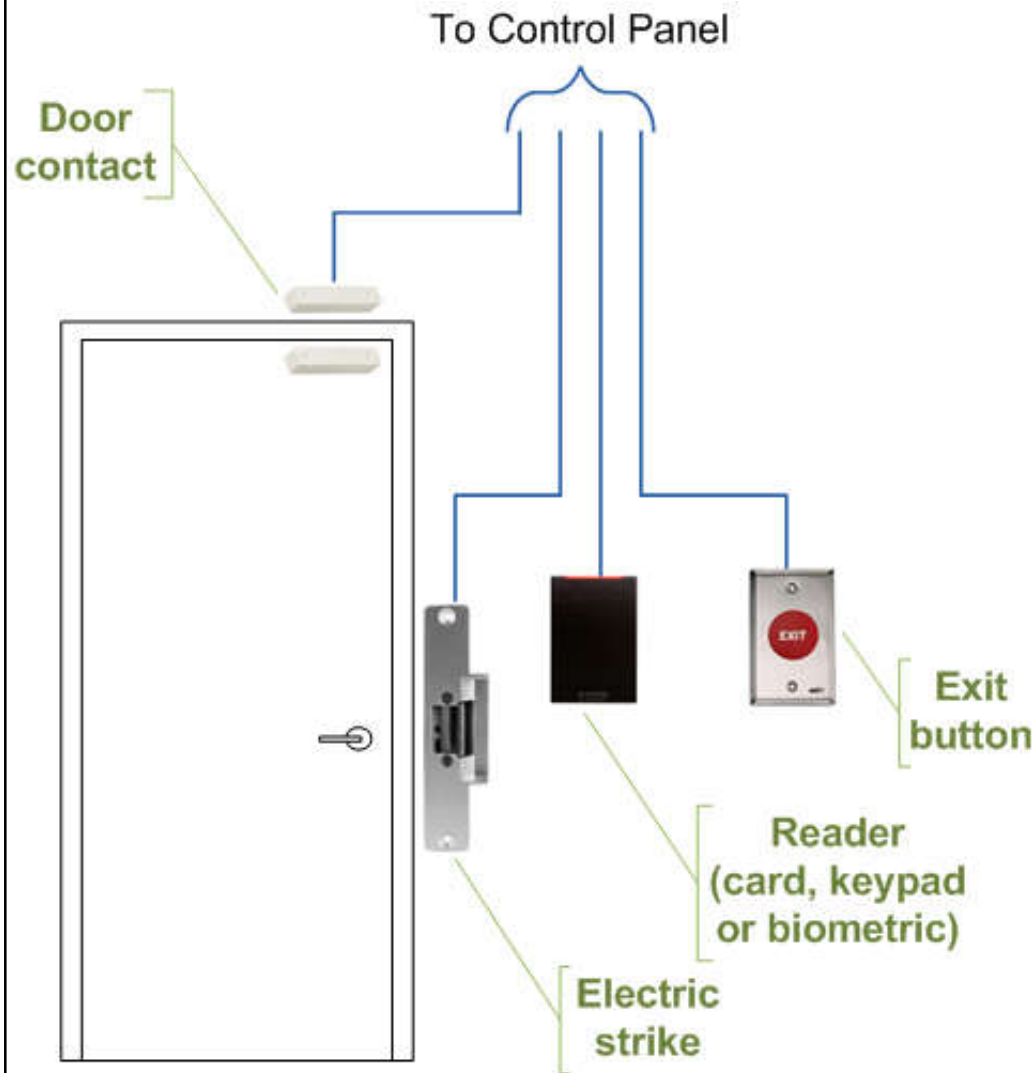
RFID = Radio frequency identification

IP = Internet protocol

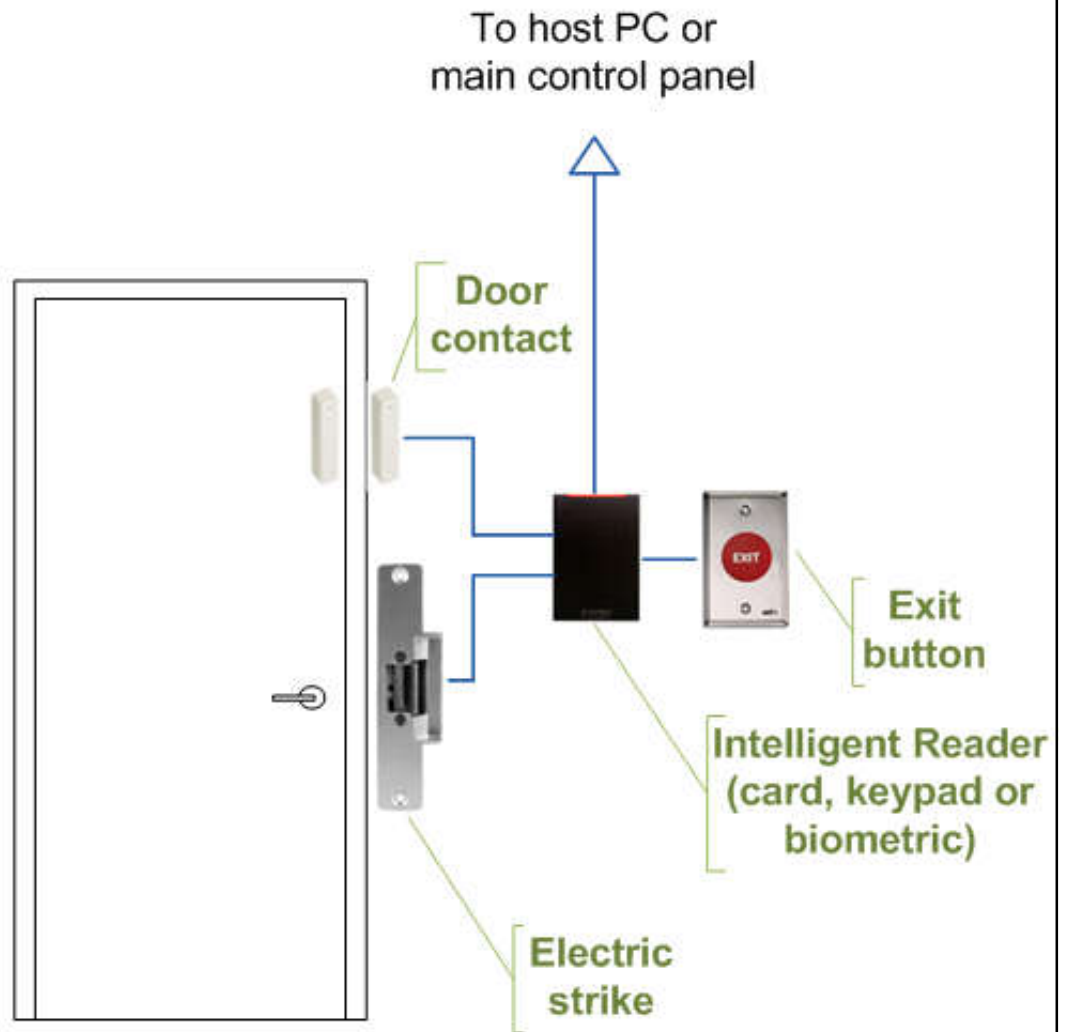


(Source: <https://kintronics.com/comparison-security-provided-door-access-systems/>)

# Typical access control door wiring

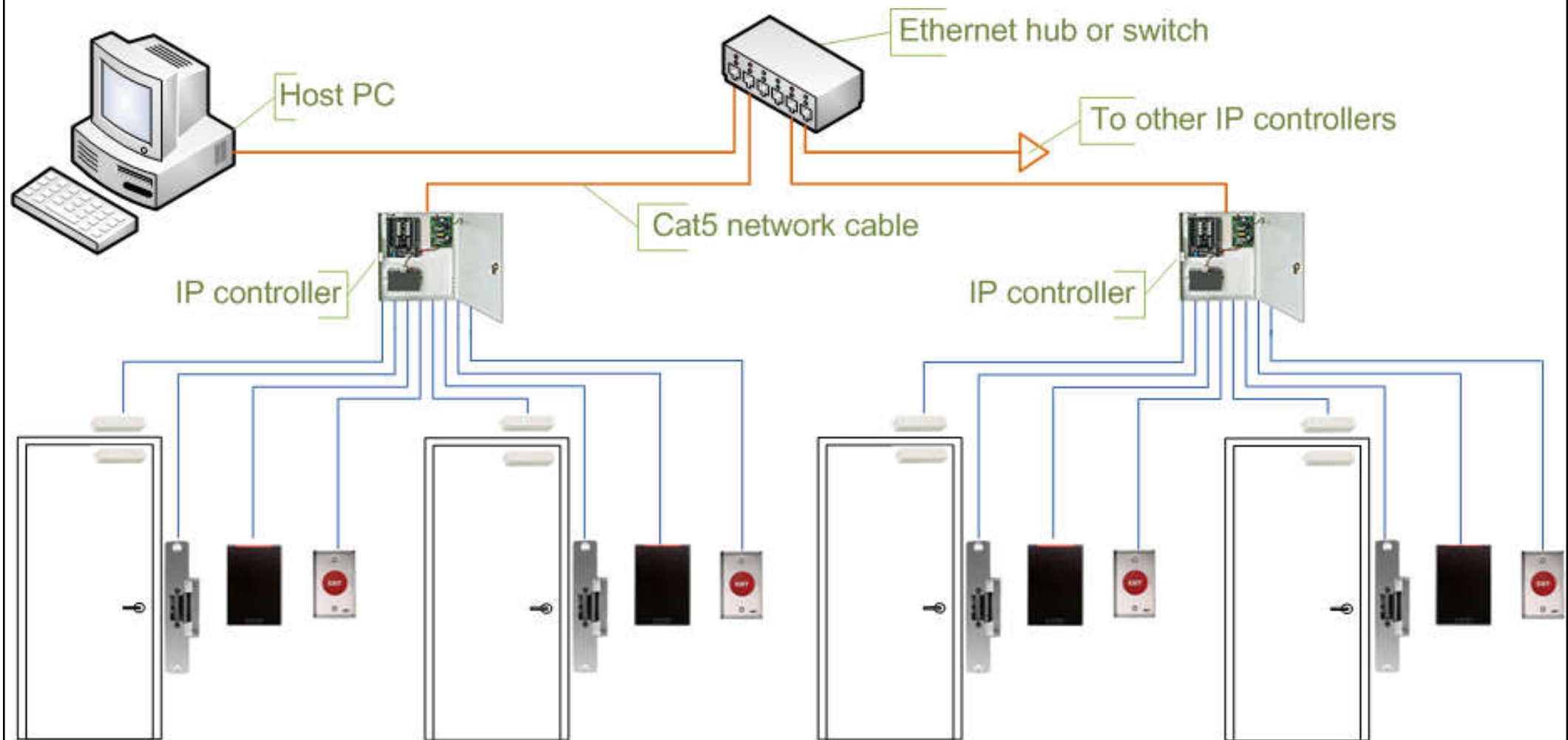


(a) With basic (non-intelligent) reader

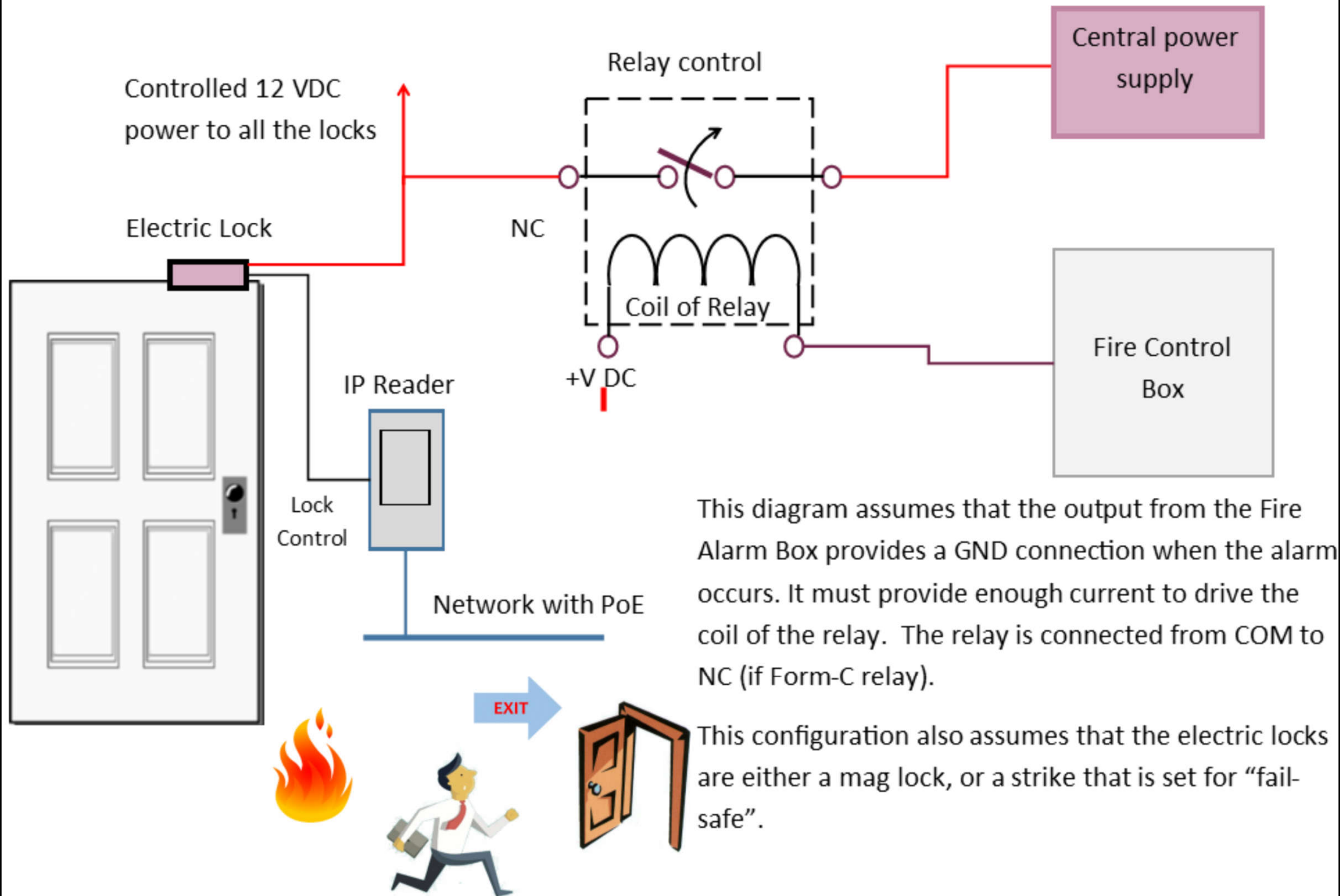


(b) With intelligent reader

# Access control system using IP controllers

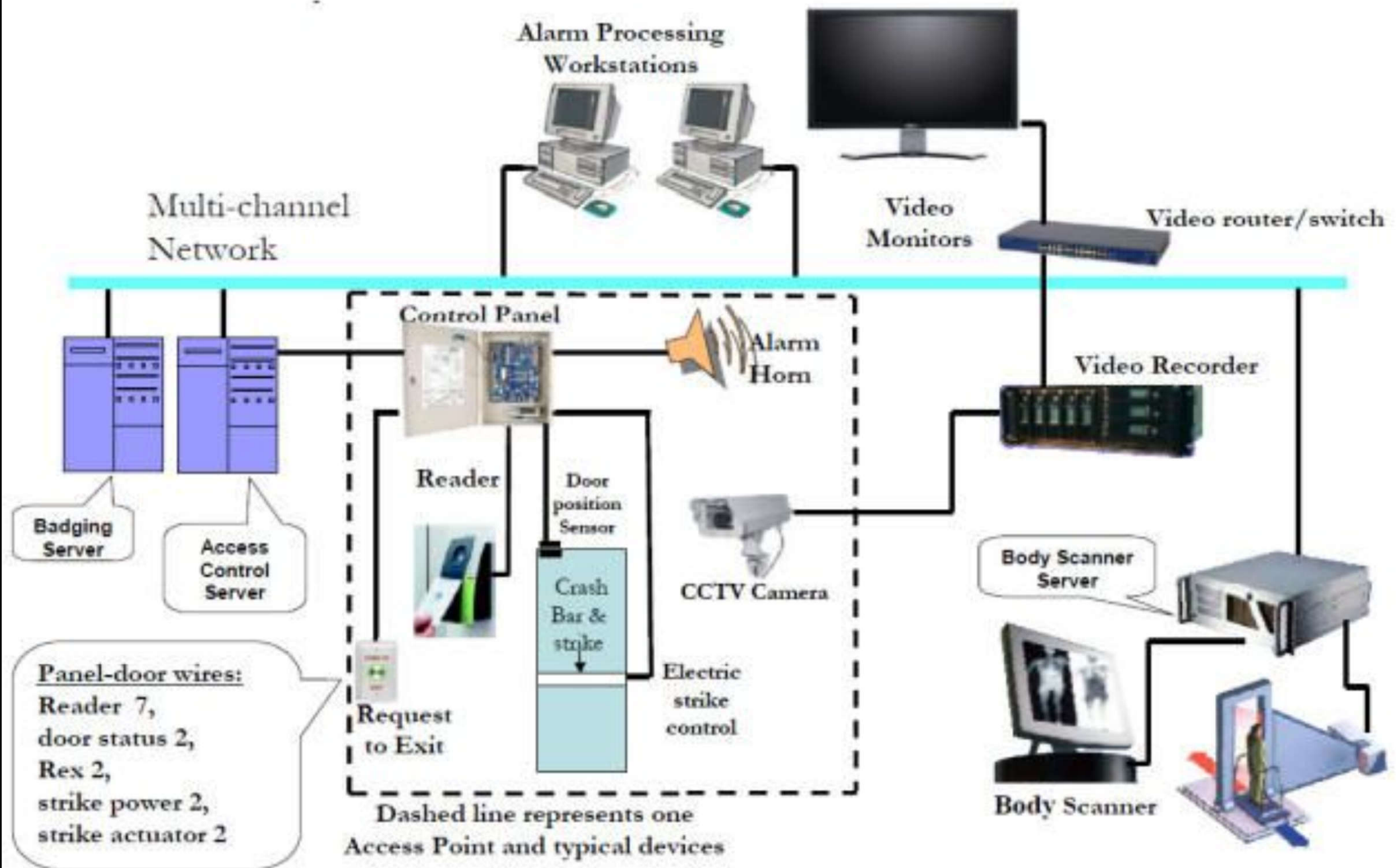


# How to integrate access control with fire alarm systems





# Architecture of an access control system with network support



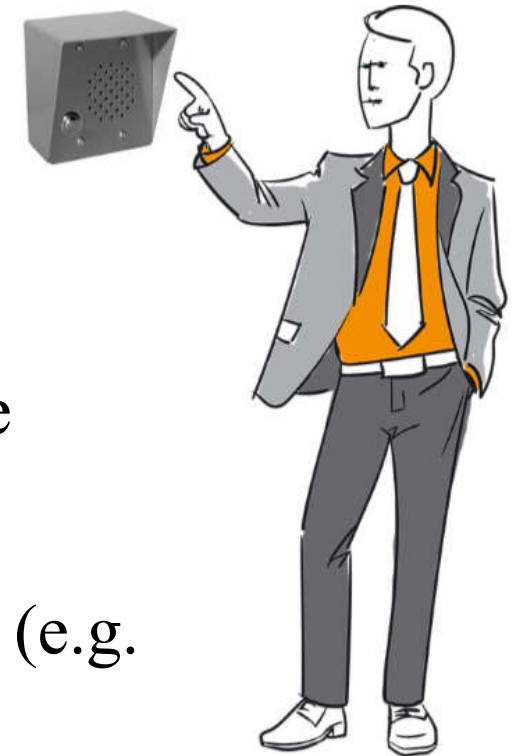


# Access control systems

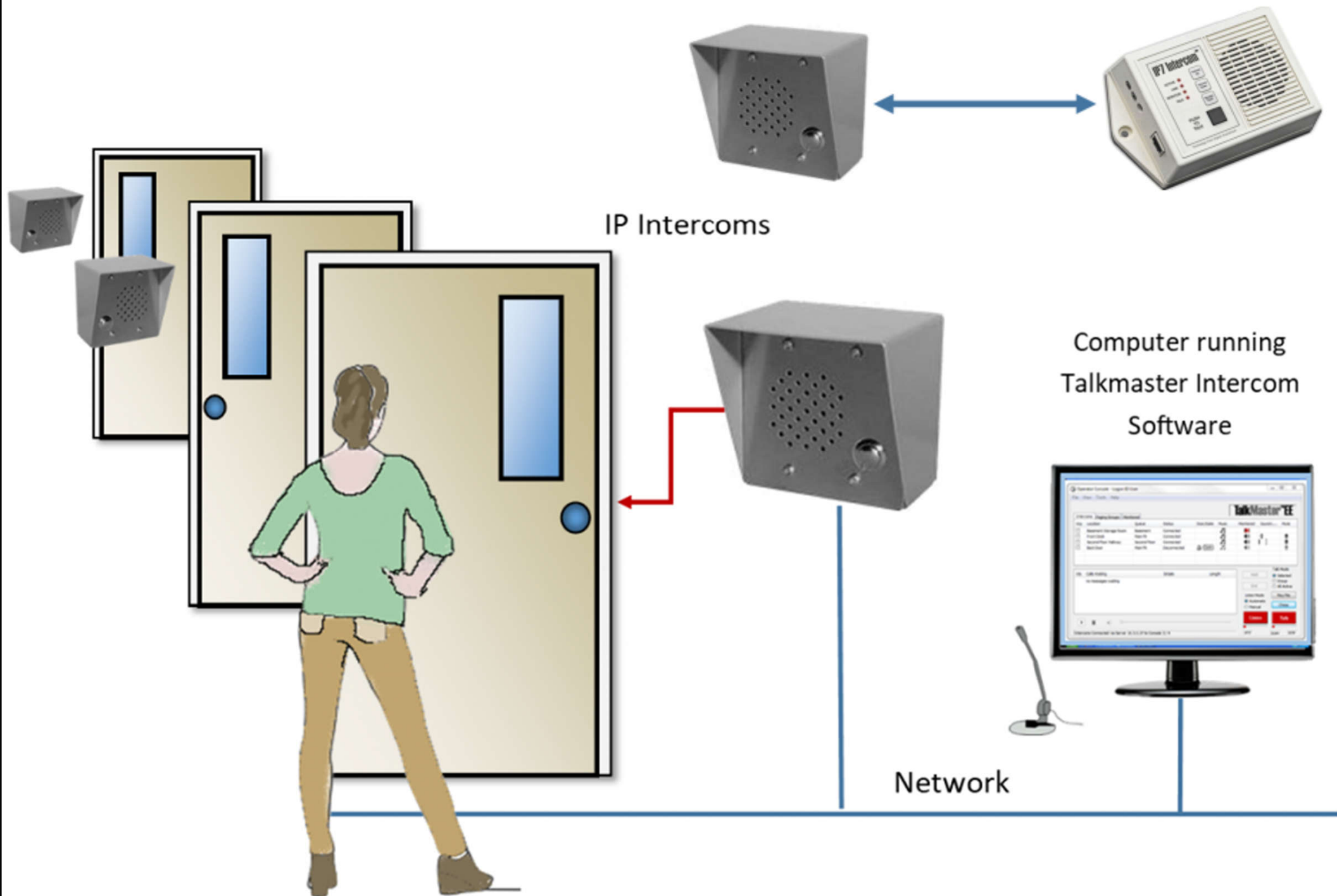


- Intercom systems

- Audio intercoms
  - One to one connections (two-way audio)
  - Many intercoms to a central control centre
- Video intercoms
  - One intercom to one or many connections (e.g. smartphones & a central computer)
  - Integrate with IP camera systems & door access control systems to provide a complete security system
- Visitor control systems (e.g. a delivery person)



# Audio intercoms for door access control

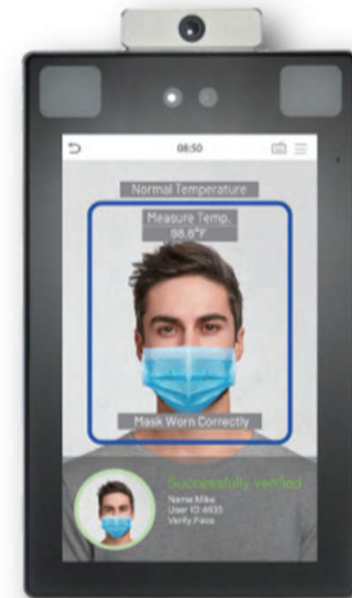
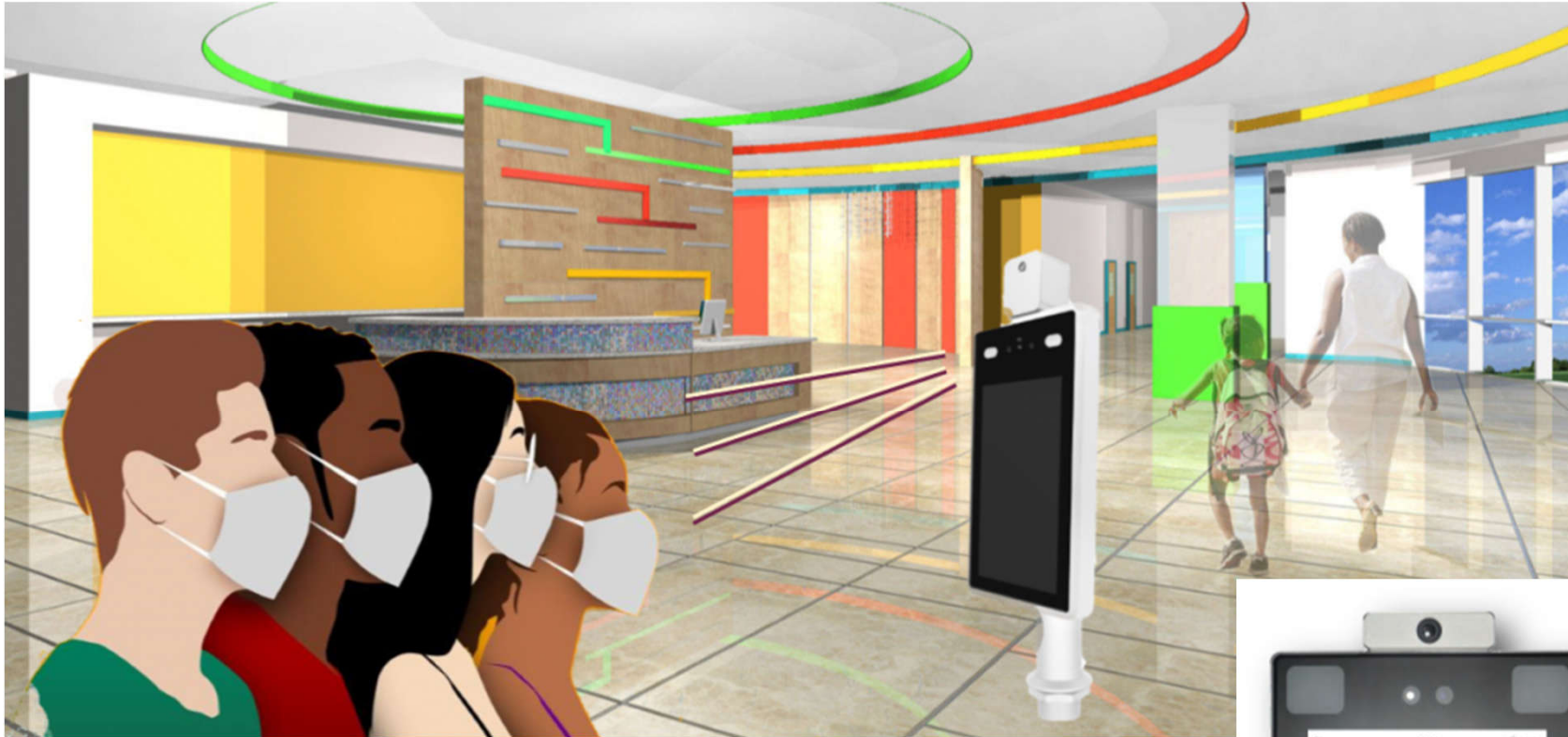


# Video intercoms and smartphone communication



(Source: <https://kintronics.com/ip-intercom-selection-and-comparison/>)

# Biometric and body temperature access control (check a person's temperature and check if they are wearing a mask)



Video: Access Control with Temperature Monitoring (1:44) <https://youtu.be/w49T2gpbz8Q>

(Source: <https://kintronics.com/solutions/ip-door-access-control/comparison-of-face-recognition-and-temperature-access-control-panels/>)



# Burglar & intruder alarms



- Burglar alarm system include:
  - Control panel
  - Keypads
  - Intruder detectors and motion detectors (e.g. passive infrared, microwave, or photoelectric)
  - Door & window magnetic contacts
  - Alarm bells or siren
  - Central monitoring station/company (optional)



# Basic approach of an alarm system

## Input

Sensors

## Control

Panel

## Output

- Bell, siren, light
- Dialer, email
- Police-connect

Detection sensors:

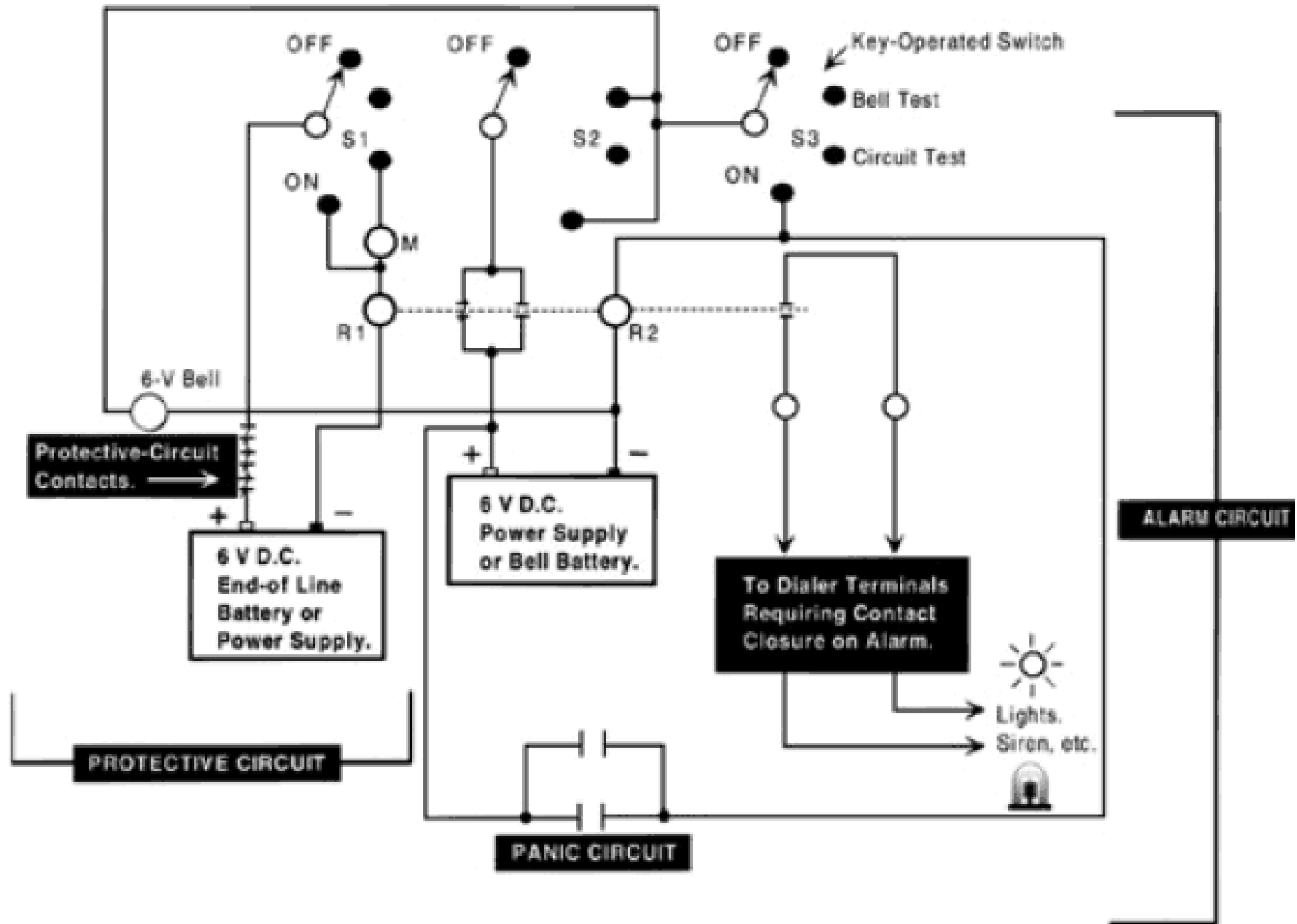
- Infrared
- Ultrasonic
- Microwave (droppler effect)
- Dual technology
- Glass breaks, switches

Annunciation/  
alarm signaling

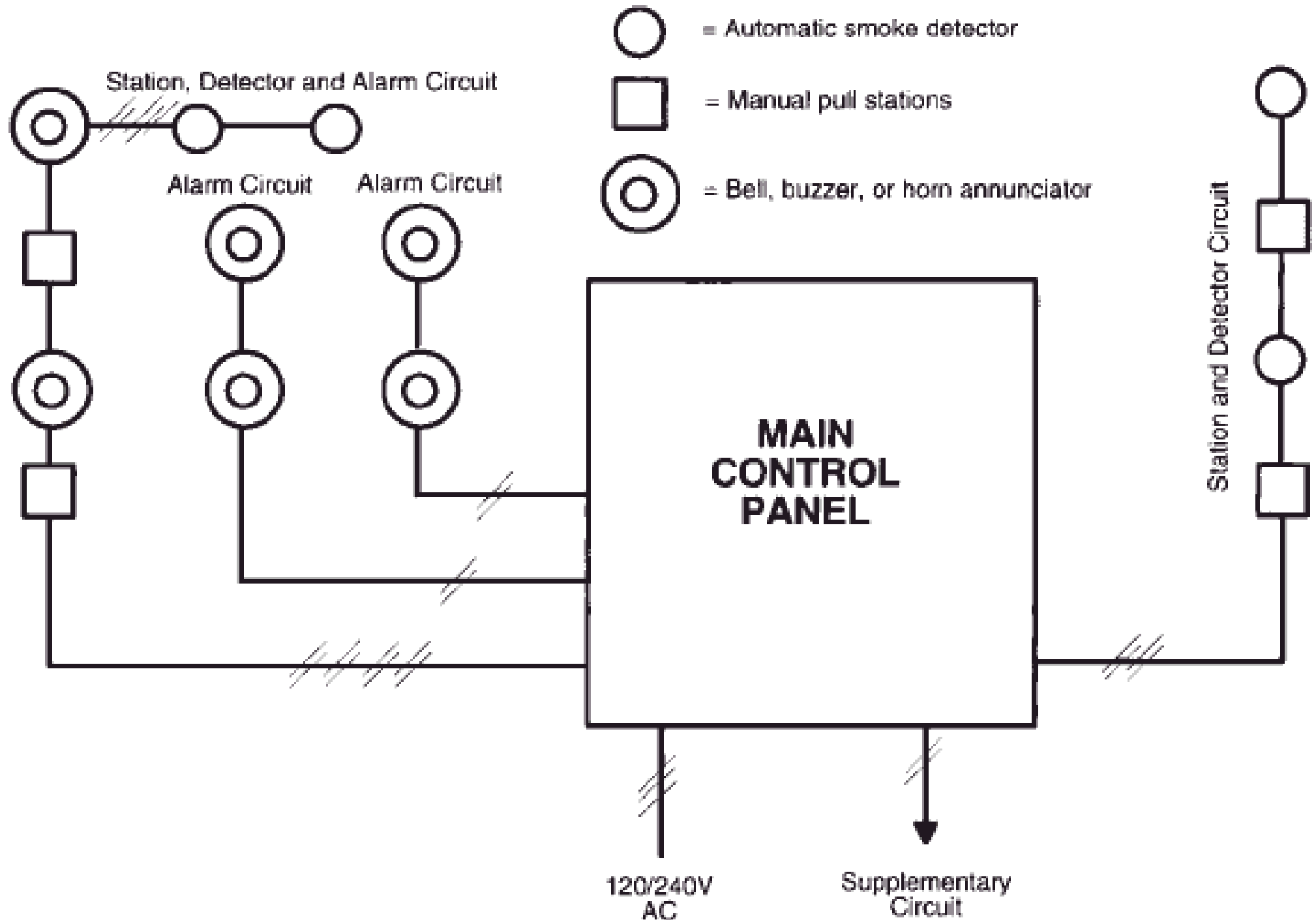




# Closed-circuit security alarm system

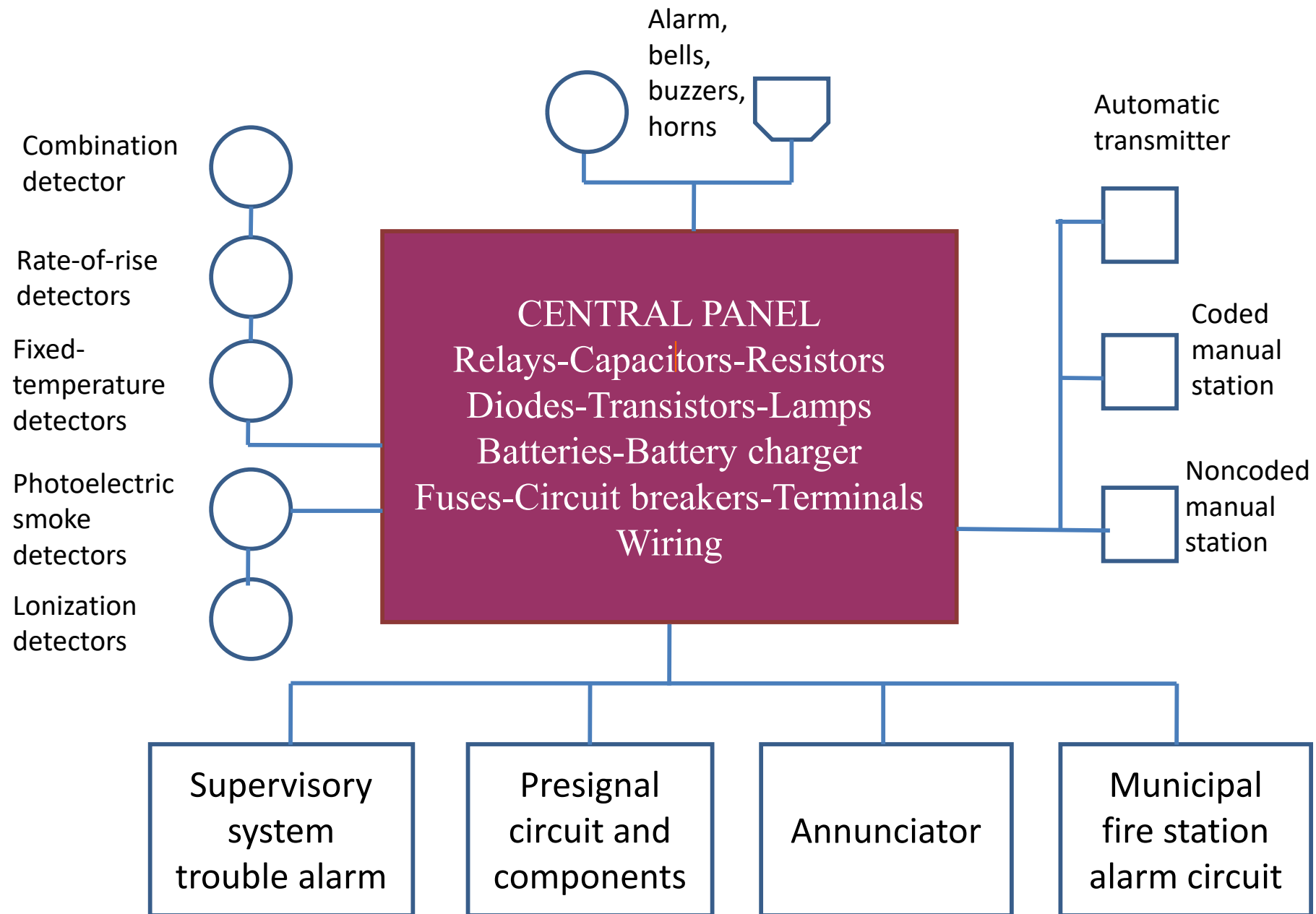


# Schematic diagram of a fire-alarm main control panel



(Source: Kennedy, T. and Traister, J. E., 2002. *Low Voltage Wiring: Security/fire Alarm Systems*)

# Components of a basic fire-alarm system

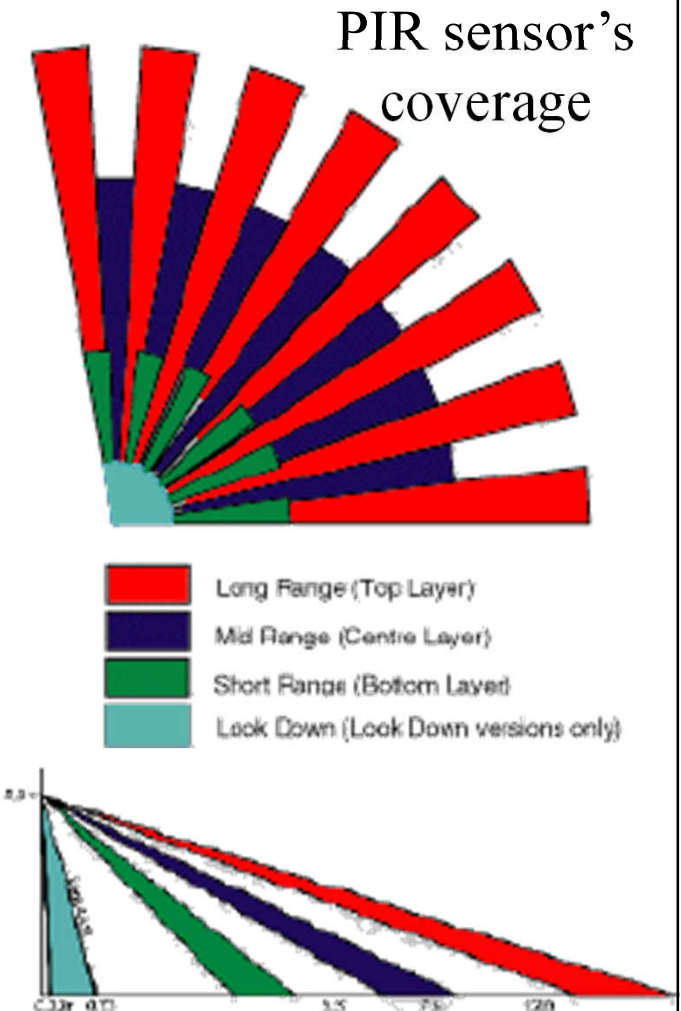


# Burglar & intruder alarms



- Intruder detection alarm system

- Mechanical contact switch
- Magnetic contact switch
- Glass-break & vibration detector
- Photo-electric sensors
- Motion sensors
  - e.g. passive infrared (PIR) sensors
- Signaling devices
  - Both audible and visual types



# Example of an intruder detection alarm system



# Components of intrusion detection alarm systems



- smoke detectors that detects smoke and sounds alarm to warn entire family.



-window/door contacts



-motion detectors



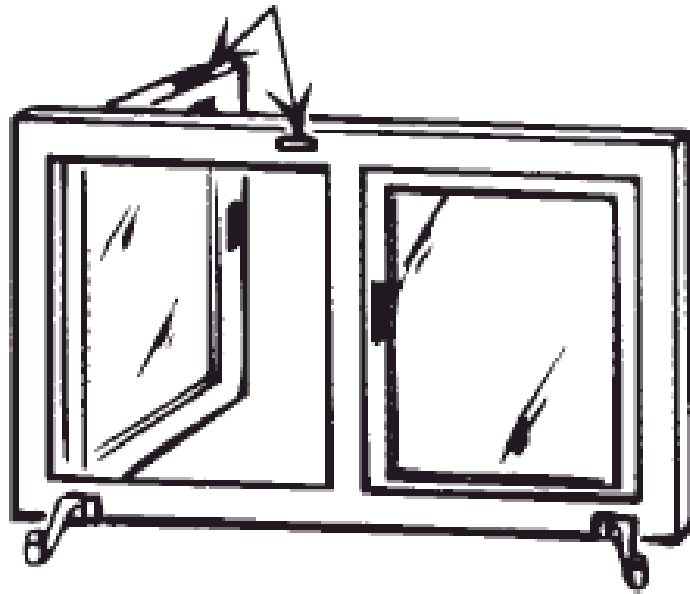
-Interior Siren



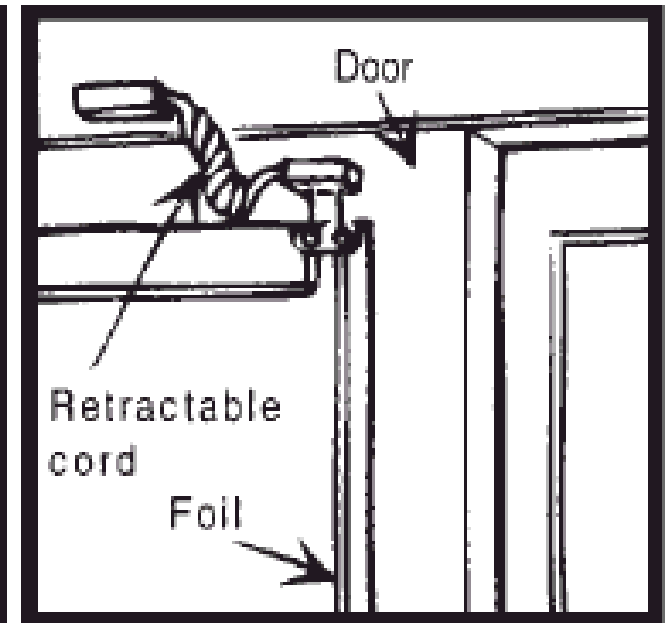
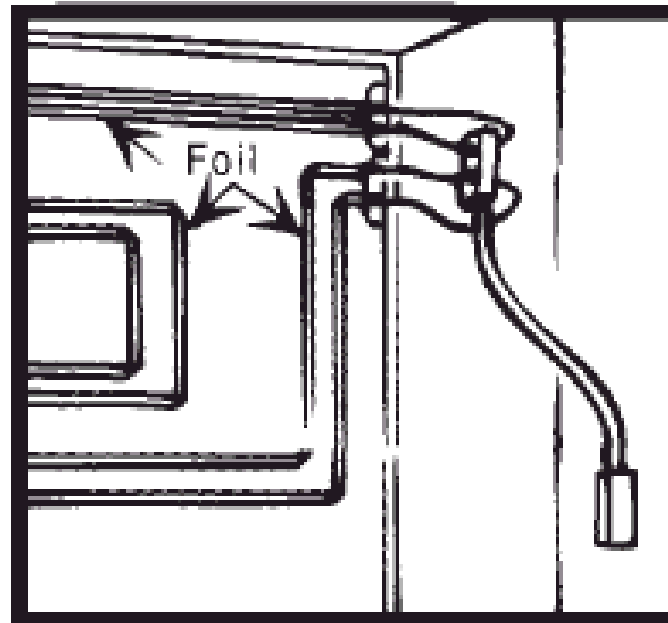
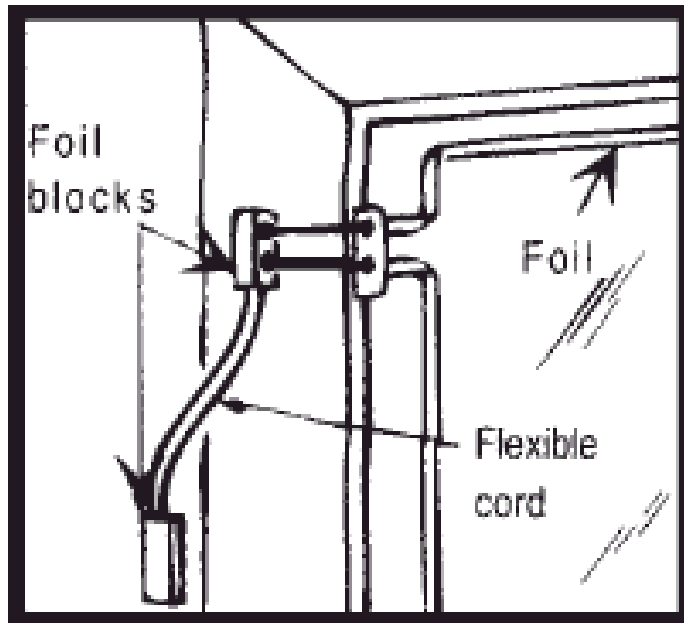
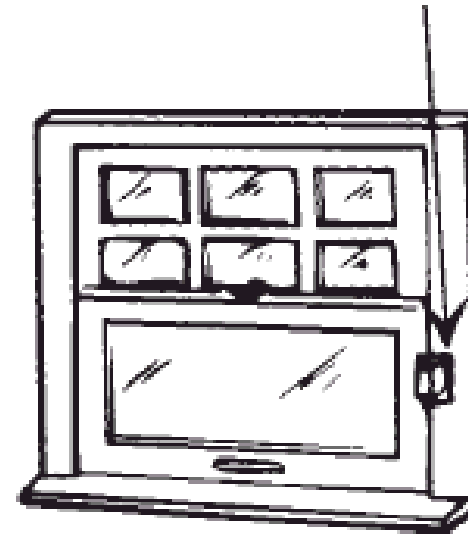


# Magnetic contacts on windows and doors

Recessed switch in top casing;  
magnet in window top



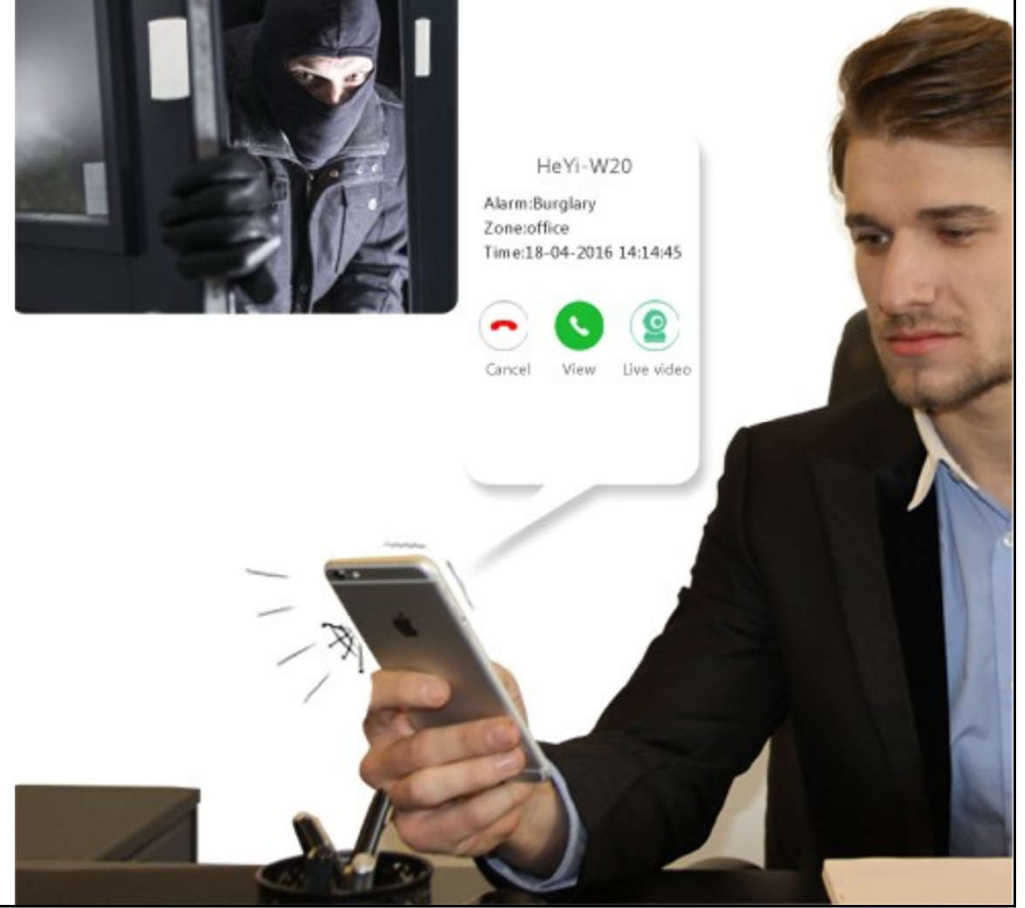
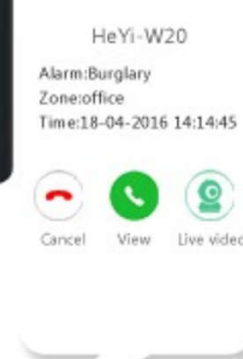
Surface-mounted  
switch and magnet



# Burglar & intruder alarms



- Additional items to the basic system
  - Smoke detectors
  - Glass break detectors
  - Panic buttons
  - Pressure mats
  - Closed circuit TV
  - Alarm screens
  - SMS alert service !! →



# Burglar & intruder alarms



- Monitored systems

- Contact a monitoring company by telephone
  - The security system senses something
  - The system waits for 30 to 45 seconds before going into alarm allowing the homeowner a chance to deactivate the system to prevent false alarms
  - If not deactivated, the security system goes into alarm and sends a message to the monitoring company over telephone lines
  - The monitoring company receives the message, determines the nature of the alarm and verifies the alarm, generally by placing a phone call to the home. If they do not receive the proper password or do not receive an answer, they call the police
  - The police receive the monitoring company's call and respond



# Burglar & intruder alarms



- Unmonitored systems
  - Typically on-site alarms and/or flashing lights to indicate the security system has been breached
  - Relies on neighbours or passersby as to see or hear the alarms and then to call police
  - A combination of strobe lights and alarms
    - Many burglars will leave once alarms and strobes are activated



# Burglar & intruder alarms



- False alarms

- 95-99% of the alarms received are false
- Some police departments impose fines for false alarms after a specified number of false alarms



- Common causes of false alarms

- Environmental conditions e.g. a storm that causes loose windows and doors with sensors to rattle
- Wandering pets that are not in a "safe" zone and may activate motion sensors
- Drafts that move objects such as curtains or plants in the home within the motion sensor's detection area

# False alarm management scheme in Hong Kong

## 防盜警鐘分級處理計劃

Do you know  
how to overcome  
false alarm  
problems?

第一級 - 新警鐘/可靠性系統 new alarm/reliable system

Level 1

(衝鋒隊及巡邏人員 - 留守一小時)  
(Emergency Unit & Patrol – stay 1 hour)

第二級 - 30天內 3次誤鳴、180天內 5次誤鳴

Level 2

3 false alarms in 30 days; 5 in 180 days  
(巡邏人員 - 不需留守)  
(Emergency Unit & Patrol – no stay)

第三級 - 30天內 5次誤鳴、180天內10次誤鳴

Level 3

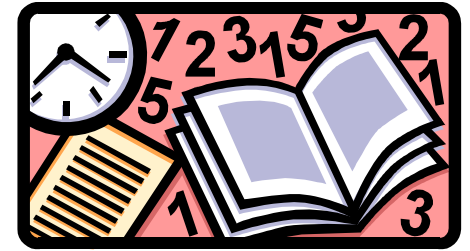
5 false alarms in 30 days; 10 in 180 days  
(通知巡邏人員 - 不需優先處理)  
(Patrol – no priority to take care)





# Further Reading

- Extra-low voltage - Wikipedia [https://en.wikipedia.org/wiki/Extra-low\\_voltage](https://en.wikipedia.org/wiki/Extra-low_voltage)
- Security Products  
[https://www.police.gov.hk/ppp\\_en/04\\_crime\\_matters/cpa/sec\\_products.html](https://www.police.gov.hk/ppp_en/04_crime_matters/cpa/sec_products.html)
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<https://www.designingbuildings.co.uk/wiki/CCTV>
- Introduction to Access Control Systems  
<https://www.silvaconsultants.com/intro-to-access-control-systems>
- Introduction to Intrusion Alarm Systems  
<https://www.silvaconsultants.com/intro-to-intrusion-alarm-systems>
- Basic information on intruder alarm systems  
[https://www.dipolnet.com/basic\\_information\\_on\\_intruder\\_alarm\\_systems\\_bib770.htm](https://www.dipolnet.com/basic_information_on_intruder_alarm_systems_bib770.htm)



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<https://www.coms-auth.hk/filemanager/statement/en/upload/105/cop201202e.pdf>
- Kennedy T. & Traister J. E., 2002. *Low Voltage Wiring: Security/Fire Alarm Systems*, 3rd ed., McGraw-Hill, New York.
- HK Police requirements for digital CCTV systems  
<http://www.police.gov.hk/info/doc/cpa/CCTV%20English.pdf>