Extra Low Voltage Systems

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- CABD and SMATV systems

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- Security systems

- CCTV systems

- Access control systems

- Burglar & intruder alarms

Basic concepts

- <u>Extra low voltage (ELV)</u>: (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
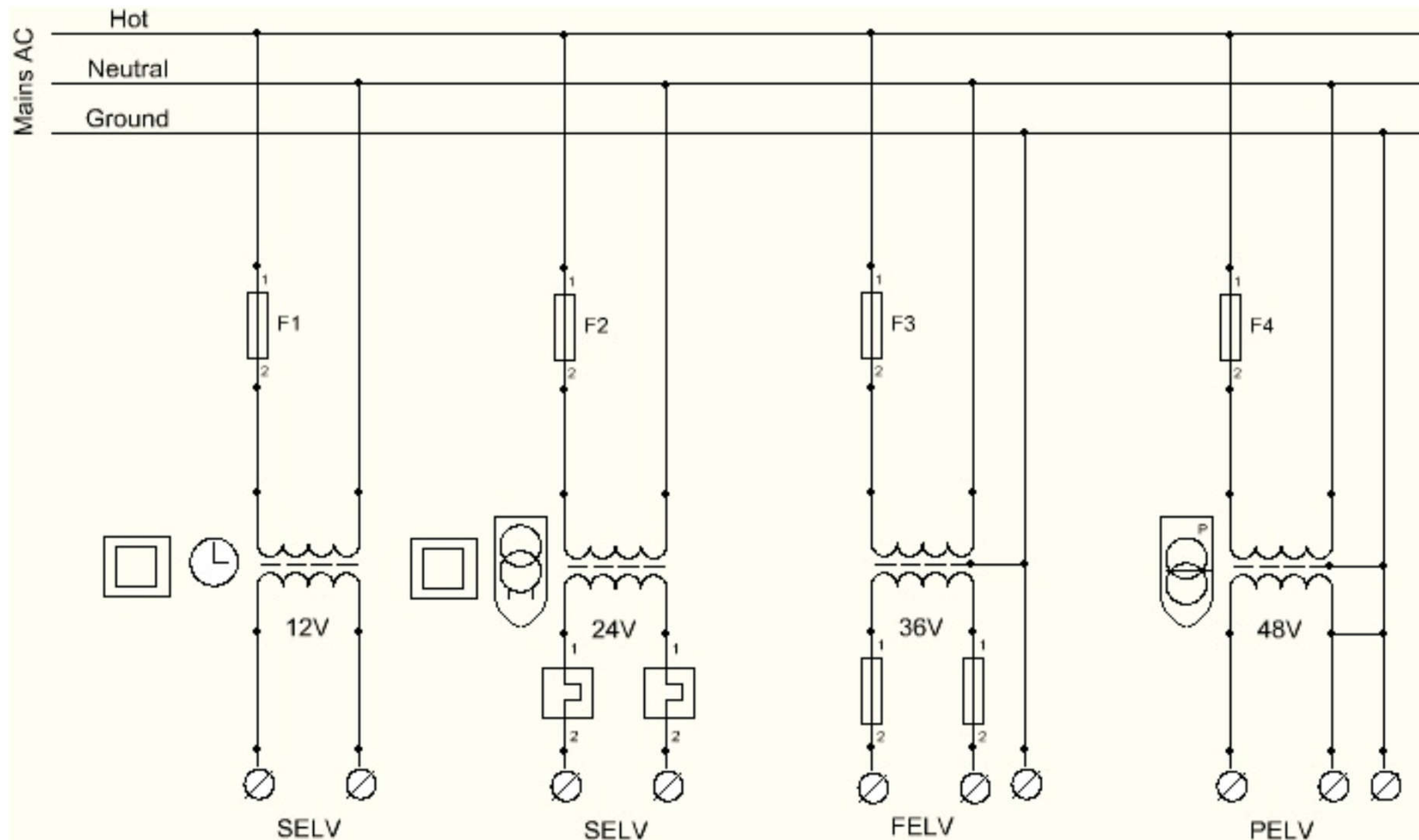
FELV = Functional extra low voltage; PELV = Protective extra low voltage; SELV = Safety extra low voltage

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

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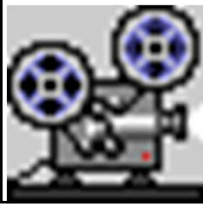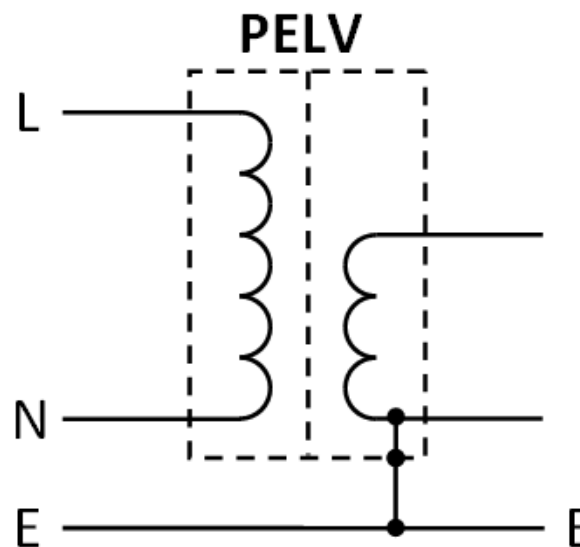
Video: Safety for extra low voltage circuit (5:18) https://youtu.be/fdxE8bl8Kmo

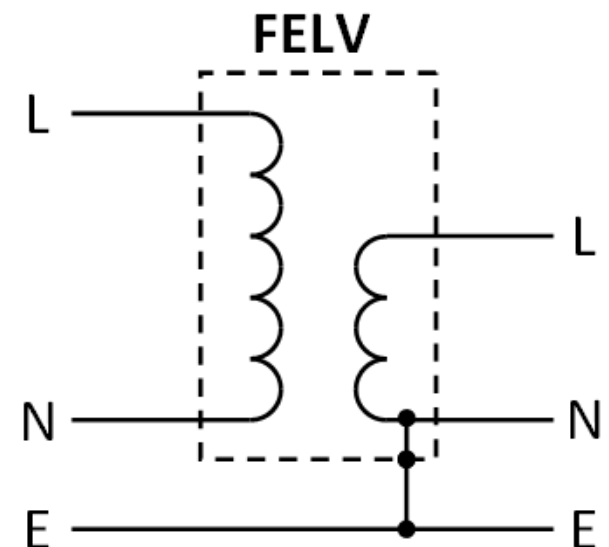# Three types of extra low-voltage (ELV) systems
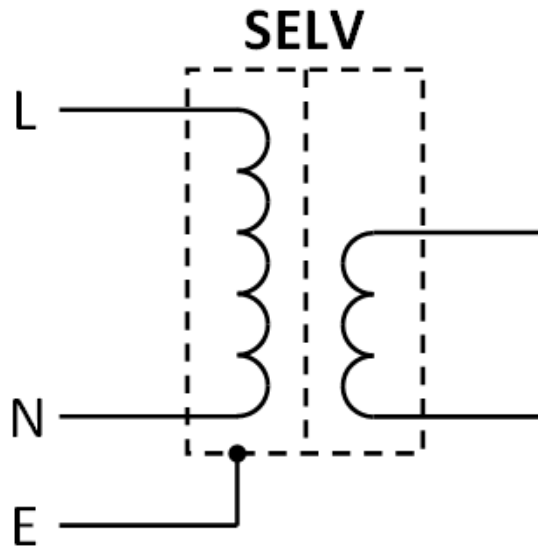
Safety extra low voltage (SELV)
- Presence of a special insulation
- The loads are not isolated by earthing (grounding)
- Eliminate the connection between earth & the equipment

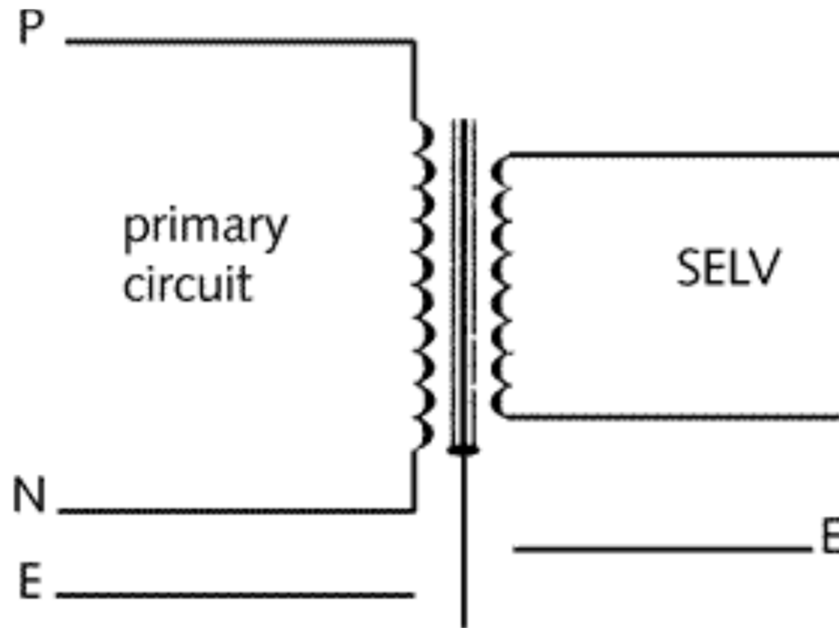**Protective extra low voltage (PELV)**
- Presence of a special insulation
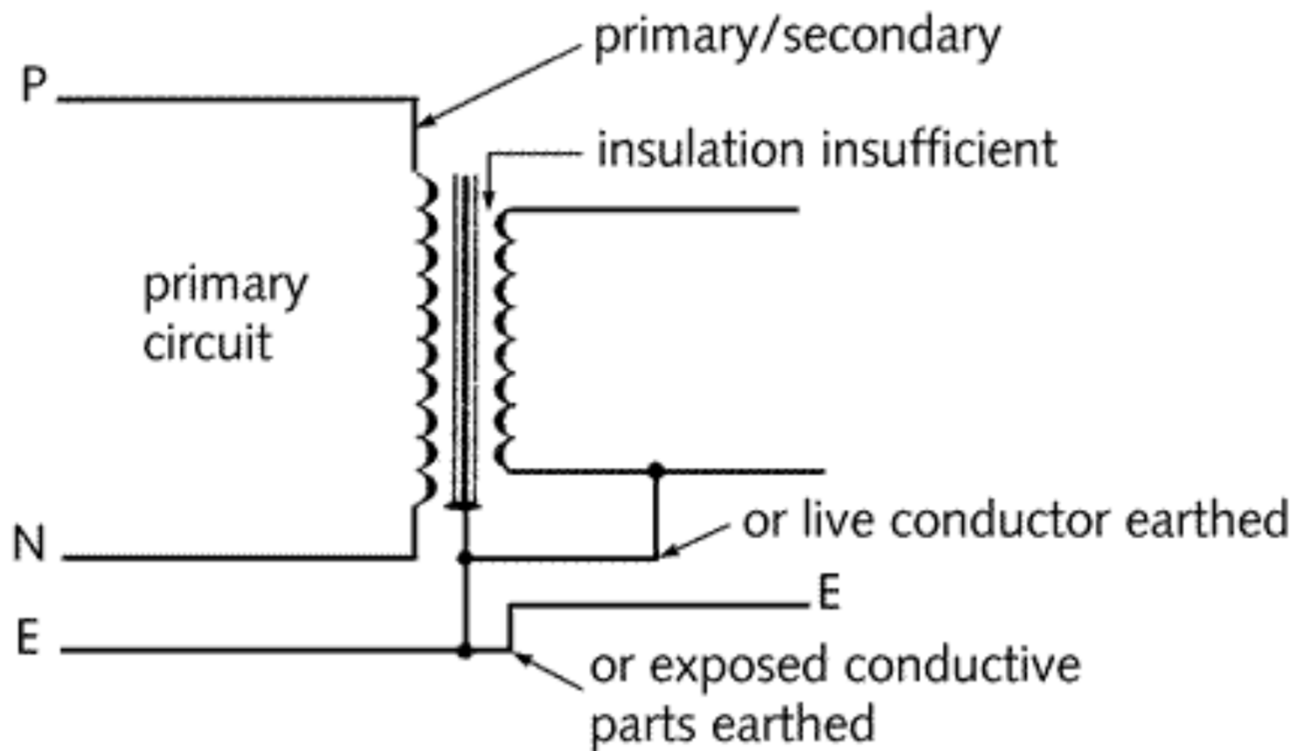- The loads are not isolated by earthing (grounding)

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) 衞星電視共用天線
  - Private branch exchange (PBX) telephone systems
  - Public address (PA) systems
  - Computer networking systems
  - Audio/visual system & intercom systems
  - Fire alarms & security systems
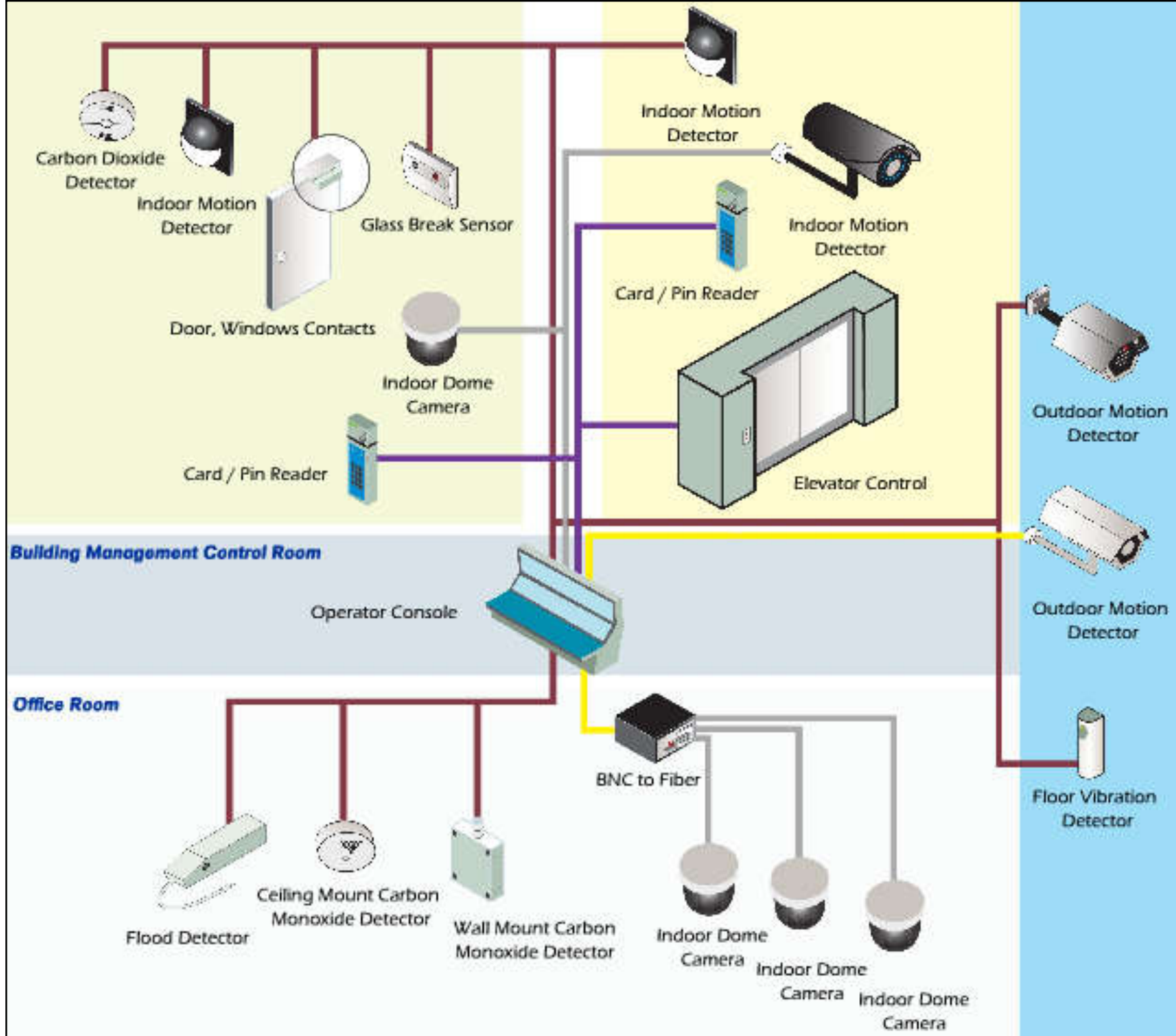
Examples of extra low voltage (ELV) systems & devices in buildings

Carbon Dioxide Detector

Indoor Motion Detector

Glass Break Sensor

Door, Windows Contacts

Indoor Dome Camera

Card / Pin Reader

Indoor Motion Detector

Card / Pin Reader

Indoor Motion Detector

Elevator Control

Outdoor Motion Detector

Outdoor Motion Detector

Building Management Control Room

Operator Console

Office Room

BNC to Fiber

Flood Detector

Ceiling Mount Carbon Monoxide Detector

Wall Mount Carbon Monoxide Detector

Indoor Dome Camera

Indoor Dome Camera

Indoor Dome Camera

Floor Vibration Detector

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
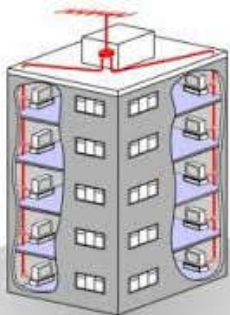
In-building coaxial cable distribution system (IBCCDS)

Cable television system

SMATV/CABD system

Drop cable

Set-top box

Drop cable

Cable television signals
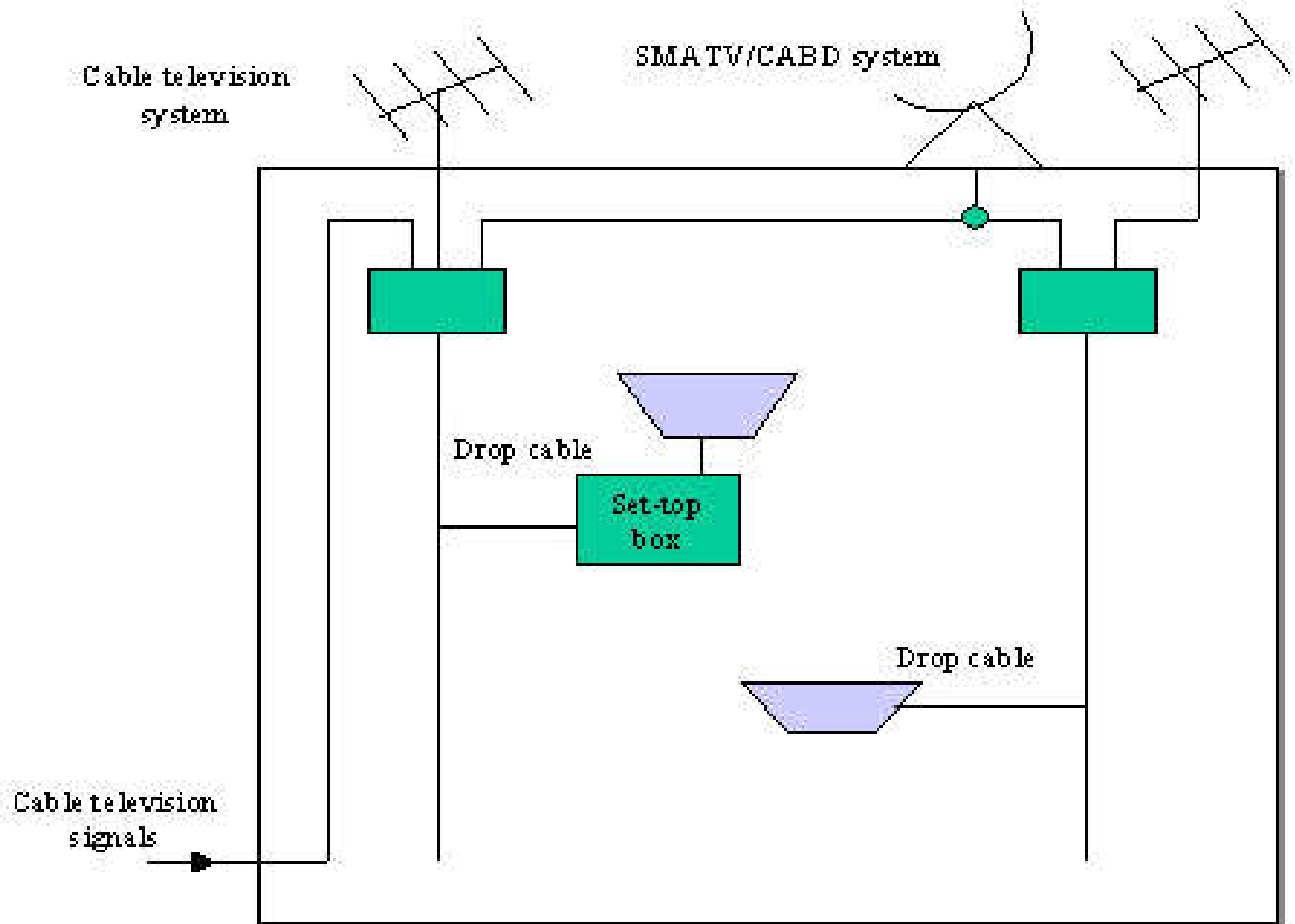
# CABD and SMATV systems

- [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
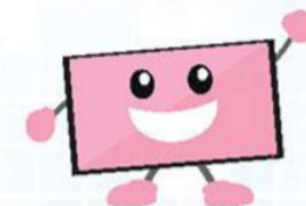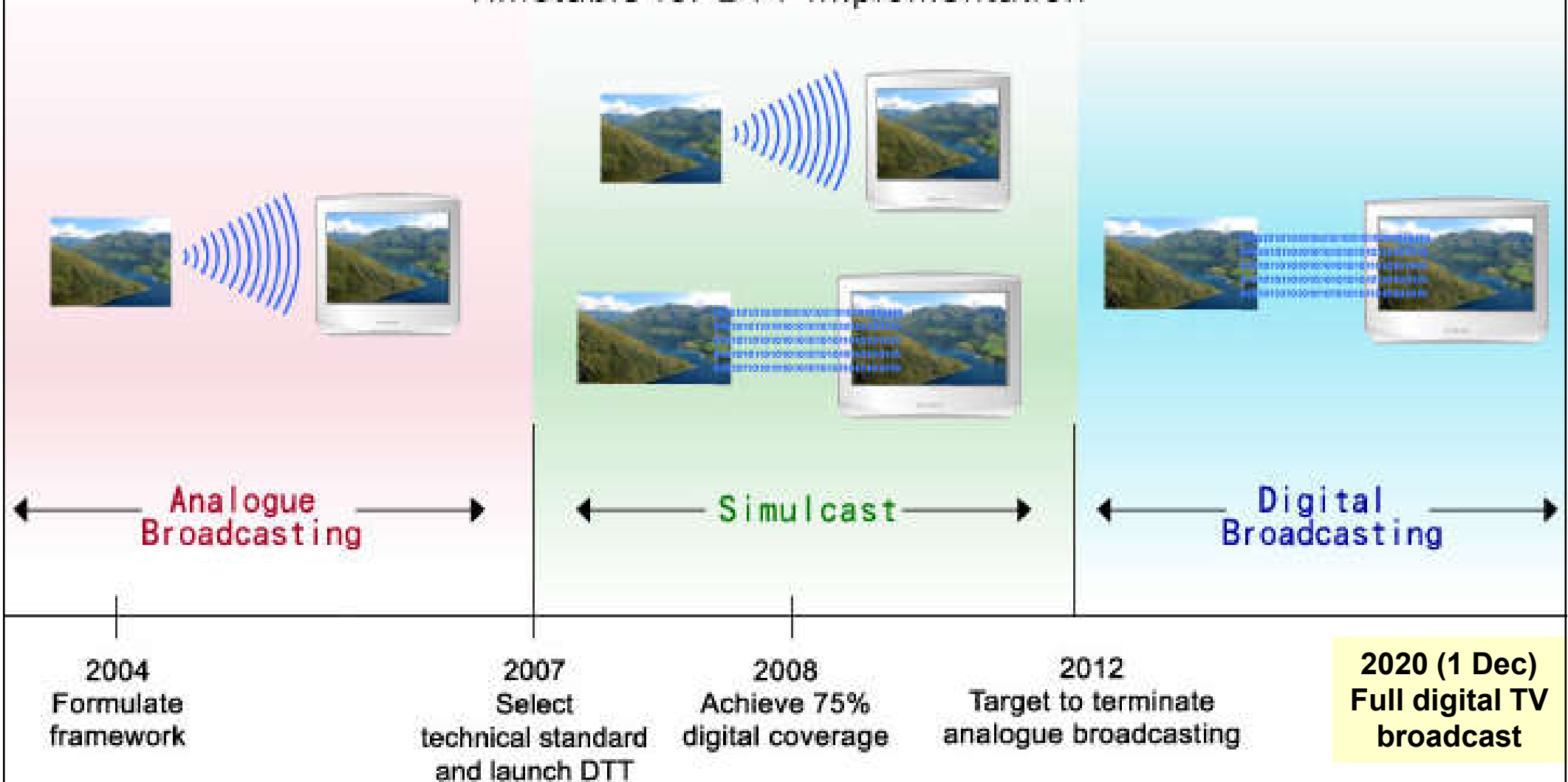
Comparison of analogue & digital TVs

What type of TV do you have at home?

Analogue TV (standard definition)	Digital TV (high definition)
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)

(Source: Office of Telecomm Authority www.ofta.gov.hk)

Timetable for Digital Terrestrial Television (DTT) implementation in HK

Timetable for DTT Implementation

Analogue Broadcasting — Simulcast — Digital Broadcasting

2004 Formulate framework

2007 Select technical standard and launch DTT

2008 Achieve 75% digital coverage

2012 Target to terminate analogue broadcasting

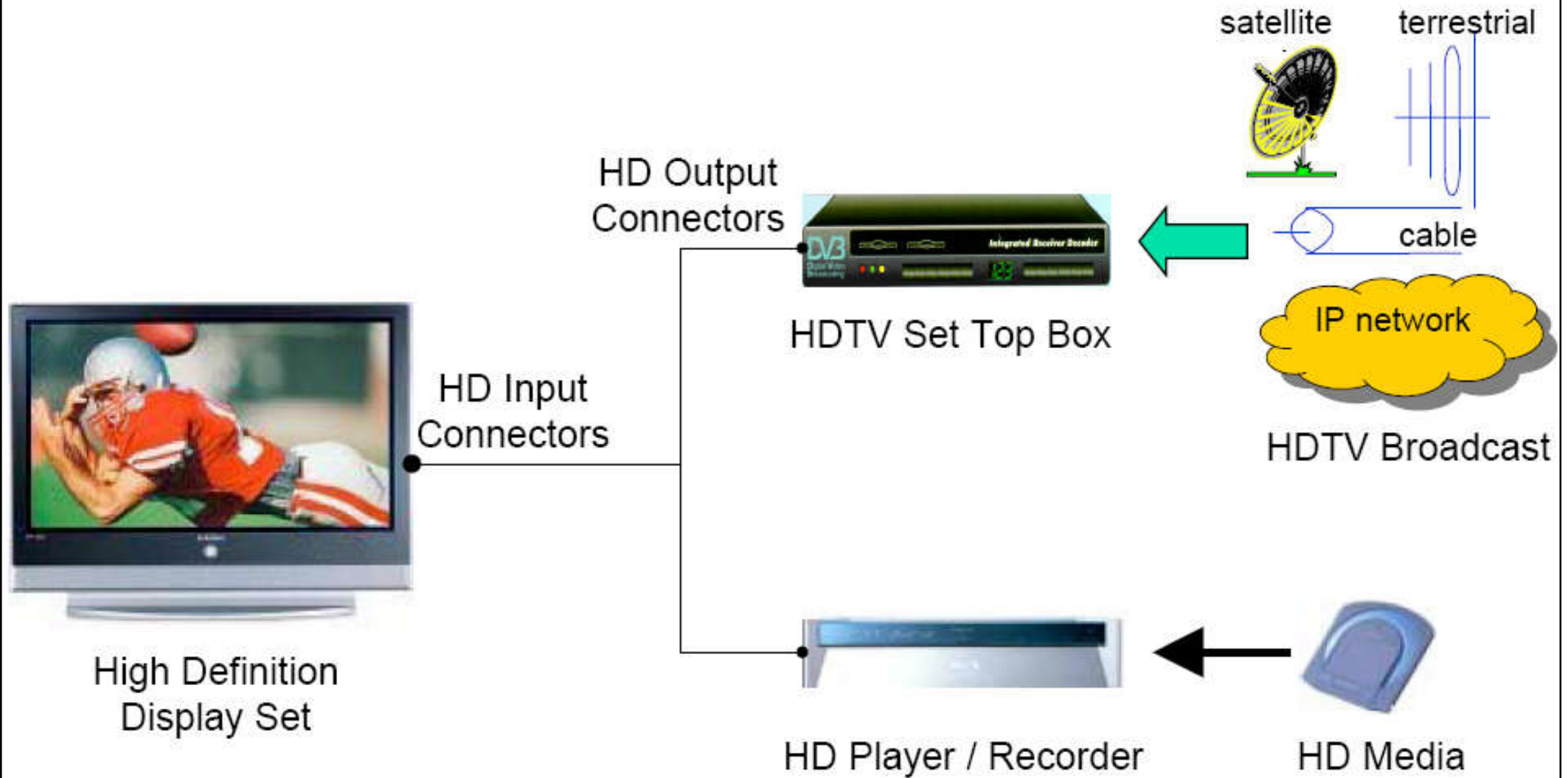**2020 (1 Dec) Full digital TV broadcast**

(* 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

satellite   terrestrial

cable

HD Output Connectors

HDTV Set Top Box

IP network

HD Input Connectors

HDTV Broadcast

High Definition Display Set

HD Player / Recorder

HD Media

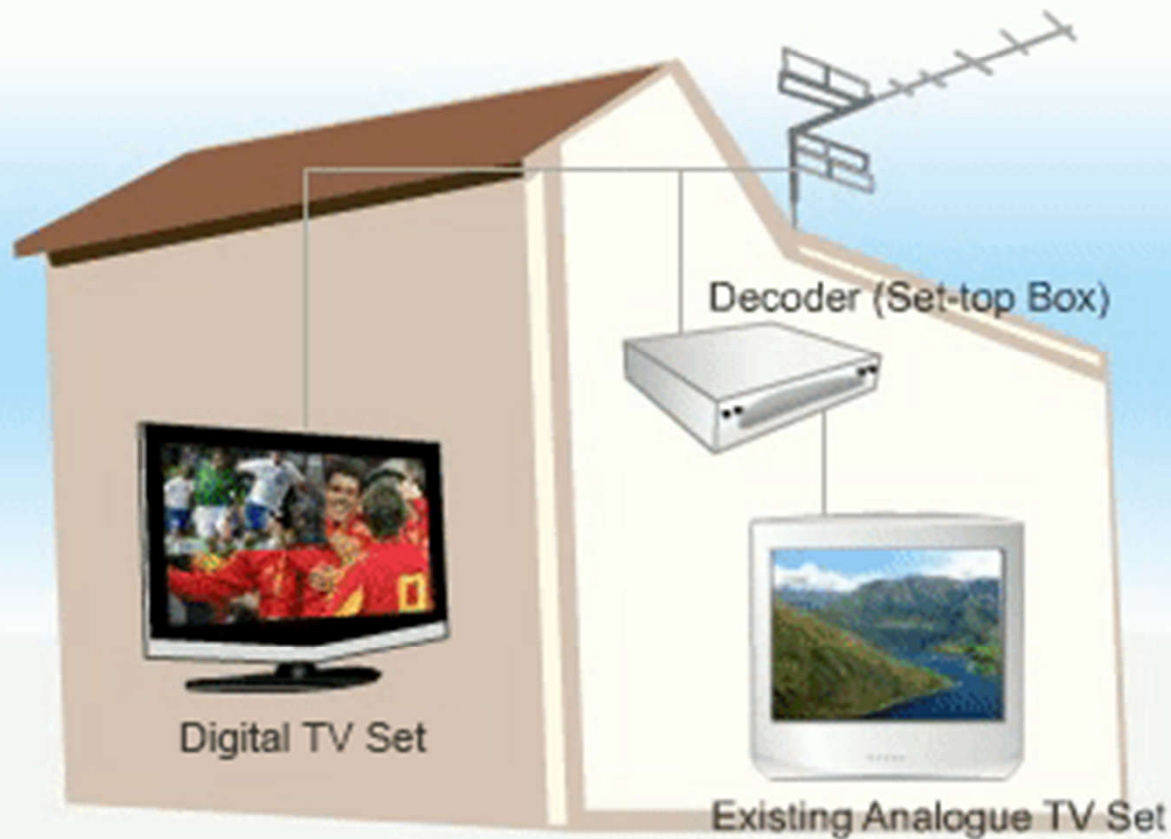Transmitting stations of digital terrestrial television (DTT) in HK

(Source: www.digitaltv.gov.hk)

Reception of Digital TV signals through CABD systems

Reception through Communal Antenna Broadcast Distribution (CABD) System

CABD System

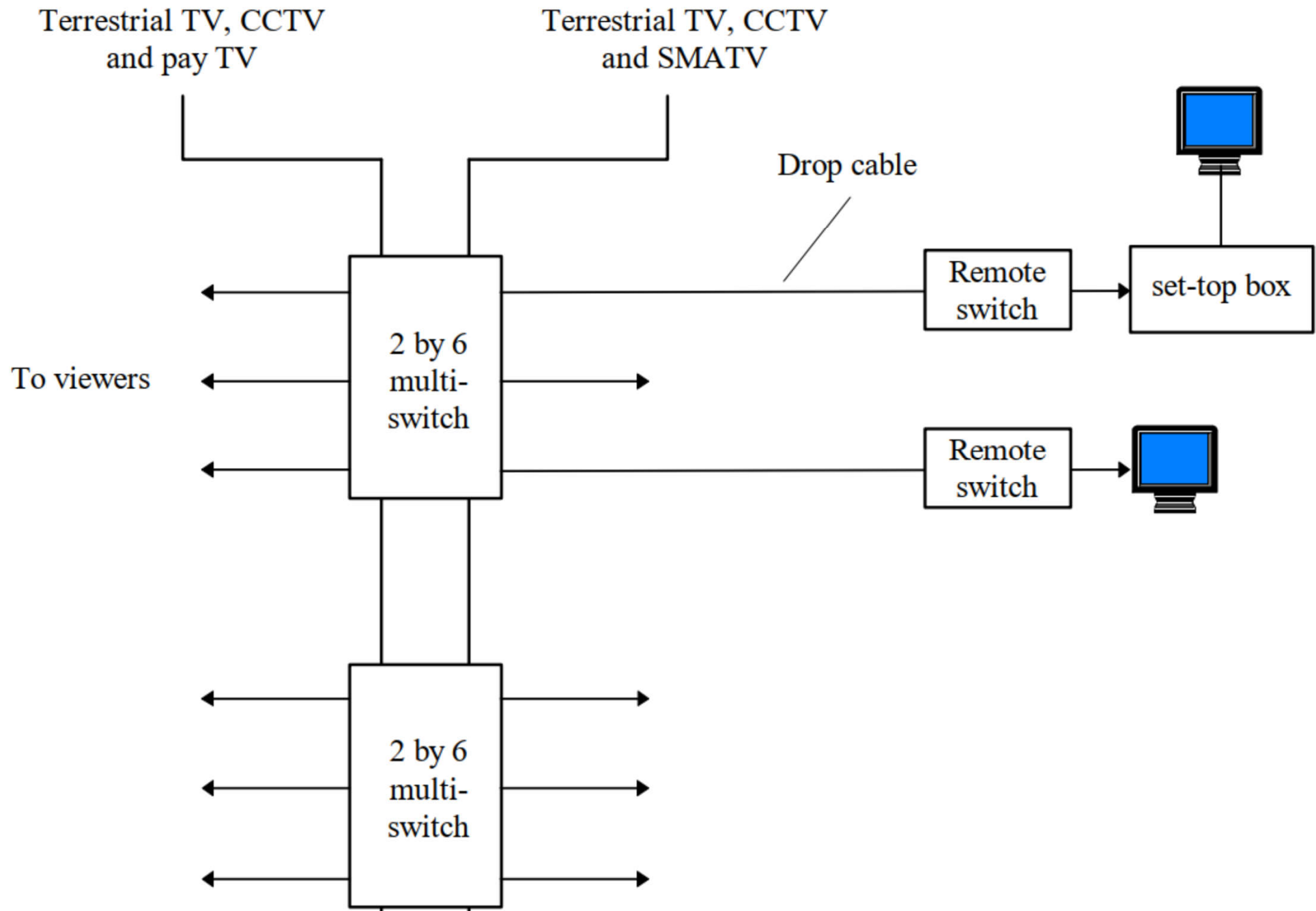Building management companies need to install suitable signal amplifiers/converters

Signal amplifier/converter

Decoder (Set-top Box)

Existing Analogue TV Set

or

In-building Coaxial Cable Distribution System

Digital TV Set

(Source: www.digitaltv.gov.hk)

Reception of Digital TV signals through rooftop antenna

Reception through Rooftop Antenna

Decoder (Set-top Box)

Digital TV Set

Existing Analogue TV Set

(Source: www.digitaltv.gov.hk)

Typical configuration of a parallel distribution system

Terrestrial TV, CCTV and pay TV

Terrestrial TV, CCTV and SMATV

Drop cable

To viewers

2 by 6 multi-switch

Remote switch

set-top box

Remote switch

2 by 6 multi-switch
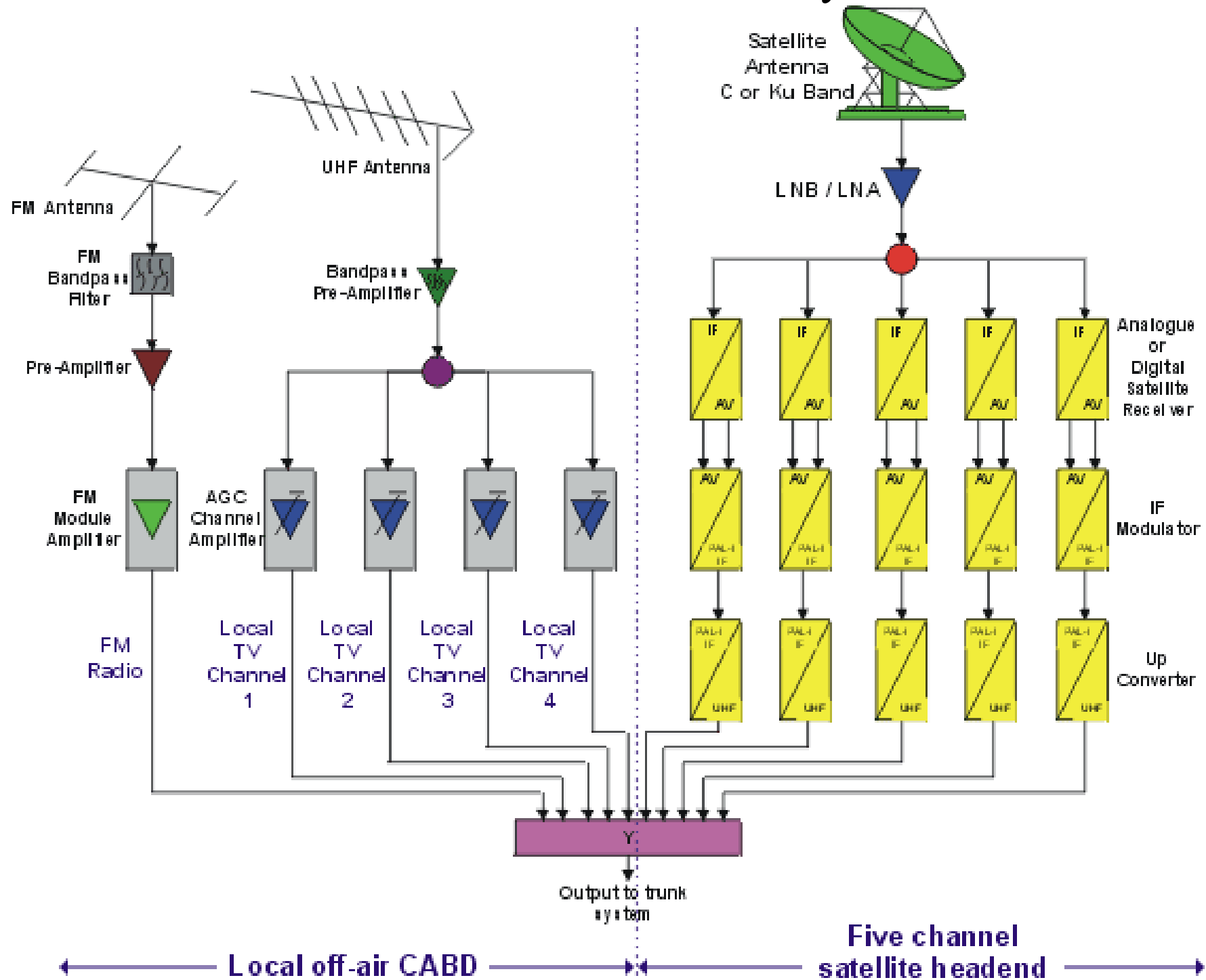
Satellite antenna television system

LNB/Feedhorn

Dish

IF

Receiver

A/V

TV

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
  - 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
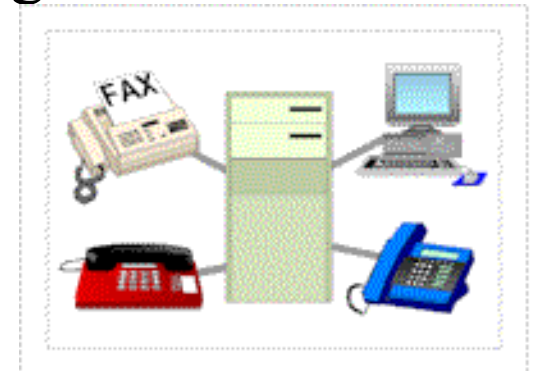
Video: What is PBX? (2021) (3:48) https://youtu.be/KviuXiNr_7w

Old PBX with publicly switched telephone network (PSTN) & "IPBX" uses Internet Protocol to carry calls
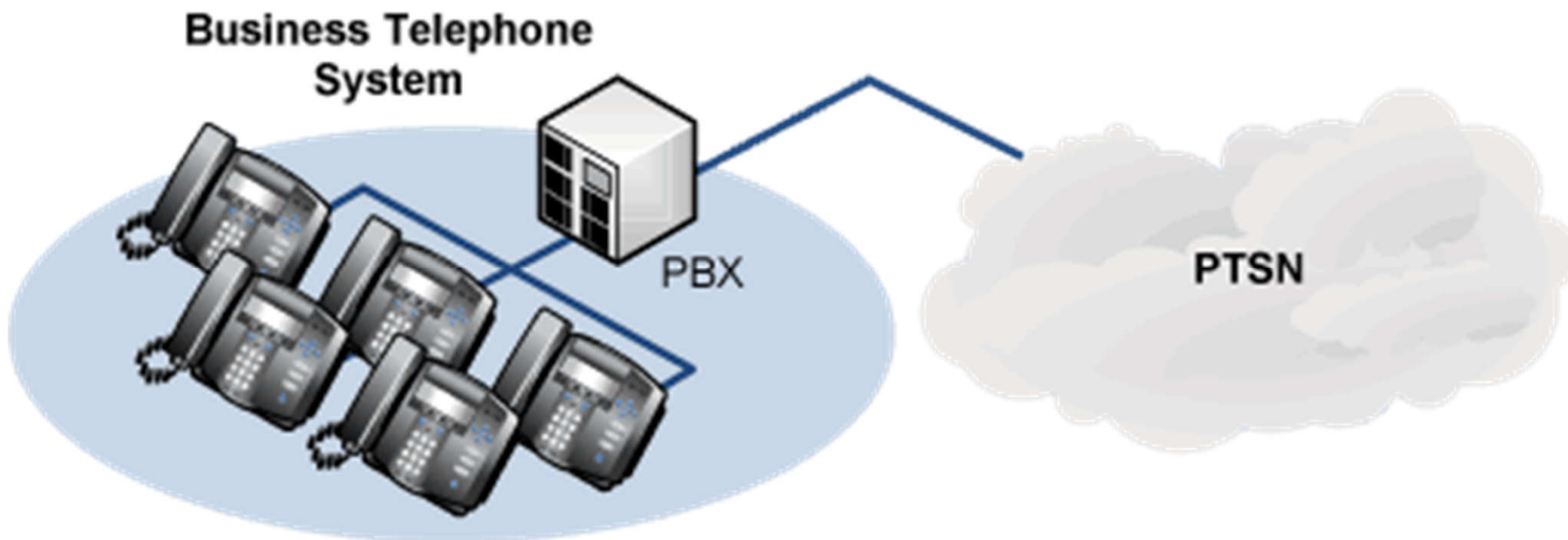
PBX and PA systems

- 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)
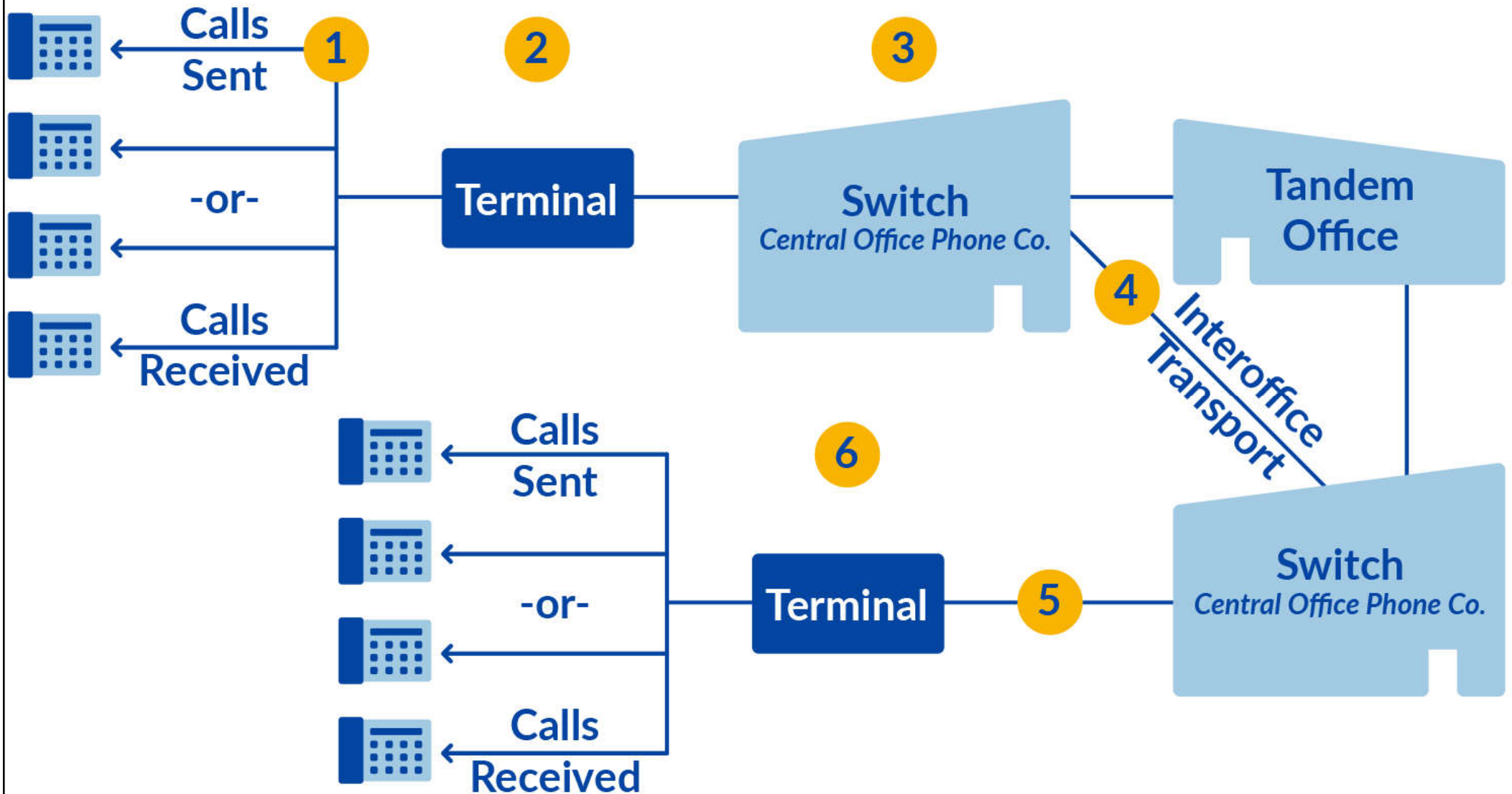
New PBX system using Internet Protocol (IP), Session Initiation Protocol (SIP) & Voice over Internet Protocol (VoIP) technology
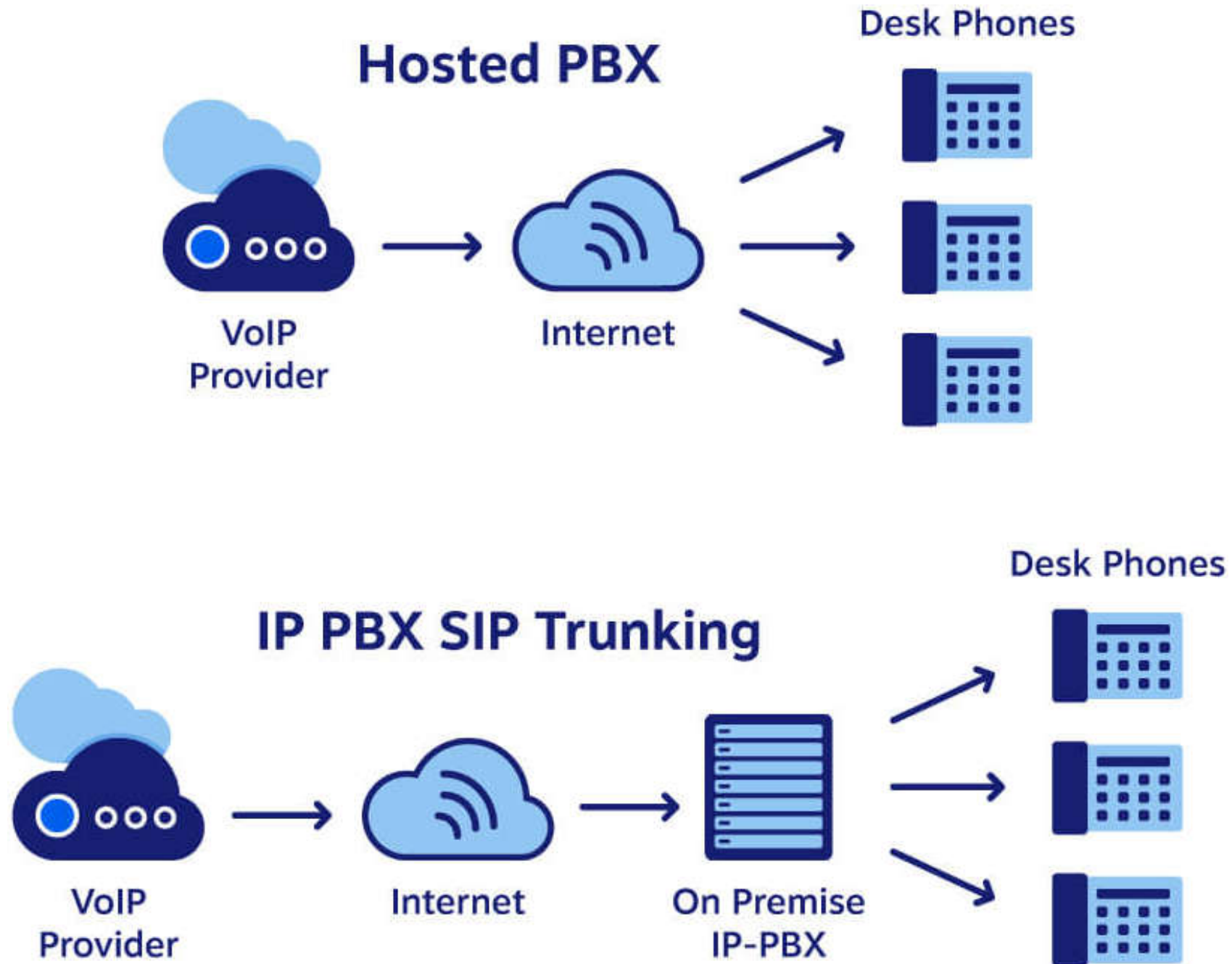
PBX and PA systems

- 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

Mic
Mic
Mic → **Mixer** → **Voltage Amplifier** → **Process Circuit** → **Driver Amplifier** → **Power Amplifier** → LS

Desk Output (FOH)

Desk Output (Foldback)

FOH Speakers

This is where the graphic equalisers should be placed →

Inputs 1 2

Outputs 1 2

Foldback Speakers

Two-Channel (Stereo) Amplifier
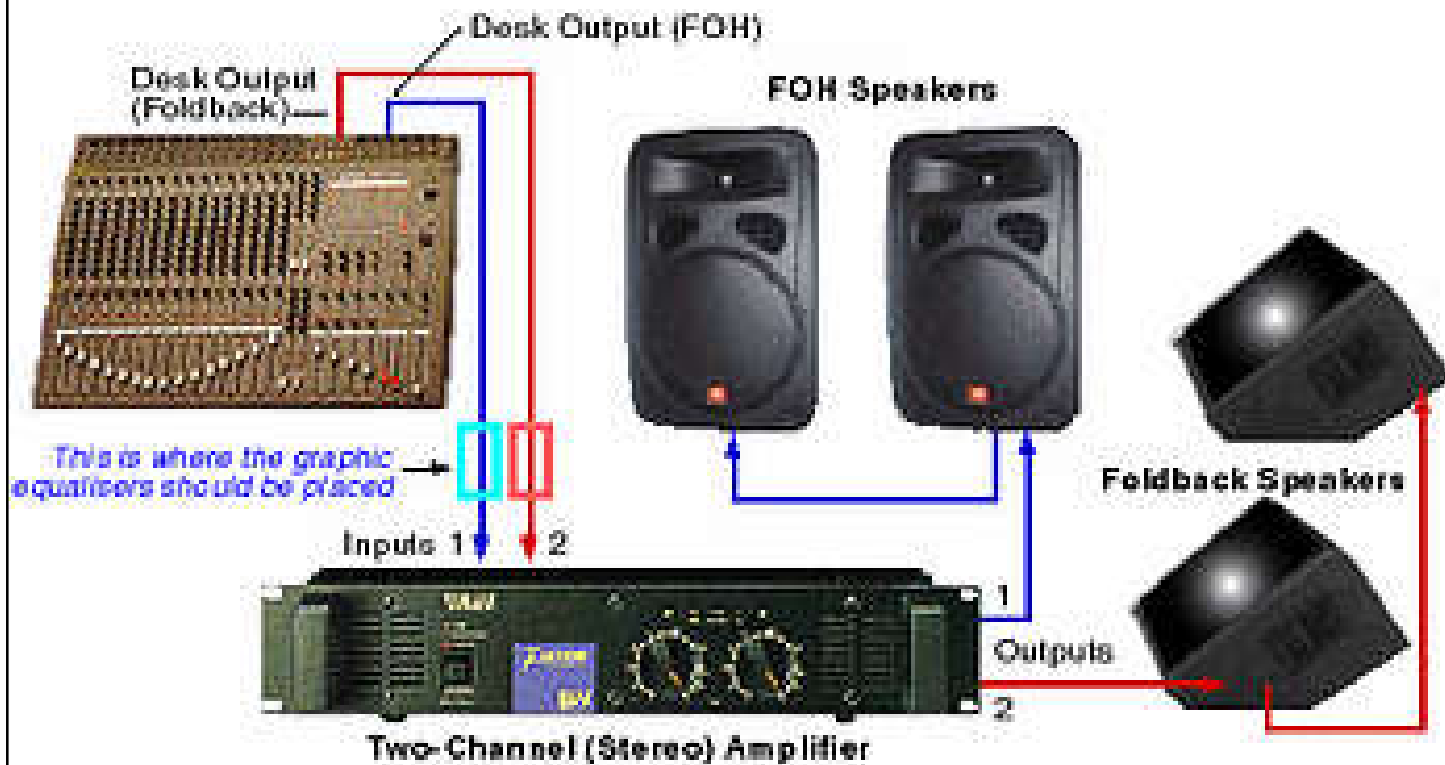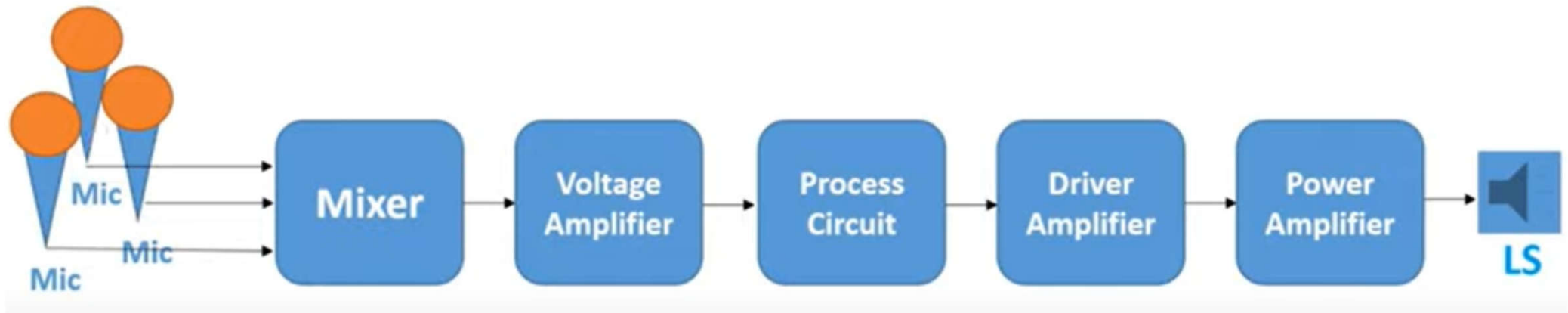
Public address (PA) system with electronic sound amplification & distribution

Paging
Microphone 1

Zone 1

Zone 2

Paging
Microphone 2

Background
Music

Zone 3
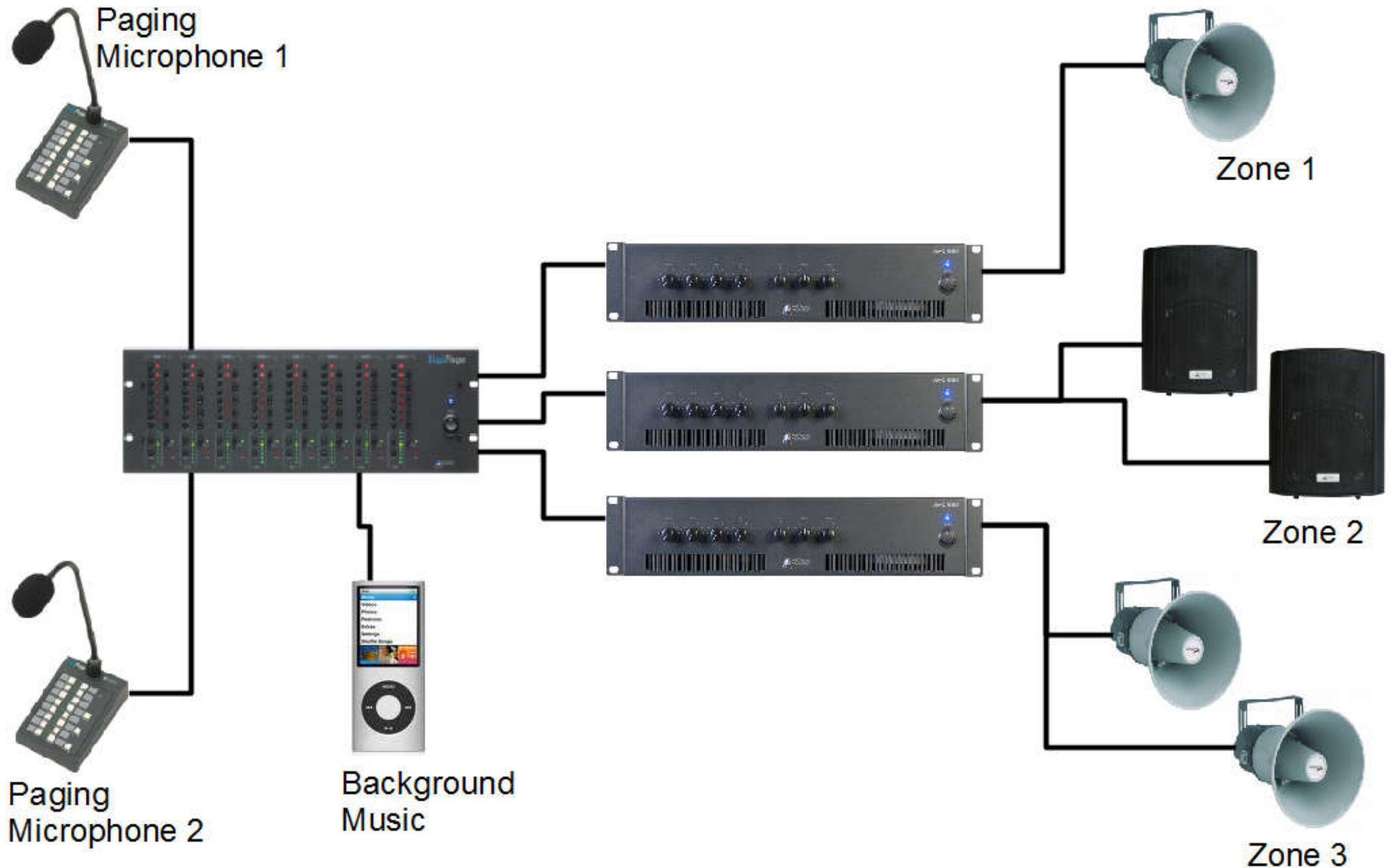
An examples of public address (PA) system for shopping centre

(Source: https://www.dsppatech.com/mp812-6-zones-public-address-solution.html)
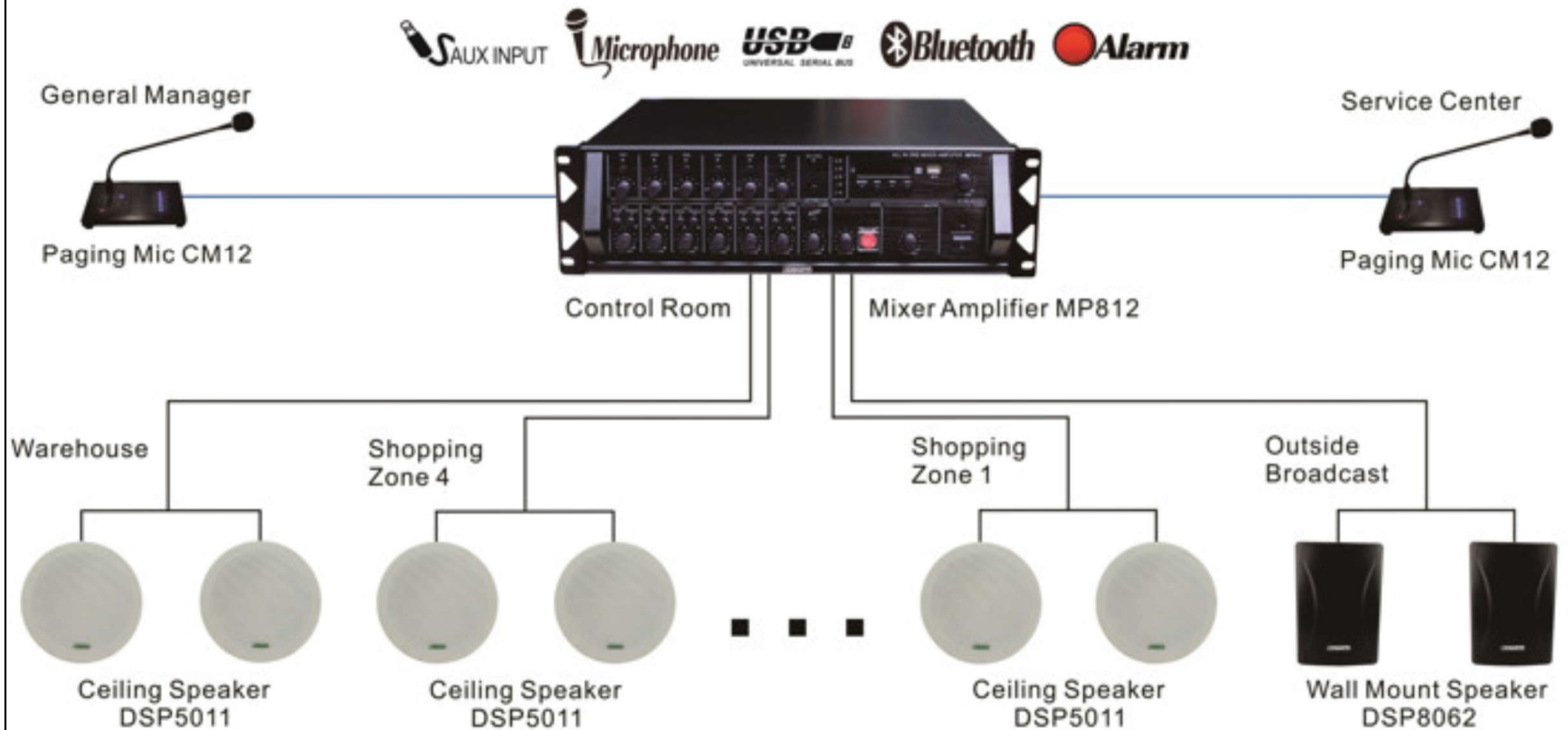
PBX and PA systems

- 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

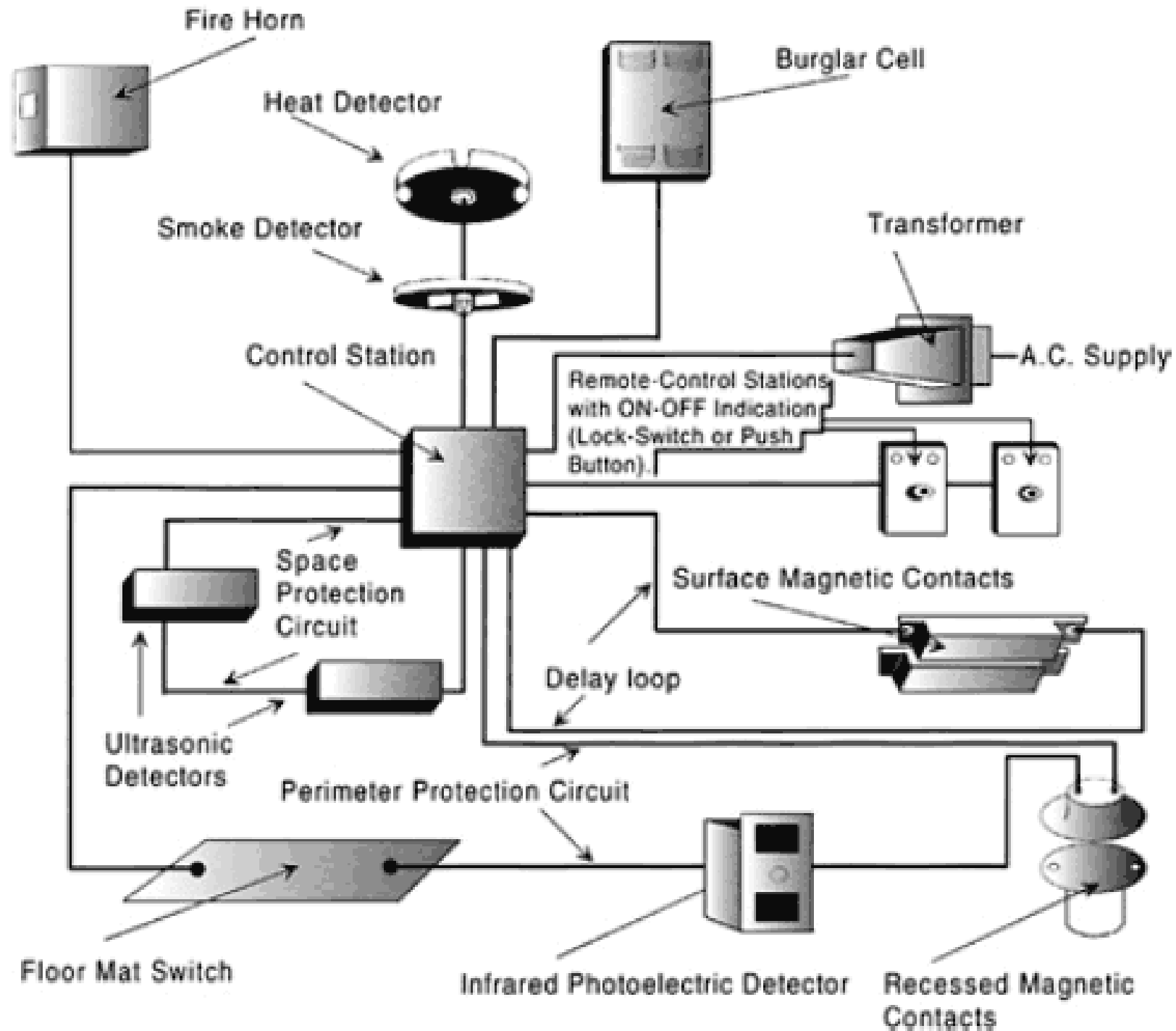- Electronic security systems　電子防盜系統

  - 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

Fire Horn

Heat Detector

Burglar Cell

Smoke Detector

Transformer

Control Station

A.C. Supply

Remote-Control Stations with ON-OFF Indication (Lock-Switch or Push Button).

Space Protection Circuit

Surface Magnetic Contacts

Delay loop

Ultrasonic Detectors

Perimeter Protection Circuit

Floor Mat Switch

Infrared Photoelectric Detector

Recessed Magnetic Contacts

(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
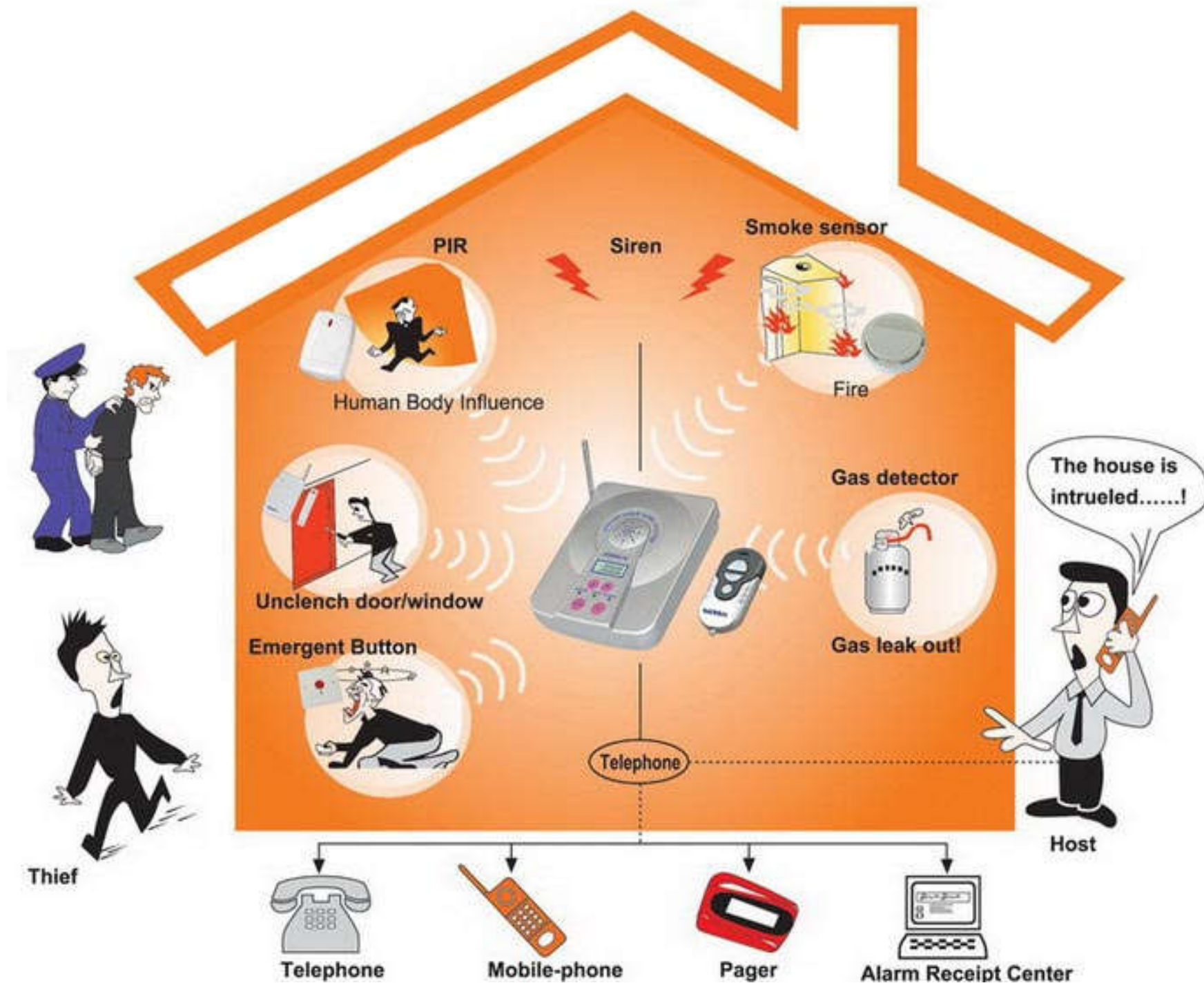
Typical components of security and alarm systems

Intrusion
Alarms

Closed Circuit
Television

Digital Video
Surveillance

Access
Control

Critical Process
Monitoring

Integrated security in a typical building management solution

Telesecurity

Access Card

Biometrics

Asset Management

Fence defense

X-Ray Checking

CCTV

Metal Detector

Bollard

Road Blocker

LPR System

Sliding Gate
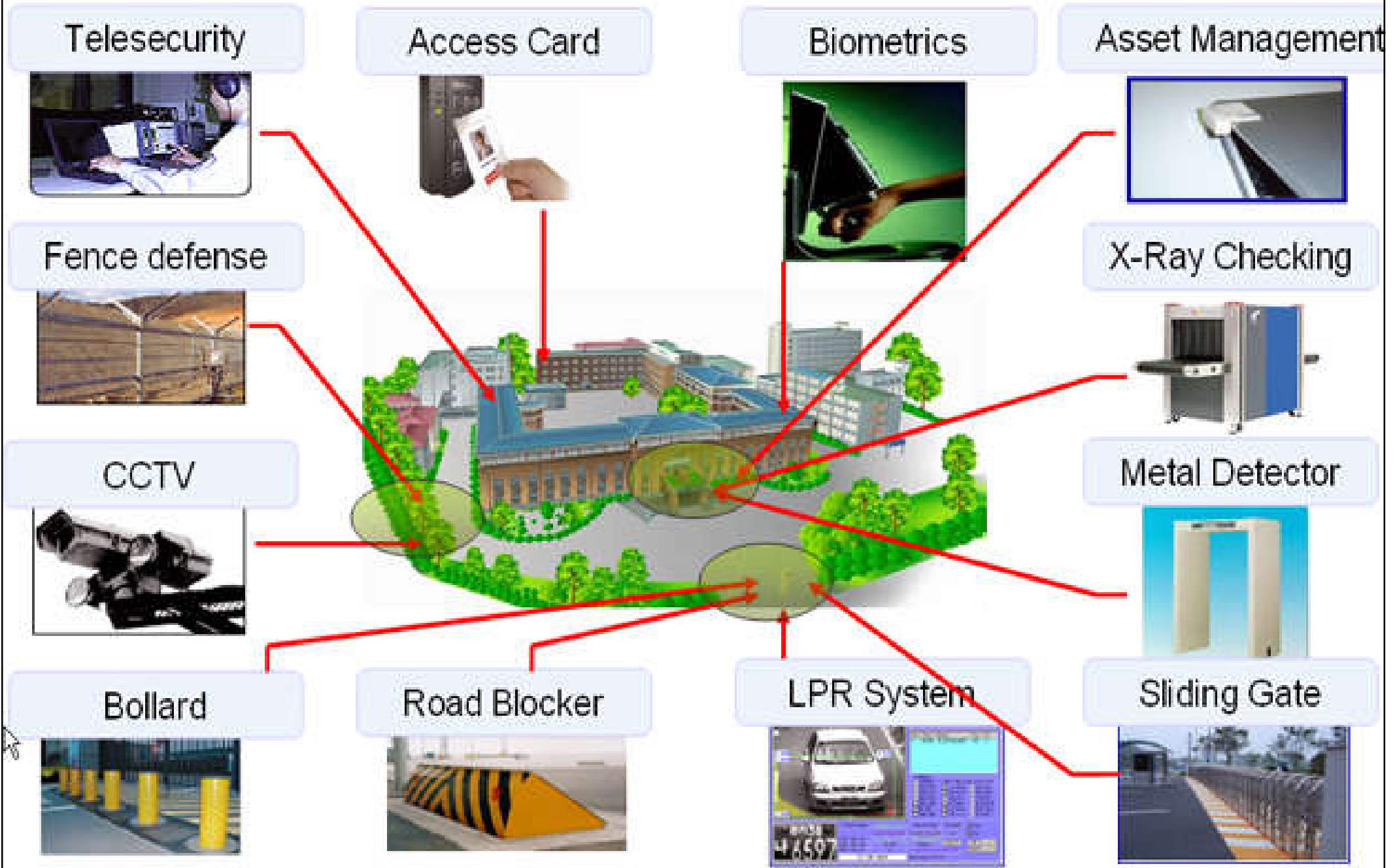
Example of a highly secured premise in Hong Kong

CCTV

Security control centre

Access control

Blocks & fencing

(Source: Hong Kong Note Printing Limited http://www.hknpl.com.hk/)
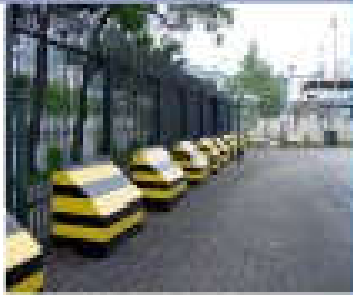
A typical building security & car park control system

(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
    - 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 monchrome)
    - Monitors, recorders and switchers
    - Multiplexer (triplex operation simultaneous playback and recording)
  - Key factors: quality, storage, export, playback

(* See also: HK Police requirements for digital CCTV systems http://www.police.gov.hk/info/doc/cpa/CCTV%20English.pdf)
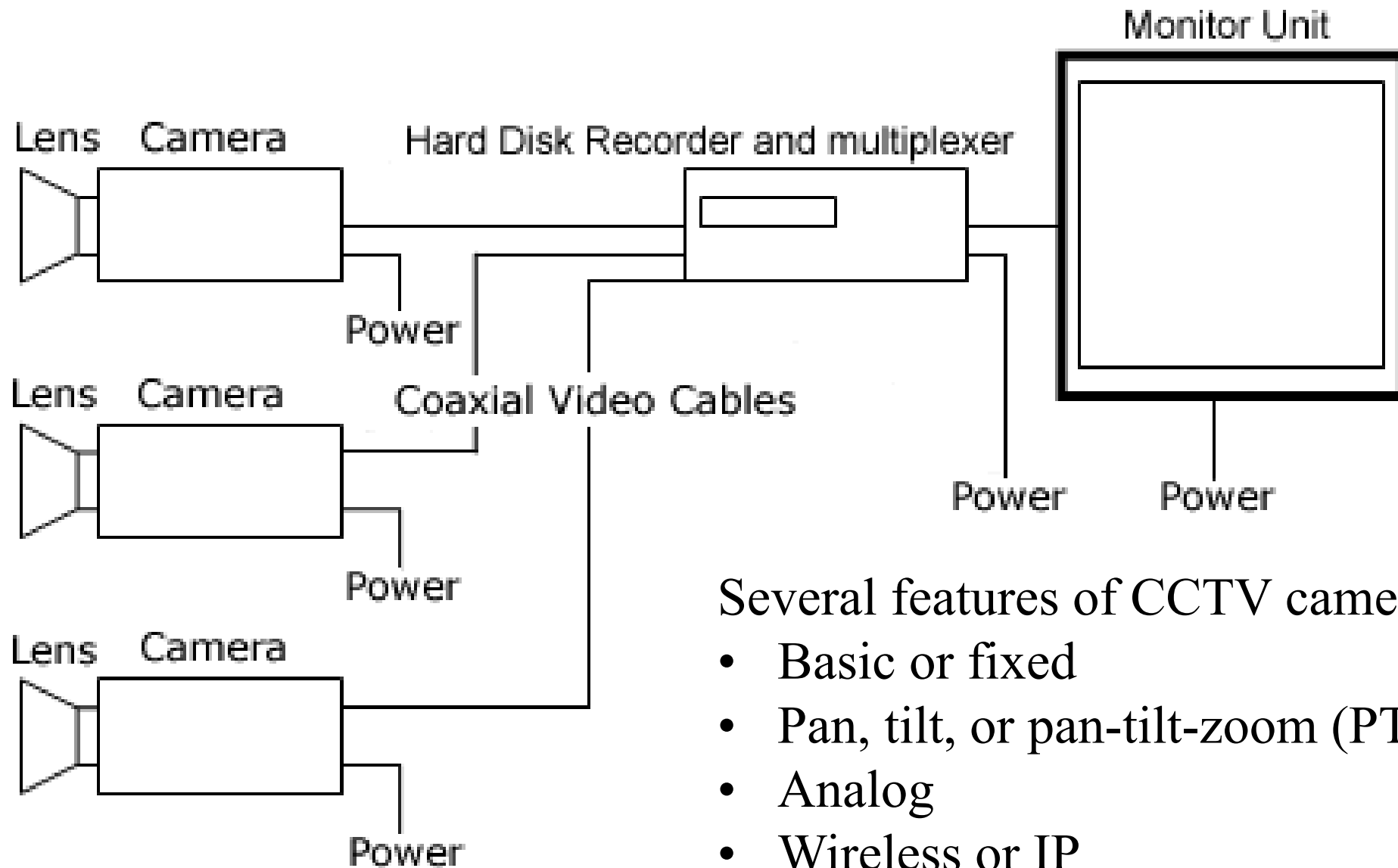
Different types of CCTV cameras

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

Monitor Unit

Lens   Camera   Hard Disk Recorder and multiplexer

Power

Lens   Camera   Coaxial Video Cables

Power

Power   Power

Lens   Camera

Several features of CCTV cameras:
- Basic or fixed
- Pan, tilt, or pan-tilt-zoom (PTZ)
- Analog
- Wireless or IP
- Night vision
- Exterior
- Motion-detection

Power

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 (crowed) 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

5 Megapixel

2 Megapixel

1080P

700TVL – 960H WD1

CIF

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 Recognition | Environment Safety | Traffic Monitoring
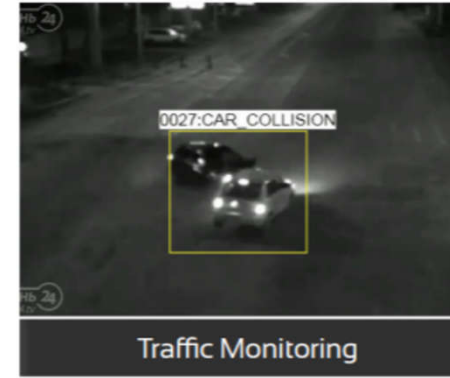
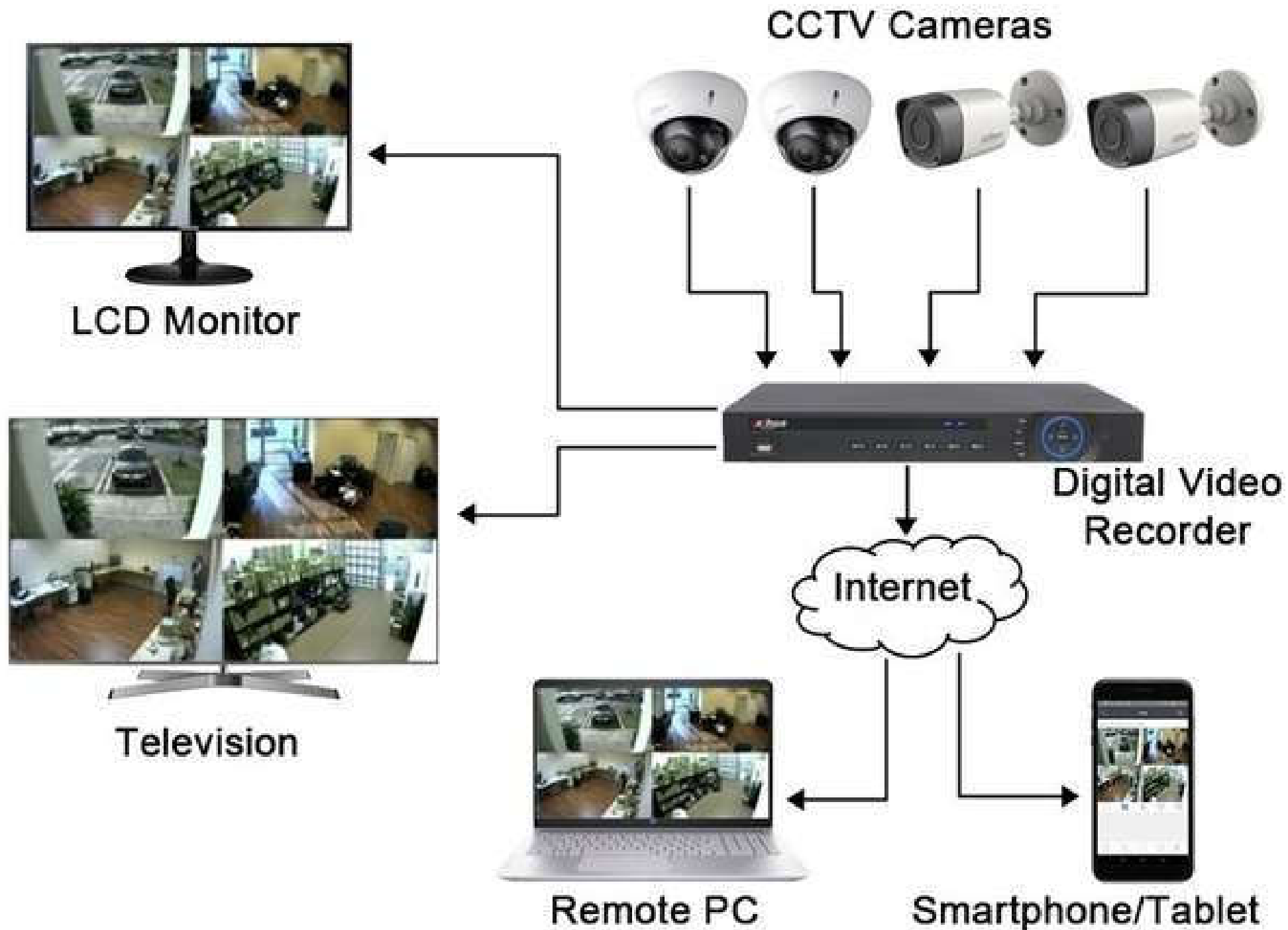| Violent Activity	Suspicious Activity	Person & Crowd Behaviour
• People fighting • Brawl/Riot • Vandalism • Person with blood • Person with weapon	• Contextual loitering, tailgating • Person abandons an object • Person with mask /no mask • Person running/walking/falling • Person gets in/out of a vehicle	• Crowd classification by size • Crowd moving /gathering /dispersing • Occupancy analytics • Person to person proximity
Perimeter Protection • Person entering/exiting predefined zone • Vehicle entering/exiting predefine 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 Cameras

LCD Monitor

Television

Digital Video Recorder

Internet

Remote PC

Smartphone/Tablet

(Source: https://57543.8b.io/CCTVSystem.html)

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
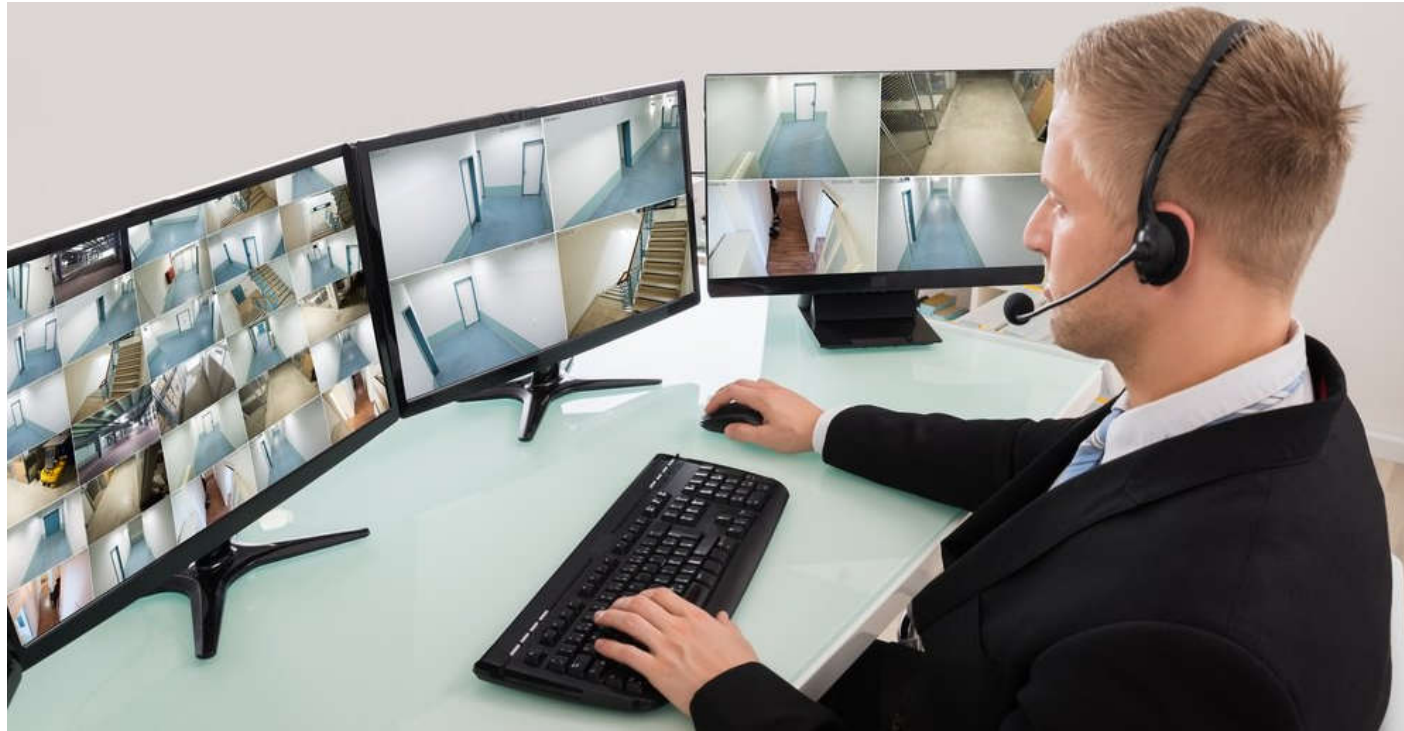 - Network video recorders (NVR)

IP camera system diagram

Recording Servers

Client Display Stations

Network
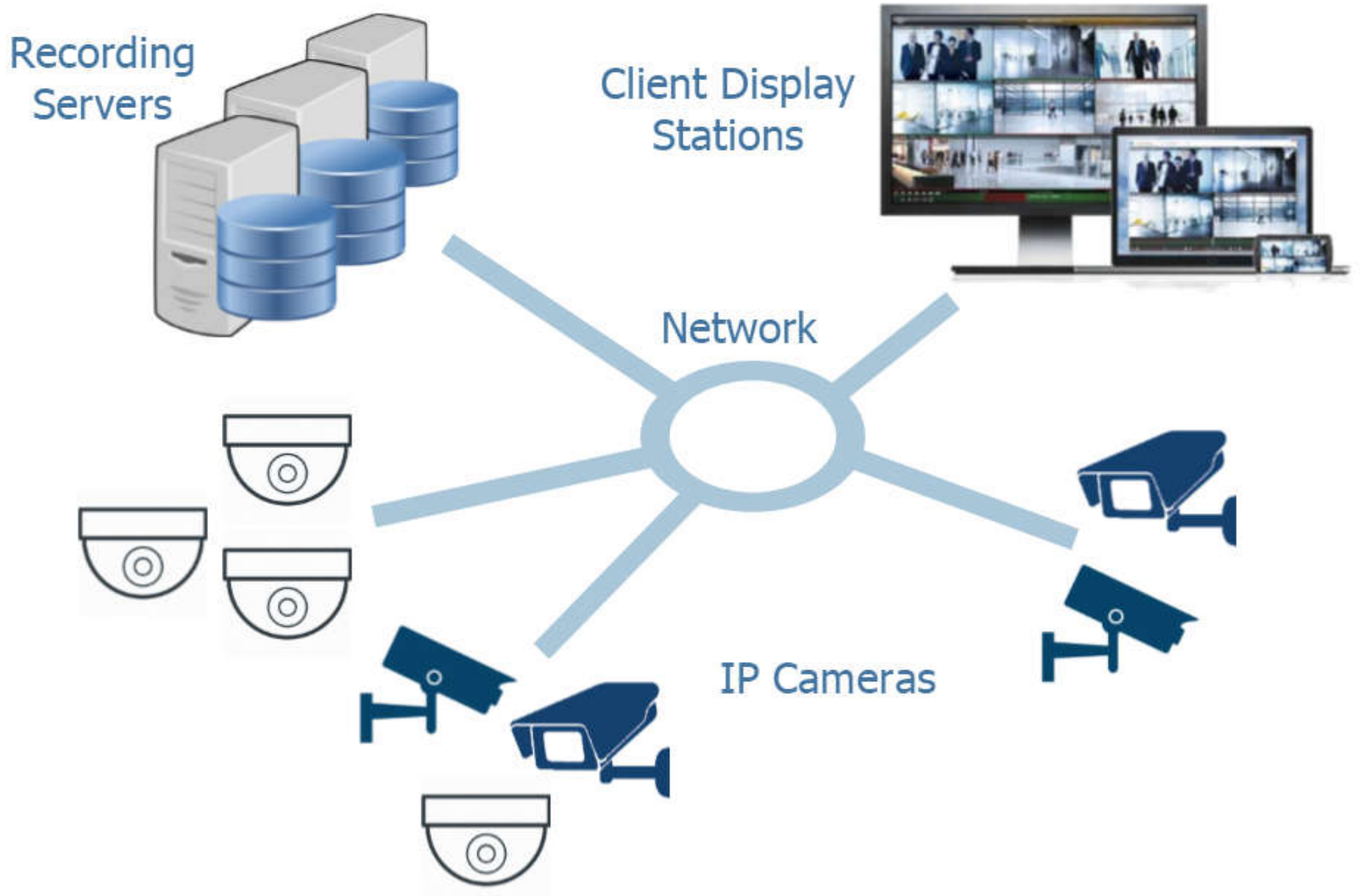
IP Cameras

Examples of CCTV installations with wireless, IP & analogue cameras
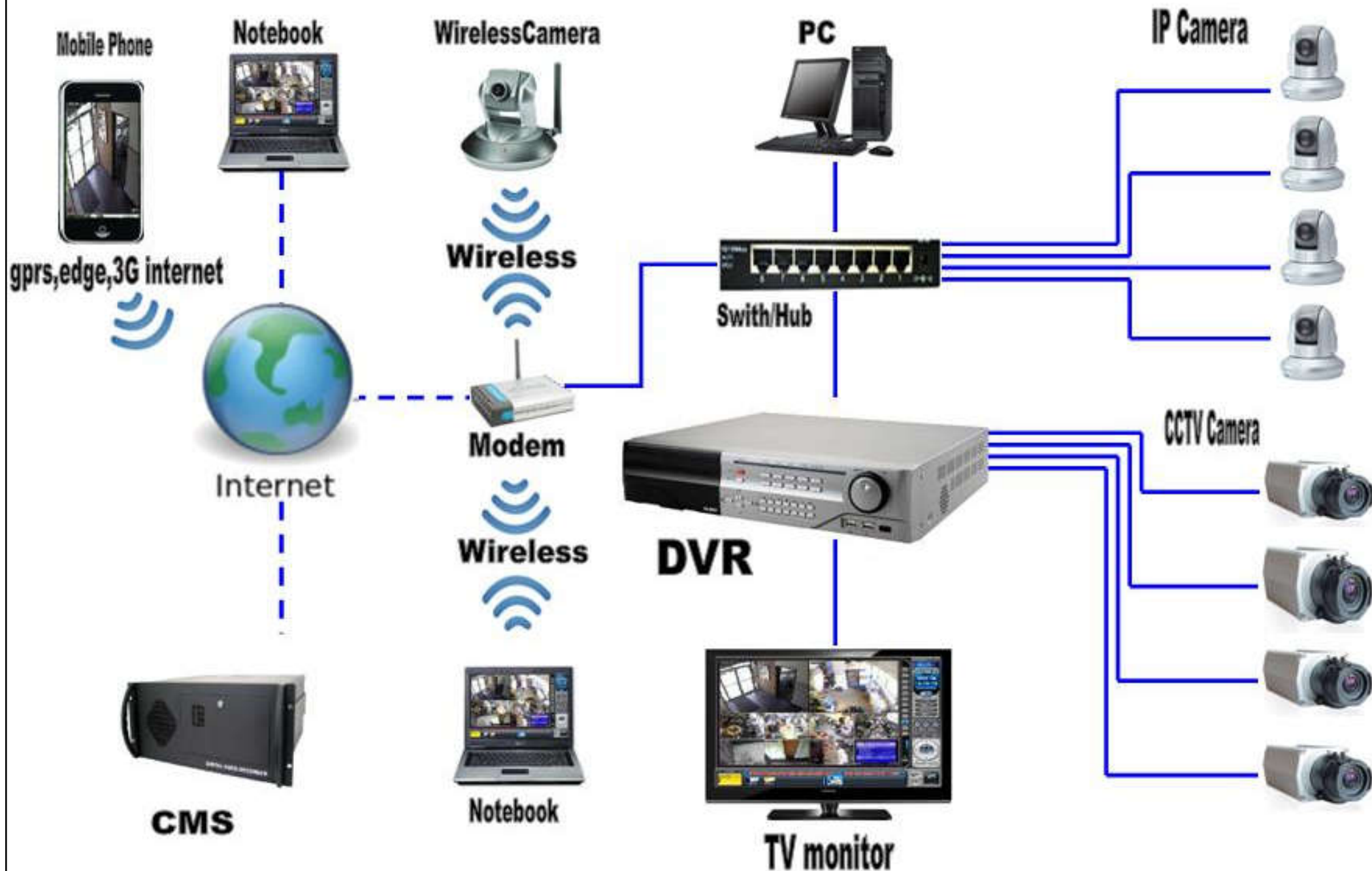
Talking CCTV - the system's operator can challenge criminals or members of the public via an intercom system (help stop antisocial behaviour)

Access control systems
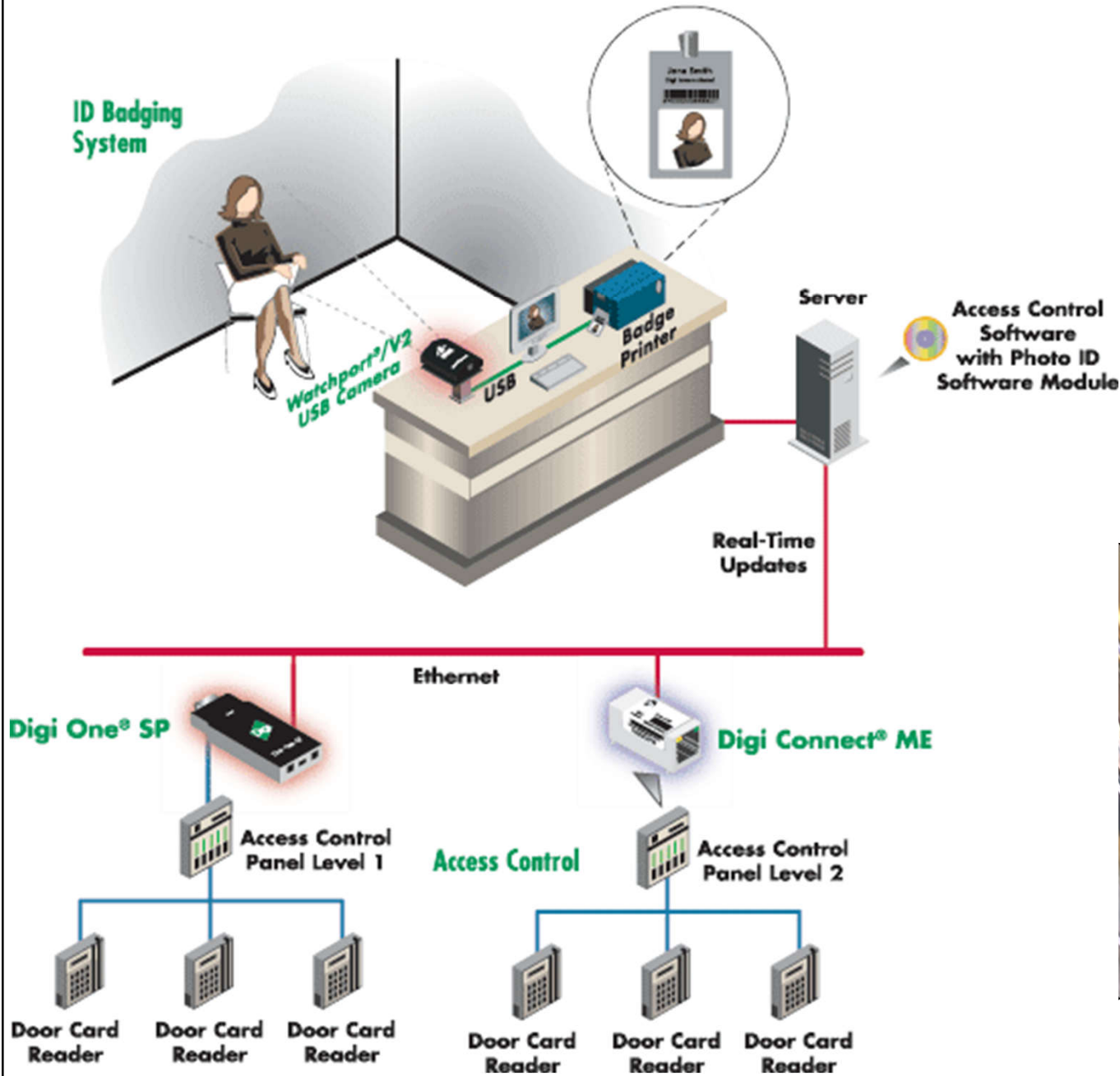

- ## Access control
  - Stand-alone or online systems
  - Methods:
    - Digital codes
    - Magnetic stripe cards
    - Embedded wire cards
    - Proximity cards/tags
    - Biometric access control (e.g. retina, finger prints)
  - Pedestrian turnstiles (like those in subway stations)
  - Car park control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

Access Control Terminal

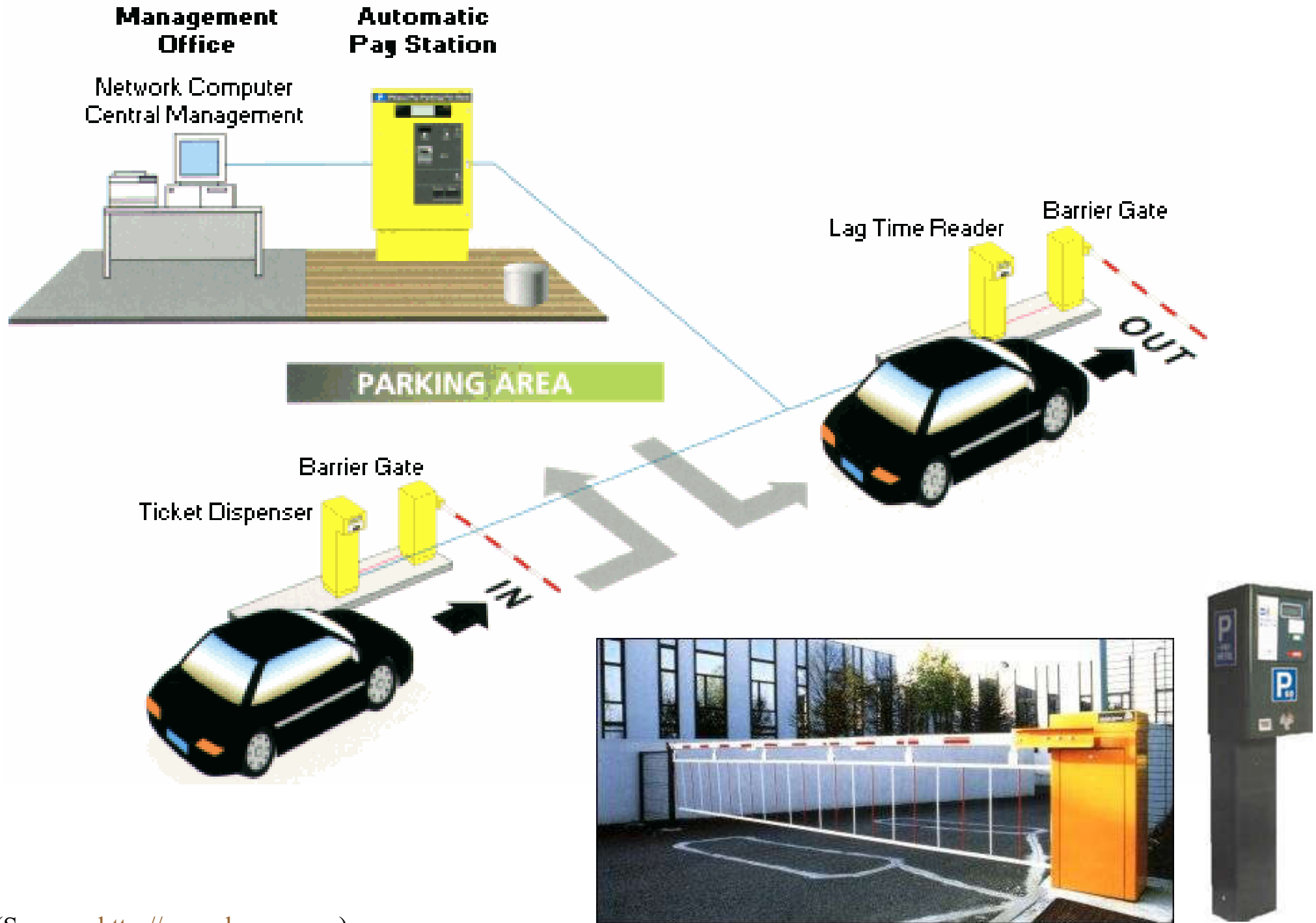# Integrated Photo ID Badge and Access Control System

Access control system

ID Badging System

Watchport®/V2 USB Camera

USB

Badge Printer

Server

Access Control Software with Photo ID Software Module

Real-Time Updates

Ethernet

Digi One® SP

Digi Connect® ME

Access Control Panel Level 1

Access Control

Access Control Panel Level 2

Door Card Reader
Door Card Reader
Door Card Reader

Door Card Reader
Door Card Reader
Door Card Reader

Pedestrian turnstiles

Car park control system

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

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
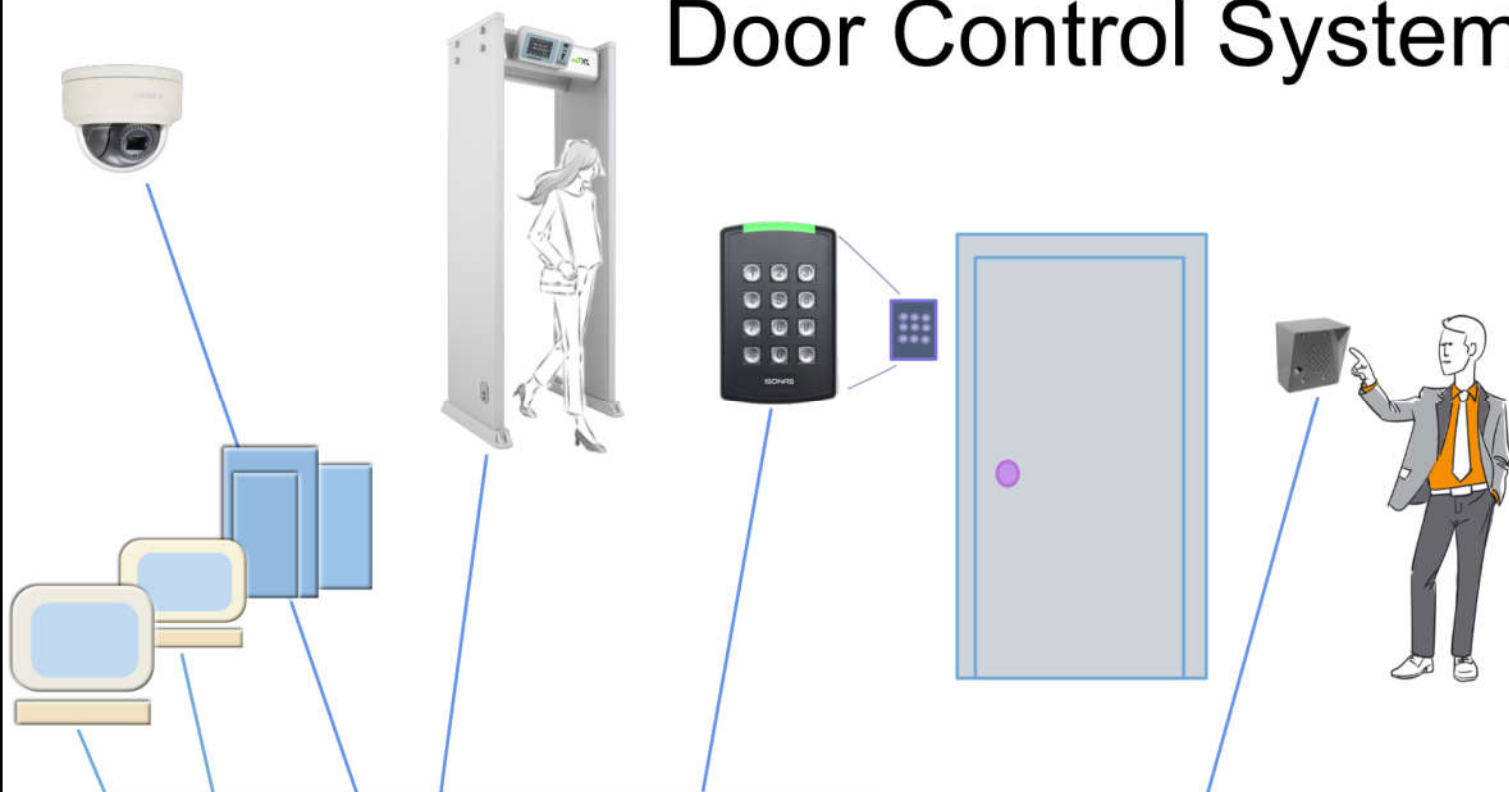
What are the key factors for door access control?

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 Intelligent IP Reader
Level 2.5 Credentials With Video	
Level 3 Security – Dual Authentication Systems	RFID IP Reader Intelligent IP Reader with Keypad
Level 3.5 Dual Authentication Plus Video	
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/)
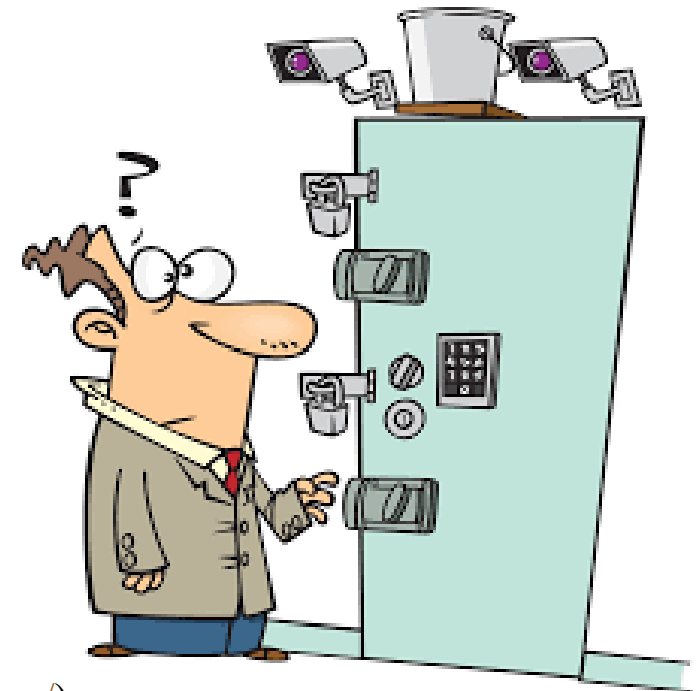
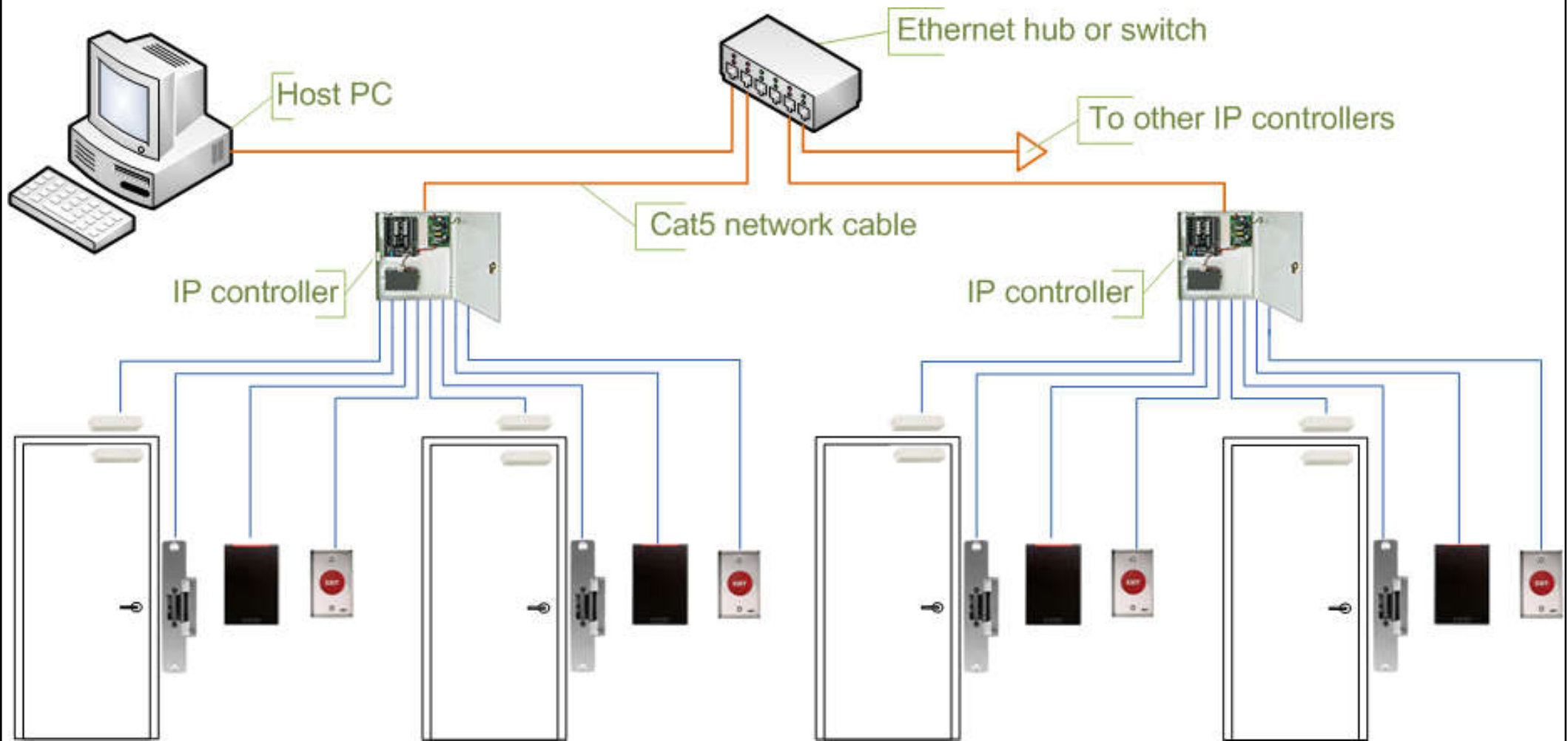# Typical access control door wiring
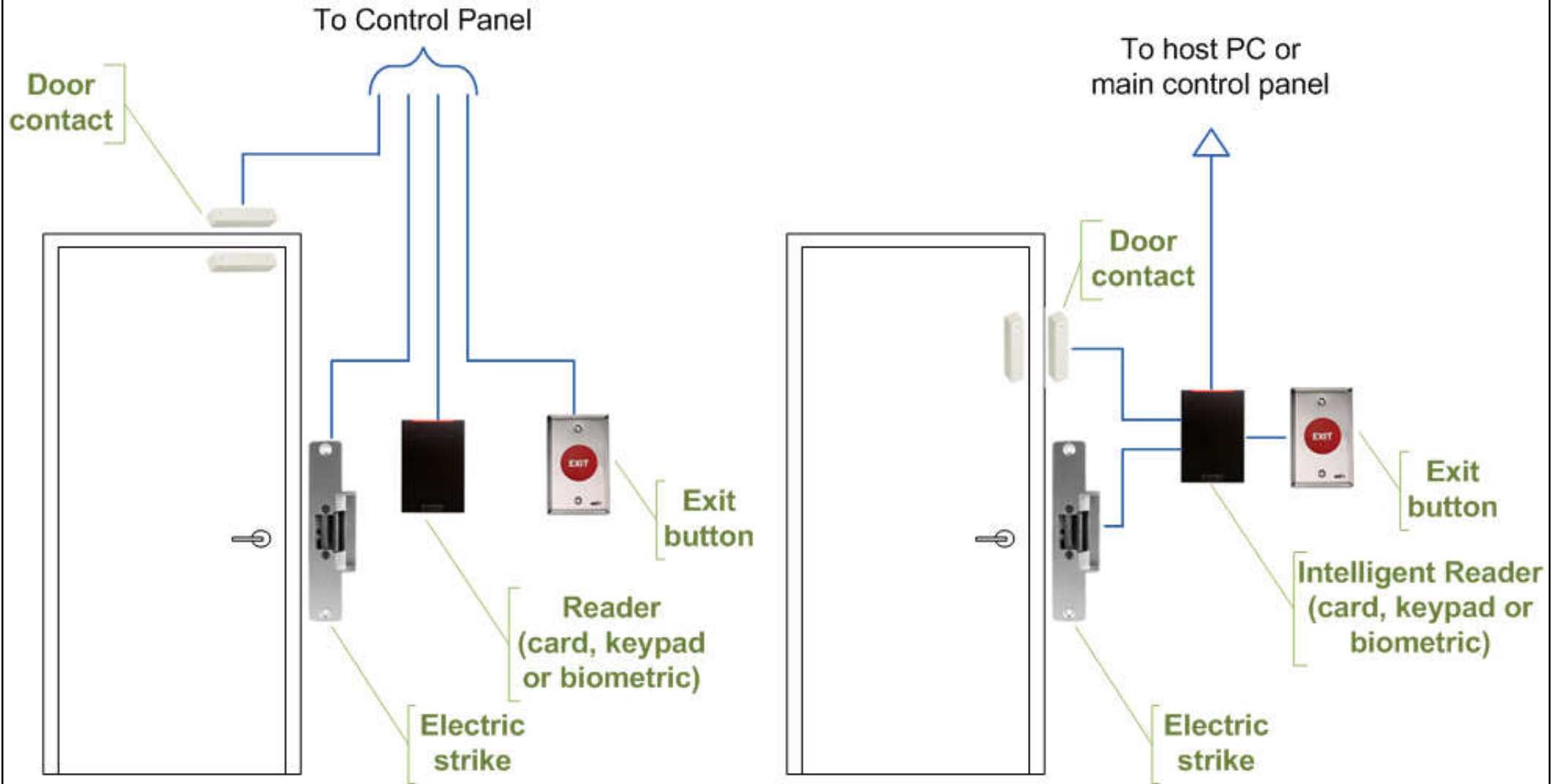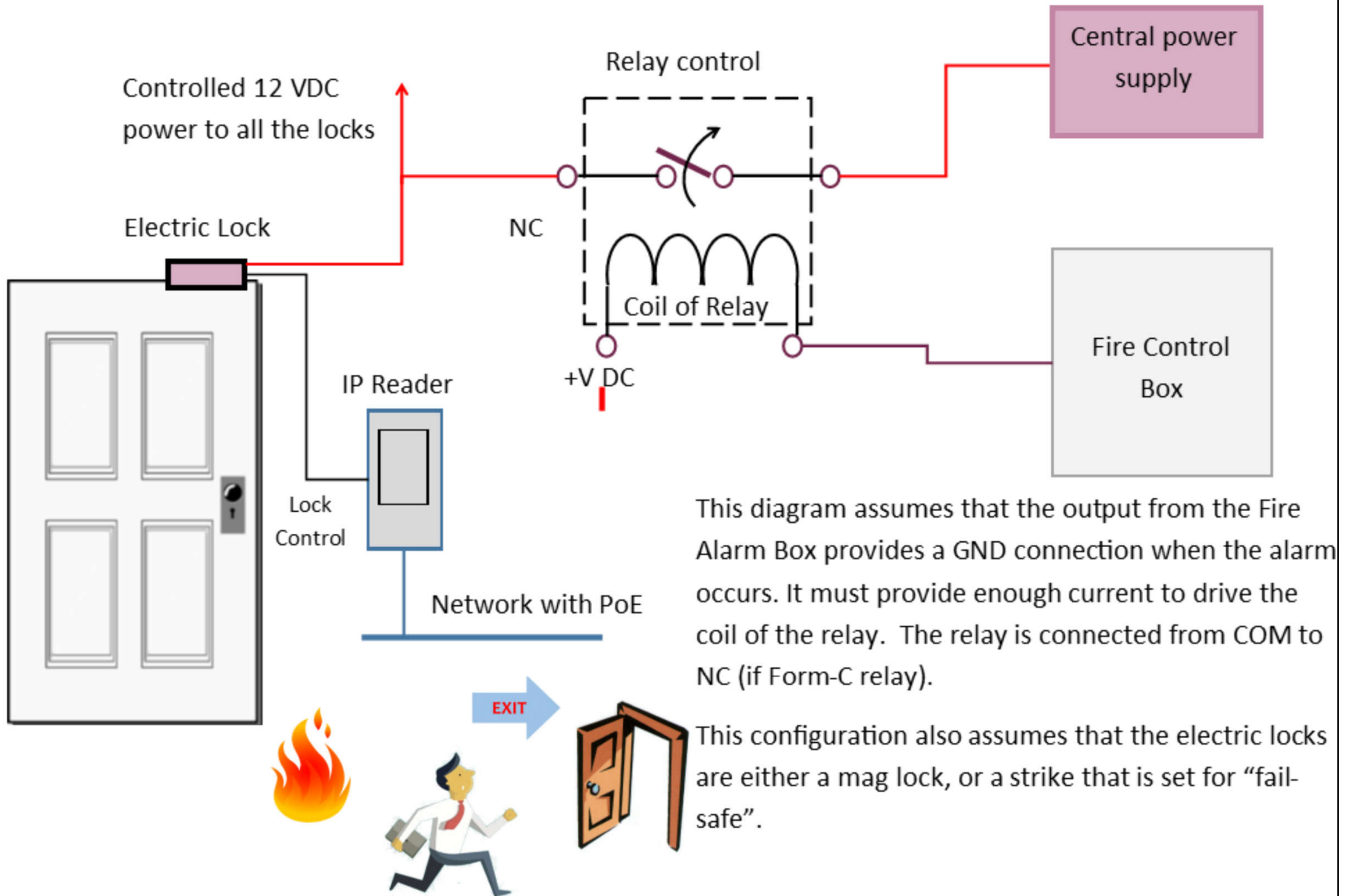

(a) With basic (non-intelligent) reader   (b) With intelligent reader
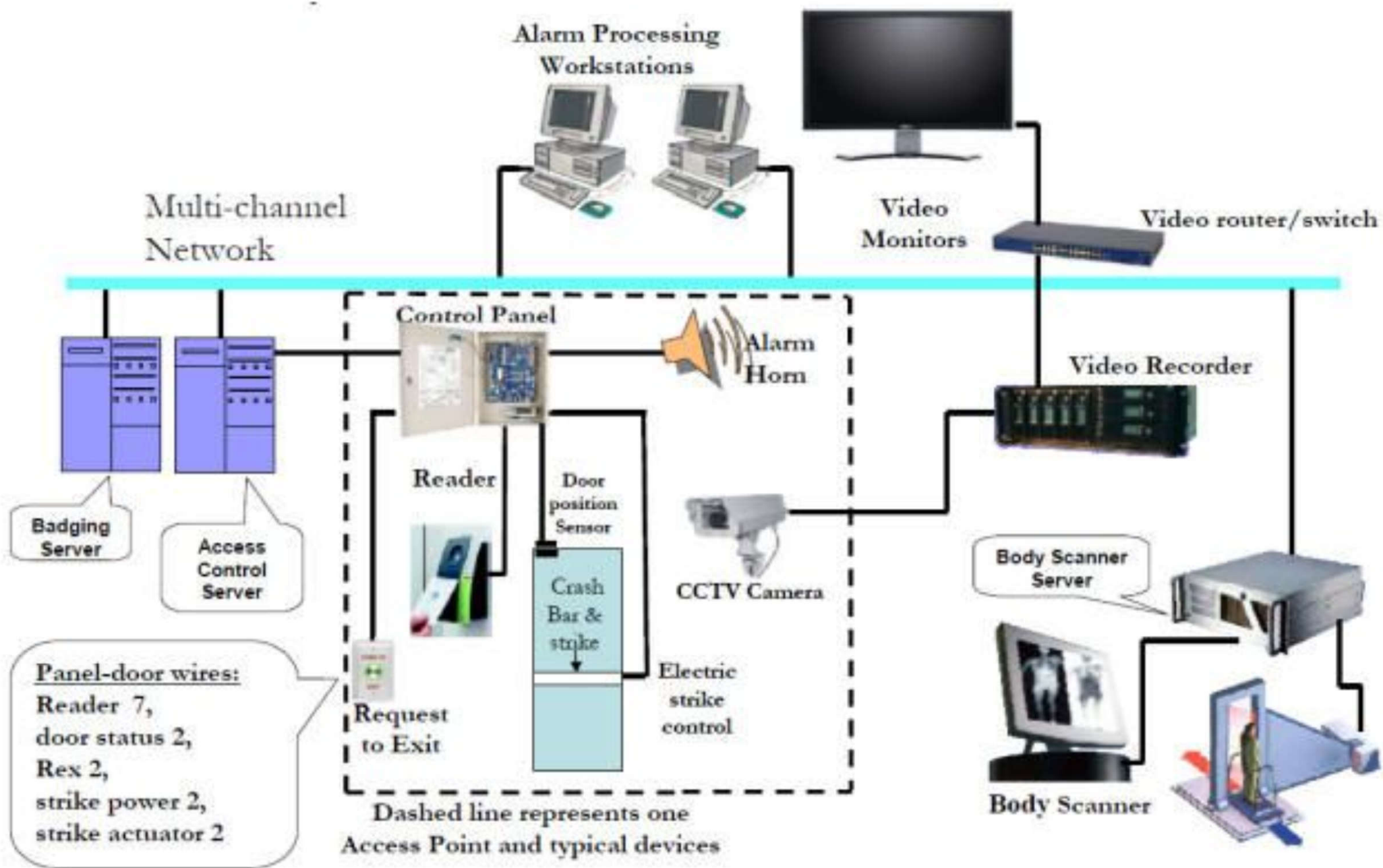
Access control system using IP controllers

Labels in figure: Ethernet hub or switch, Host PC, To other IP controllers, Cat5 network cable, IP controller, IP controller

How to integrate access control with fire alarm systems

Relay control

Central power supply

Controlled 12 VDC power to all the locks

Electric Lock

NC

Coil of Relay

+V DC

Fire Control Box

IP Reader

Lock Control

Network with PoE

EXIT

This diagram assumes that the output from the Fire Alarm Box provides a GND connection when the alarm occurs. It must provide enough current to drive the coil of the relay. The relay is connected from COM to NC (if Form-C relay).

This configuration also assumes that the electric locks are either a mag lock, or a strike that is set for "fail-safe".

Architecture of an access control system with network support

Alarm Processing Workstations

Multi-channel Network

Video Monitors

Video router/switch

Control Panel

Alarm Horn

Video Recorder

Badging Server

Access Control Server

Reader

Door position Sensor

Crash Bar & strike

CCTV Camera

Electric strike control

Body Scanner Server

Request to Exit

Panel-door wires:
Reader 7,
door status 2,
Rex 2,
strike power 2,
strike actuator 2

Dashed line represents one Access Point and typical devices

Body Scanner

(Source: https://diamondlockandsecurity.com.au/)

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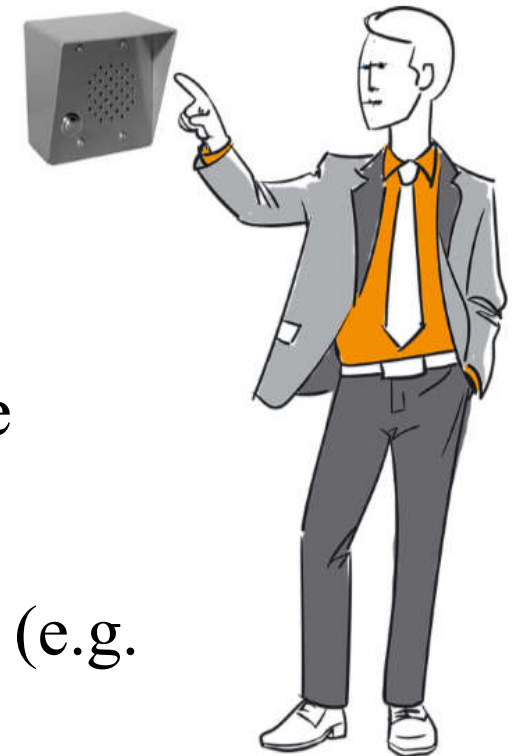
- [Intercom systems](#)
  - Audio intercoms
    - One to one connections (two-way audio)
    - Many intercoms to a central control centre
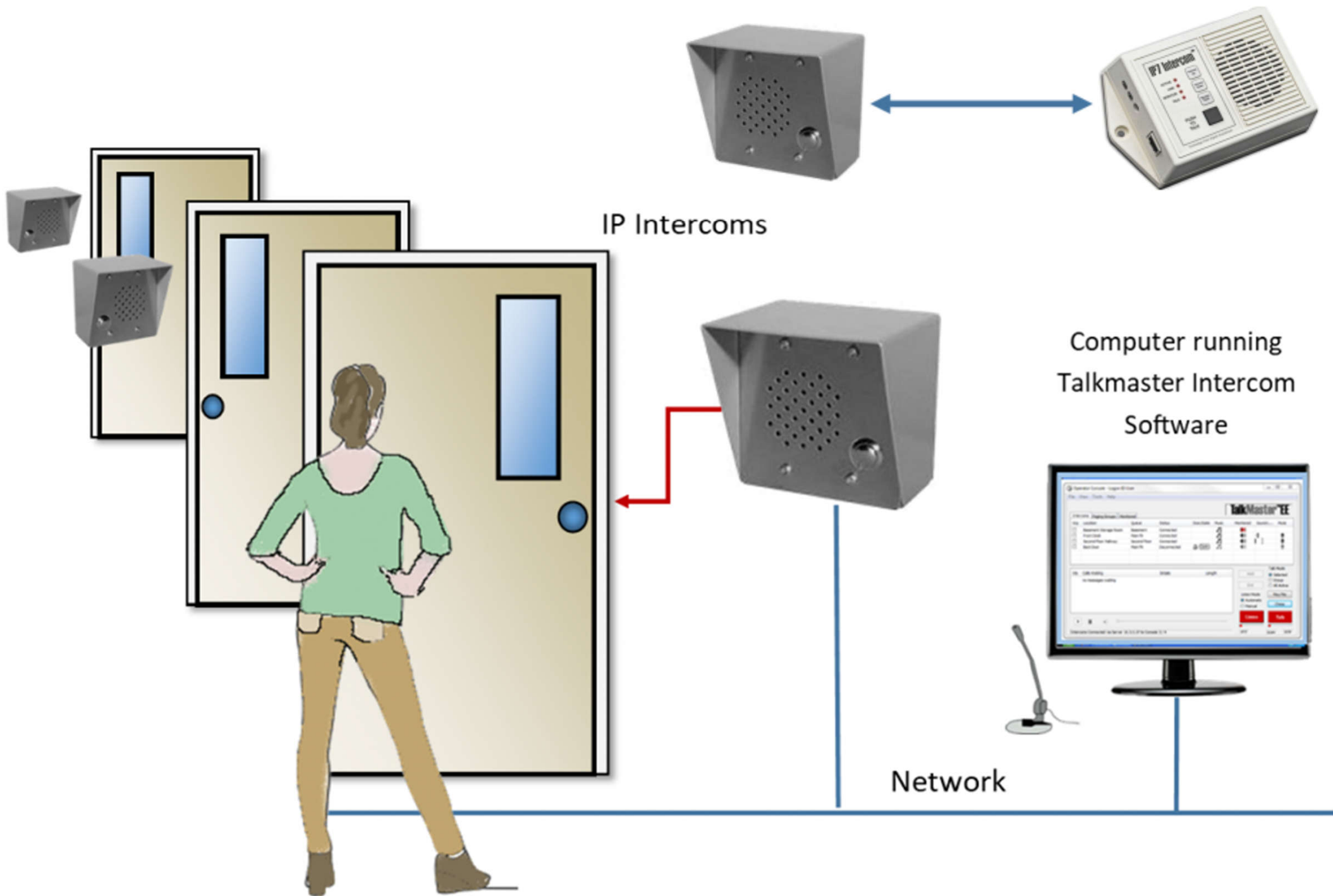 - Video intercoms
    - One intercom to one or many connections (e.g. smartphones & a central computer)
    - Integrate with IP camera systems & door access control systems to provide a complete security system
  - Visitor control systems (e.g. a delivery person)
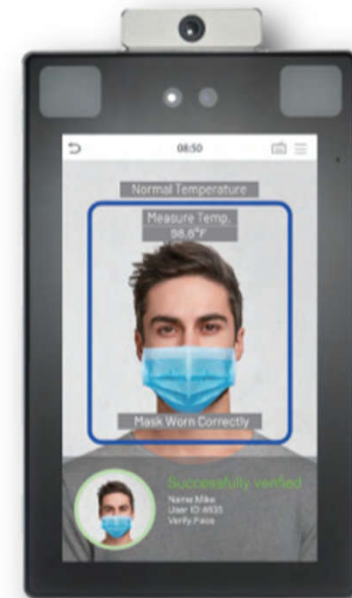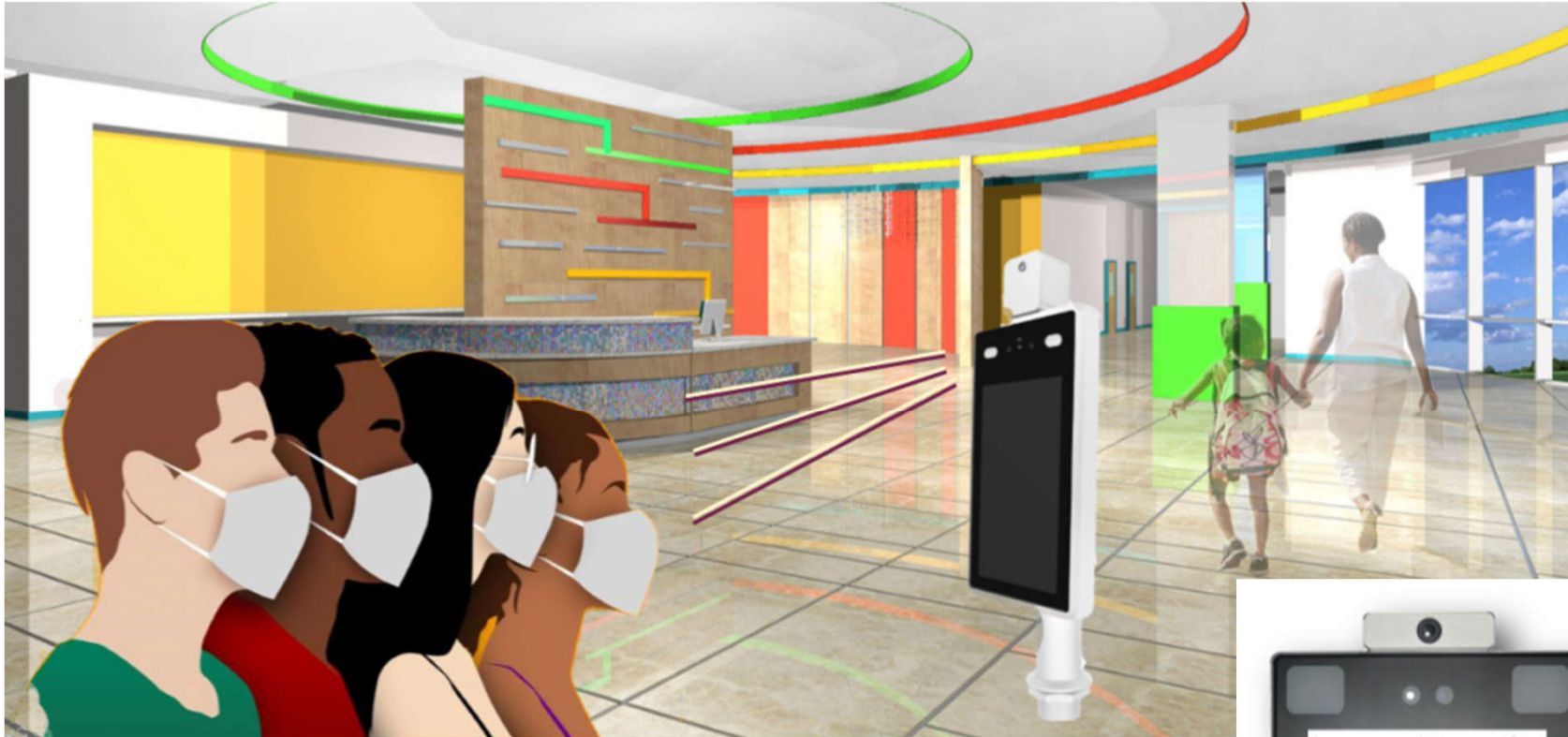
Audio intercoms for door access control

IP Intercoms

Computer running
Talkmaster Intercom
Software

Network

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

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

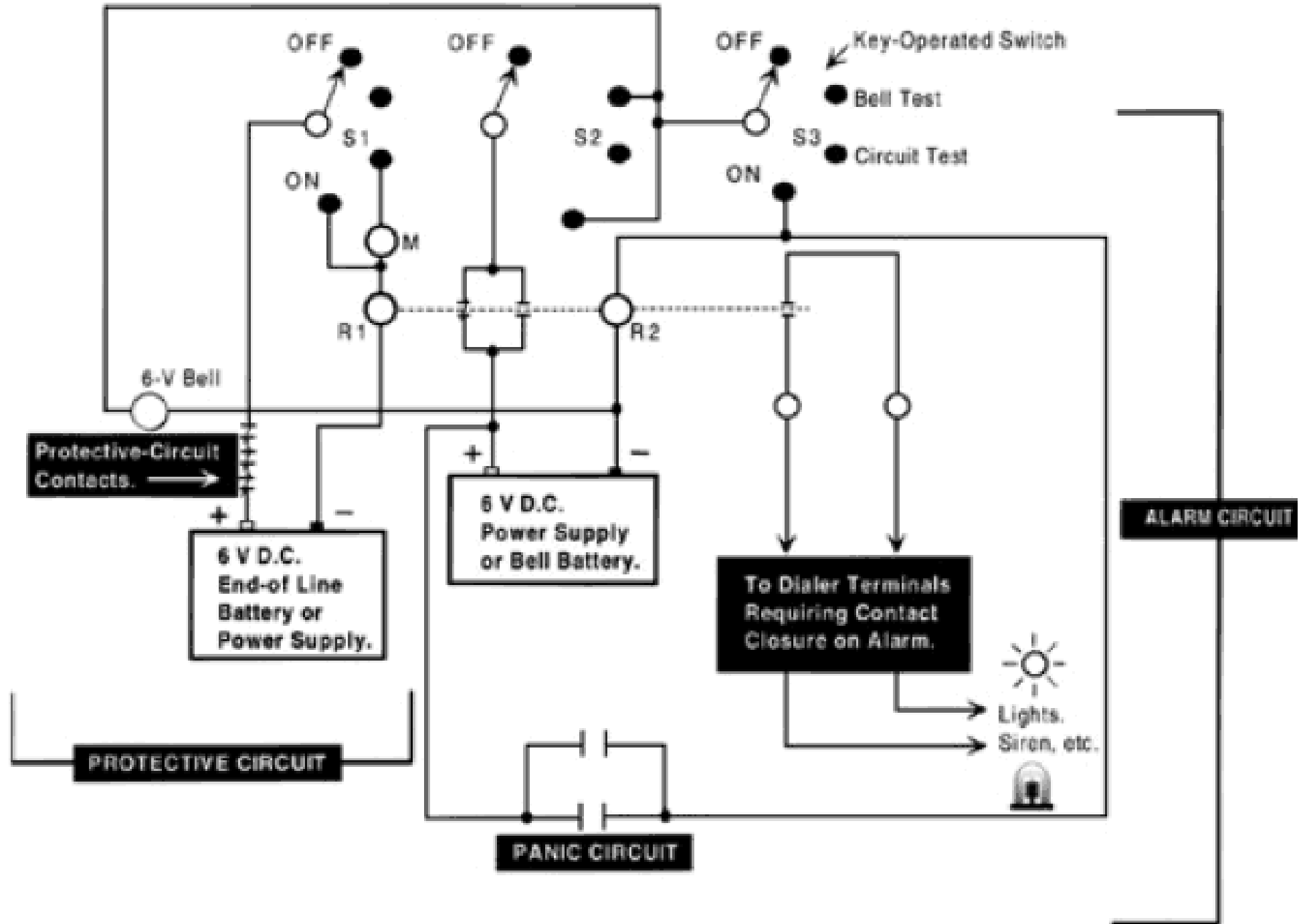| **Input**	**Control**	**Output**
Sensors	Panel	- Bell, siren, light - Dialer, email - Police-connect
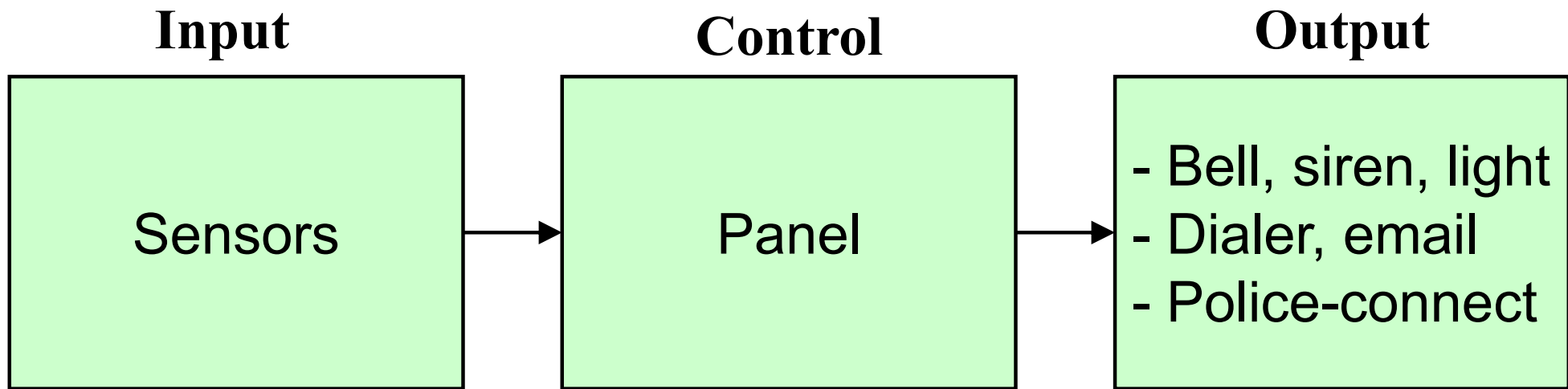
Detection sensors:
- Infrared
- Ultrasonic
- Microwave (droppler effect)
- Dual technology
- Glass breaks, switches

Annunciation/
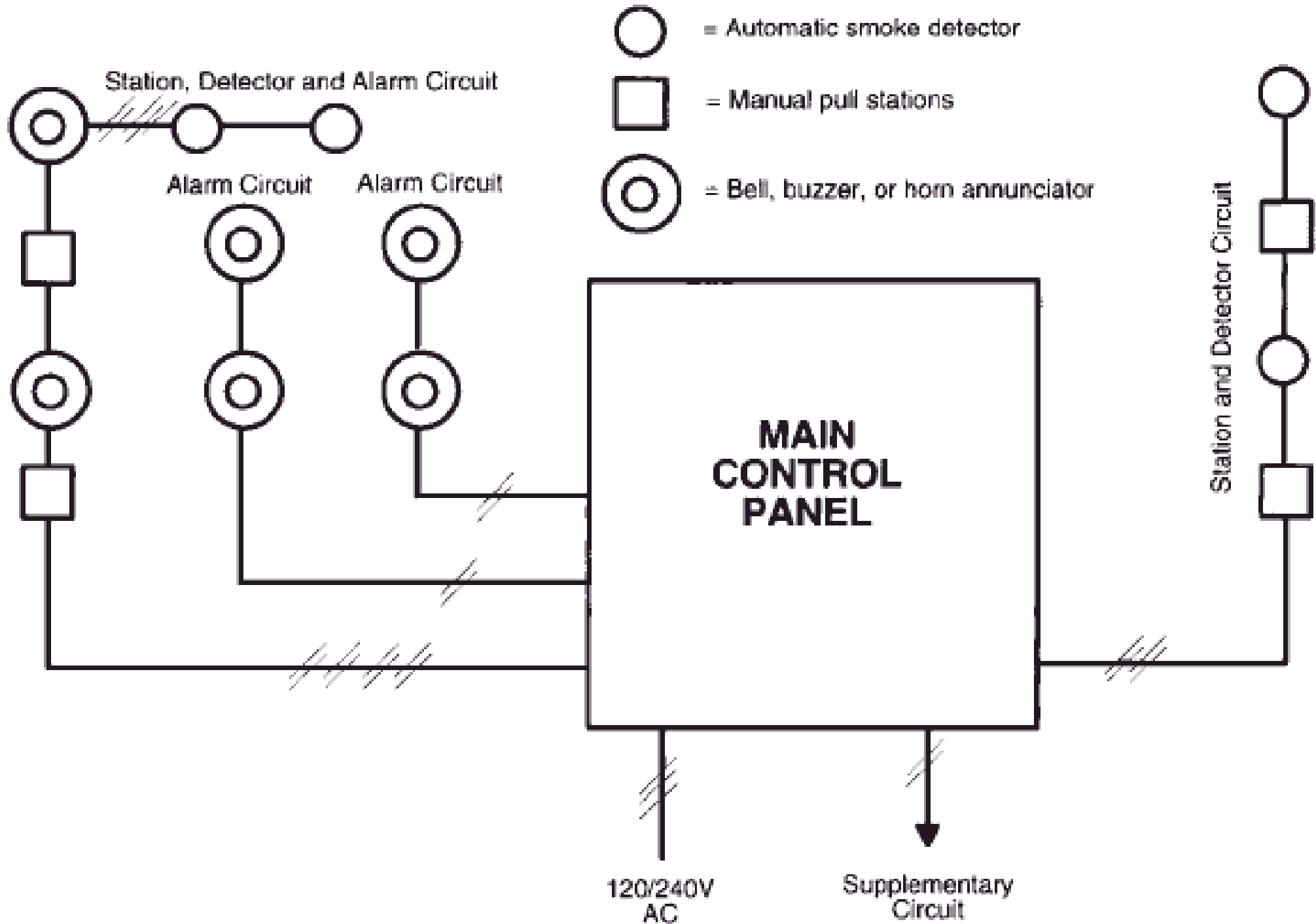alarm signaling

(* See also: Alarm Systems – An Overview http://www.shieldjournal.com/alarm-systems-an-overview/)

Closed-circuit security alarm system

Schematic diagram of a fire-alarm main control panel

= Automatic smoke detector

= Manual pull stations

= Bell, buzzer, or horn annunciator

Station, Detector and Alarm Circuit

Alarm Circuit   Alarm Circuit

Station and Detector Circuit

MAIN CONTROL PANEL

120/240V AC

Supplementary Circuit

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

Components of a basic fire-alarm system

Combination detector

Rate-of-rise detectors

Fixed-temperature detectors

Photoelectric smoke detectors

Lonization detectors

Alarm, bells, buzzers, horns

Automatic transmitter

CENTRAL PANEL
Relays-Capacitors-Resistors
Diodes-Transistors-Lamps
Batteries-Battery charger
Fuses-Circuit breakers-Terminals
Wiring

Coded manual station

Noncoded manual station

Supervisory system trouble alarm

Presignal circuit and components

Annunciator

Municipal fire station alarm circuit

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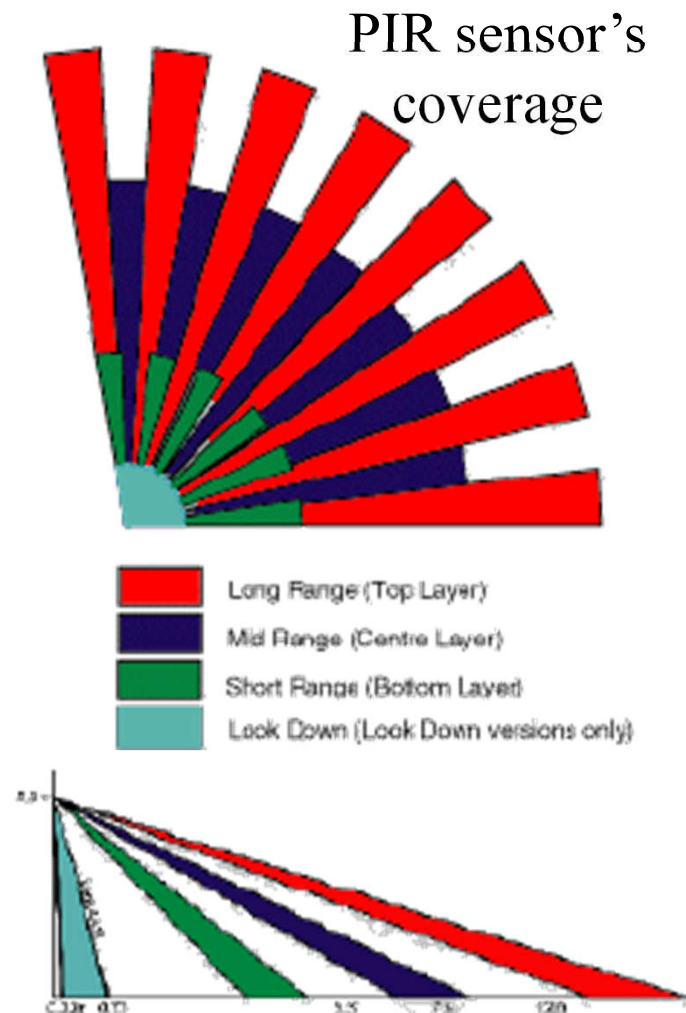
Burglar & intruder alarms

- <u>Intruder detection alarm system</u>

  - 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

PIR sensor's coverage

Long Range (Top Layer)
Mid Range (Centre Layer)
Short Range (Bottom Layer)
Look Down (Look Down versions only)

(* See also: 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)

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.
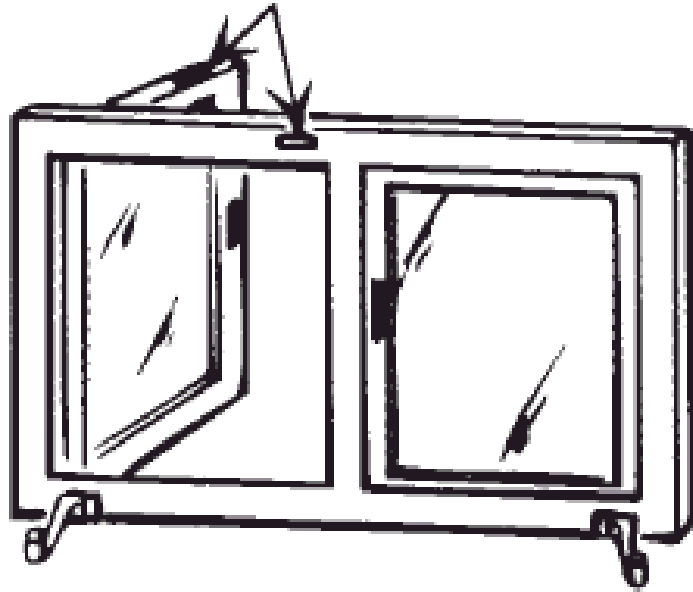
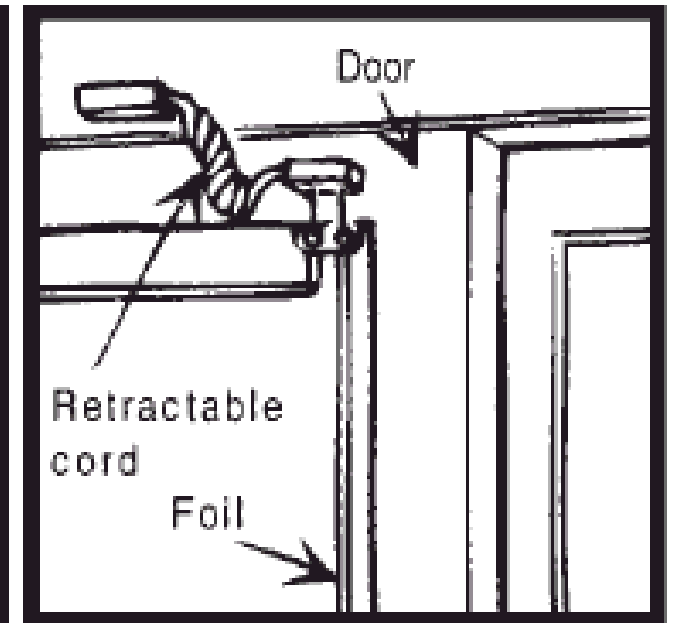window/door contacts
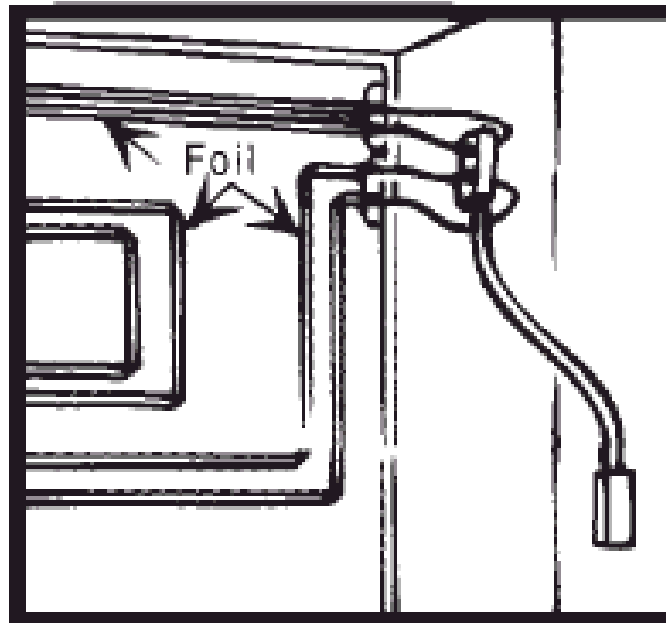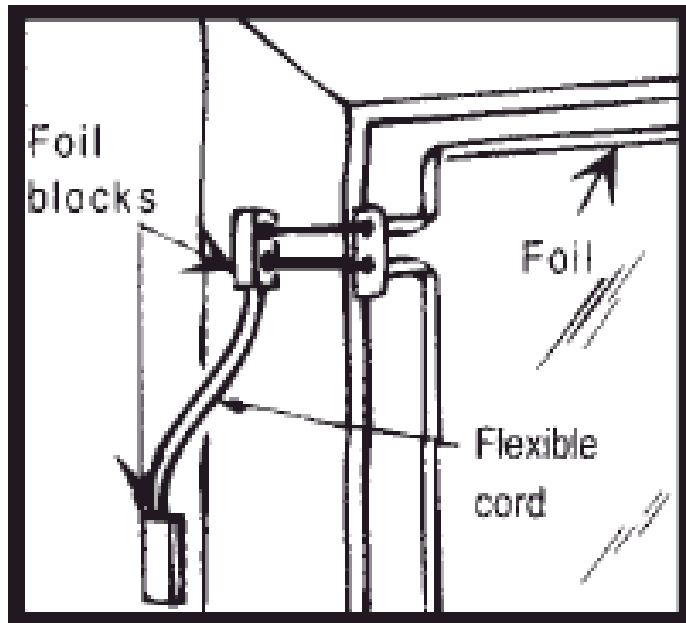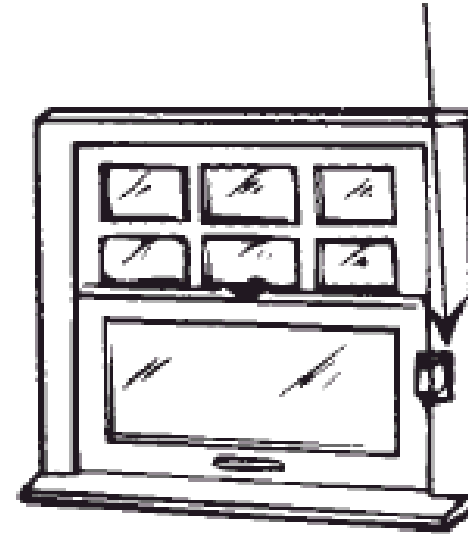
-motion detectors

-Interior Siren

Magnetic contacts on windows and doors

Recessed switch in top casing; magnet in window top

Surface-mounted switch and magnet

Foil blocks

Foil

Flexible cord

Foil

Door

Retractable cord

Foil

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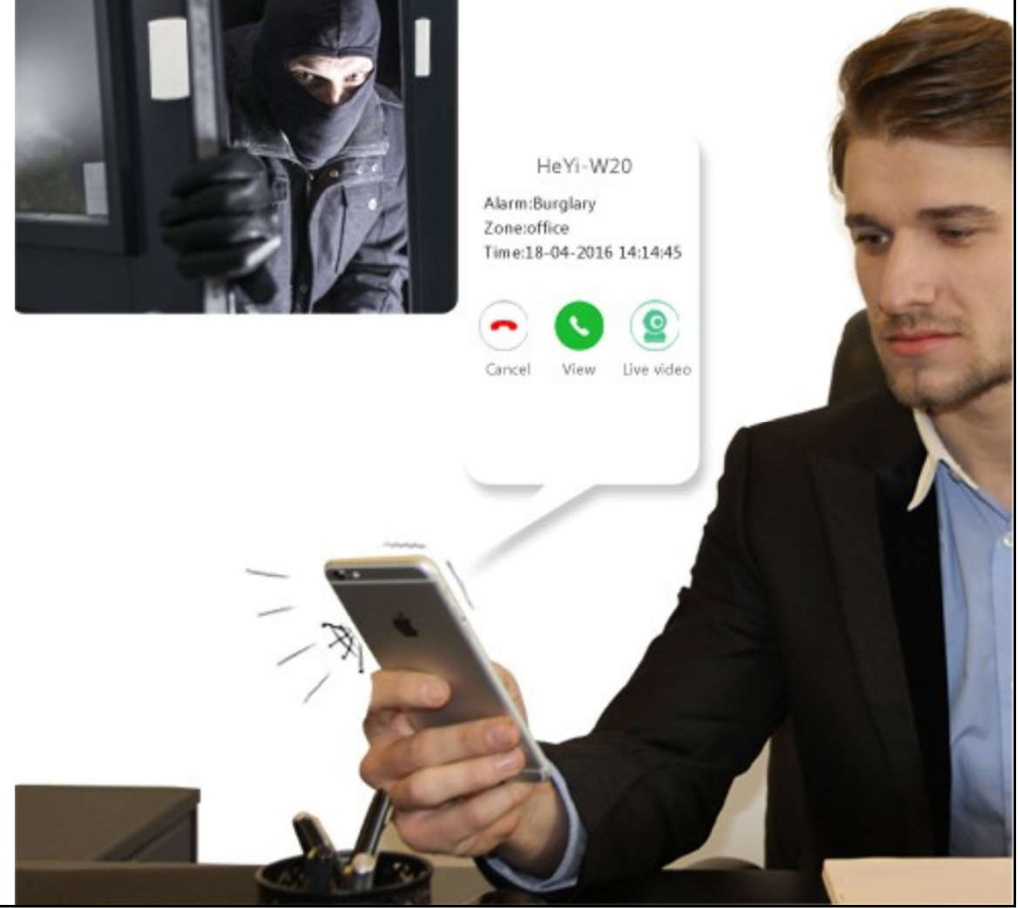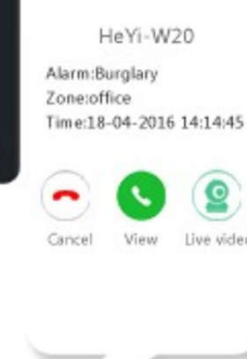
Burglar & intruder alarms

- 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)

(Source: Hong Kong Police Crime Prevention Bureau)

Further Reading

- Extra-low voltage - Wikipedia https://en.wikipedia.org/wiki/Extra-low_voltage

- Security Products
https://www.police.gov.hk/ppp_en/04_crime_matters/cpa/sec_products.html

- CCTV - Designing Buildings Wiki
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
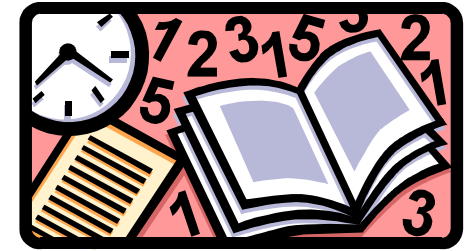
References

- 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

- 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